



S. F. BAIRD. MA

BULLETIN

OF

THE UNITED STATES

GEOLOGICAL AND GEOGRAPHICAL SURVEY

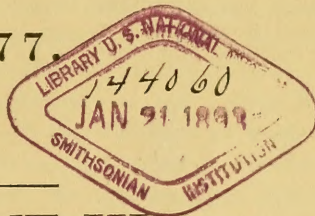
OF

THE TERRITORIES.

F. V. HAYDEN,

U. S. GEOLOGIST-IN-CHARGE.

1877.



VOLUME III.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1877.

THEATRON NOTE

U.S. GEOLOGICAL AND GEOGRAPHICAL SURVEY
BUREAU OF THE TROPICAL ISLANDS
Washington August 1, 1897

Enclosed are a series of 1897 complete Volume III, and with the
plates so issued for the large table of contents, but in the
case of the whole volume. It is hoped that the reports
of the members of the expedition for 1897, as they are prepared,
will be included in the volume from the office and as the
work is required to complete the volume.

In addition, the third volume of the Bulletin, a work containing
the progress of this expedition will not be out of place.

It is to be noted that when it was found desirable to send to the
Bureau of Communication with the public and with the
Bureau of the Smithsonian Institution, the latter

at the same time a copy of the report of the expedition
to the Smithsonian Institution, such as it is, and
the report of the expedition to the Smithsonian Institution.

The report of the expedition to the Smithsonian Institution
is now in the hands of the Smithsonian Institution
and will be published in the Smithsonian Bulletin.

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PREFATORY NOTE.

U. S. GEOLOGICAL AND GEOGRAPHICAL
SURVEY OF THE TERRITORIES,
Washington, August 1, 1877.

Bulletin No. 4, series of 1877, completes Volume III; and with this number are issued index, title-page, table of contents, list of illustrations, &c., for the whole volume. It is hoped that the separately published numbers are preserved for binding, as there is no issue of the Bulletins in bound volumes from this office, and as back numbers cannot always be supplied to complete deficient files.

In concluding the third volume of Bulletins, a word regarding the origin and progress of this publication will not be out of place. The issue began in 1874, when it was found desirable to establish more ready means of communication with the public and with scientific bodies than the regular Reports of the Survey afforded; the design being to publish, without the delay incident to the appearance of more elaborate and extended articles, such new or specially interesting matter as should be contributed to the general results of the Explorations under my charge by the members or the collaborators of the Survey. The practical importance of prompt measures in such cases is well recognized, and sufficiently attested by the success which the Bulletins have achieved.

The First and Second Bulletins, which appeared in 1874, are separately paged pamphlets, without ostensible connection with each other or with subsequent ones, but together constituting a "First Series" of the publication. Bulletins which appeared in 1875, being those of a "Second Series" and six in number, are continuously paged. With No. 6 were issued title, contents, index, &c., for all the numbers of both "series" which had then appeared; the design being that these should together constitute a Volume I, in order that the inconvenient distinction of "series" might be dropped.

With Bulletin No. 1 of 1876, the publication was established as an annual serial; the four consecutively paged numbers of that year constituting Volume II.

The four Bulletins of 1877 constitute Volume III, which compares favorably with its predecessors in the extent, variety, and importance of its contents, and is greatly improved in typography and general appearance.

Should no unforeseen circumstance prevent, the Bulletins will continue

to be issued at convenient irregular intervals, as material may come to hand; the strictly serial character of the publication, however, being maintained. The actual date of issue is given on the temporary cover of each, as it is important to fix with precision the appearance of the successive numbers of a periodical in which so many new genera and species are described.

This publication, answering so fully the special purpose for which it was established, is regarded as one of the most important means to the main ends which the Survey has in view. It has already acquired a character and standing which render it favorably comparable to the regular "Proceedings" or other similar publications of any of the learned bodies of this country or Europe. Its scope includes the whole range of the subjects for the investigation of which the Survey is conducted, and the appearance of which in this connection does not in any way restrict the plan of the formal Reports of the Survey. The volumes already issued contain articles upon Archæology, Ethnography, Linguistics, Geology, Topography, Geography, Palæontology, and Natural History in general, suitably illustrated with plates, cuts, and maps; and no effort will be spared in the future to maintain the high standard which the present volume so conspicuously illustrates.

F. V. HAYDEN,
United States Geologist.

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ERRATA.

Page 123, line 5, place a semicolon after "joint"; also, make the same correction after "second" in line 5, page 126; after "cilia" in line 10, page 123; and after "latter" in line 6, page 142.

Page 126, line 12, for "disk" read "discal".

Page 127, and on page 141, for "*concinisella*" read "*concinusella*".

Page 128, for "species" read "genus".

Page 129, between "*Æ. 4. maculella*" and "*Glyphipteryx*" insert "*Blastobasis gigantea* Cham."

Page 130, for "*arcenthina*" read "*arcuethina*".

Page 131 and 132 and 141, for "*anduegiella*" read "*anderegiella*".

Page 132, for "*Lespedegæfoliella*" read "*lespedezæfoliella*".

Page 132 and 137 and 138, for "*texana*" read "*texanella*".

Page 141, for "*æquipulsella*" read "*æquepulvella*"; for "*Lamna*" read "*Laverna*"; for "*pennivorella*" read "*prunivorella*".

Page 143, for "*cercirisella*" read "*cercerisella*".

Page 144, for "*Aetote*" read "*Aetole*".

Page 145, for "*H. Newmanella*" read "*H. bassettella*".

Page 230, line 13 from top, for "posterior" read "submarginal".

Page 265, line 20 from top, for "*aegeriiformis*" read "*aegeriformis*".

Page 267, line 16 from bottom, for "*fucata*" read "*amphitea*".

Page 267, line 14 from bottom, put "*Toxophora fulva*" in small capitals.

Page 512, line 4. The name of the species "*Lycosa indagatrix*" being preoccupied, the author changes it to "*L. dromæa*".

Page 513, line 13 from bottom. The name of the species "*Lycosa imparida*" being preoccupied, the author changes it to "*L. tachypoda*".

Page 571, line 13, for "*Physa*" read "*Bulinus atavus* White".

Page 571, line 19, for "*Anodonta*" read "*Anodonta propatoris* White".

Page 571, line 20, for "*Unio*" read "*Unio senectus* White".

Page 571, line 21, for "*Unio*" read "*Unio cryptorhynchus* White".

Page 571, line 22, for "*Unio*" read "*Unio primævus* White".

Page 571, line 23, dele the line.



BULLETIN NO. 1, VOL. III.

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ART. I.—A CALENDAR OF THE DAKOTA NATION.

BY BREVET LIEUT. COL. GARRICK MALLERY,
Captain First United States Infantry, Acting Signal Officer.

PLATE 1.

The chart presented with this paper is ascertained to be the calendar of the Dakota Nation, extending over the seventy-one years commencing with the winter of A. D. 1799-1800. The copy from which the lithograph was taken is traced on a strip of cotton cloth, in size one yard square, which the symbols almost entirely fill, and was made by Lieut. H. T. Reed, U. S. A., an accomplished officer of the present writer's company and regiment, in the two colors, black and red, used in the original, of which it purports to be a *fac simile*. The general design of the chart and the meaning of most of its symbols were determined by Lieutenant Reed, at Fort Sully, Dak., and afterward at Fort Rice, Dak., in November, 1876, by him and the writer; while further investigation by the latter of records and authorities at Washington elicited additional details. After exhibition of the copy to a number of military and civil officers connected with the Departments of War and the Interior, it appeared that those who, from service on expeditions and surveys or from special study of American ethnology, were most familiar with the Indian tribes west of the Mississippi, had never heard of this or any other similar attempt among them to establish a chronological system. Bragging biographies of chiefs and partisan histories of particular wars, delineated in picture-writing on hides or bark, are very common. Nearly every traveler on the plains has obtained a "painted robe", on which some aboriginal artist has stained rude signs purporting to represent tribal or personal occurrences, or often the pedigree of the first owner. It may here be *à propos* to hint a caution that the "fancy" prices paid by amateurs for these decorations of the bison's hide have stimulated their wholesale manufacture by agency Indians (locally termed "coffee-coolers"), who make a business of sketching upon ordinary robes the characters in common use, without regard to any real event or person, and selling them as curious records. This pictorial forgery would seem to show a gratifying advance of the Lo family in civilization; but it is feared that the credit of the invention is chiefly due to some enterprising traders, who have been known to furnish the unstained robes and paints for the purpose, and simply pay a skillful Indian for his work when the genuine antique or veracious chronicle is delivered.



The CALENDAR of the DAKOTA NATION
embracing the period from 1799 to 1870, inclusive.

Besides these records of the nomadic tribes, the eastern Algonquins used strings of beads, fashioned from shells of different colors, called *wampum*, to note events, these devices being generally mnemonic only and seldom symbolic. The Pueblos figured histories on tablets of wood, and both the Aztecs* and Toltecs have left elaborate specimens of narrative picture-writing; but it is believed that, in the similar productions hitherto discovered of all of these peoples, the obvious intention was either historical or biographical, or, more generally, was to chronicle occurrences as such, and there was not an apparent design to symbolize events selected without reference to their intrinsic interest or importance, but because they severally occurred within regular successive intervals of time, and to arrange them in an orderly form, specially convenient for use as a calendar, and valuable for no other purpose.

The copy made by Lieutenant Reed was traced over a duplicate of the original, which latter was drawn on a buffalo-robe by, and is believed to be still in the possession of, Lone Dog, an aged Indian belonging to the Yanktonai tribe of the Dakotas, and who, in the autumn of 1876, was near Fort Peck, Montana Territory.

The duplicate from which the copy was immediately taken was in the possession of Basil Clément, a half-breed interpreter, living at Little Bend, near Fort Sully, Dak., who professed to have obtained information concerning the chart and its symbols from personal inquiries of many Indians, and whose dictated translation of them, reduced to writing in his own words, forms the basis of that given in the present paper. The genuineness of the document was verified by separate examination, through another interpreter, of the most intelligent Indians accessible at Fort Rice, and at a considerable distance from Clément, who could have had no recent communication with those so examined. One of the latter, named Good Wood, a Blackfoot Dakota and an enlisted scout attached to the garrison of Fort Rice, immediately recognized the copy now in the possession of the writer as "the same thing that Lone Dog had", and also stated that he had seen another copy at Standing Rock Agency in the hands of Blue Thunder, a Blackfoot Sioux. He said that it showed "something put down for every year about his nation", knew how to use it as a calendar, beginning from the center and counting from right to left, and was familiar with the meaning of many of the later symbols and the events they commemorated, in which he corroborated Clément's translation, but explained that he had forgotten the interpretation of some of the earlier signs, which were about things done long before his birth.

All the investigation that could be made elicited the following account, which, whether accurate or not, the Indians examined certainly believed. Lone Dog has been, ever since his youth, charged with the special duty of deciding upon some event or circumstance which should distinguish

* The Aztecs used signs, chiefly sketches of different animals, to denote the days only, not years.

each year as it passed, and, when such decision was made, he marked what was considered by himself its appropriate symbol upon a buffalo-robe kept for the purpose; then calling together a number of the Dakota Nation, without regard to tribes, made known to them the sign for the year, or "year-totem", and explained what event it represented. This was done annually and formally, but it is understood that the robe was at other convenient times exhibited to other Indians of the nation, who were thus taught the meaning and use of the signs as designating the several years, in order that at the death of—so to style him—the official chronologer, the knowledge might not be lost. A similar motive, as to the preservation of the record, led to its duplication in 1870 or 1871, so that Clément obtained it in a shape ending with the former of those years. It was also reported by several Indians that other copies of the chart in its various past stages of formation have been known to exist among the several tribes, being probably kept for reference, Lone Dog and his robe being so frequently inaccessible.

Although Lone Dog is described as a very old Indian, it is not supposed that he was of sufficient age in the year 1800 to enter upon the duty as explained. Either there was a predecessor, from whom he received the earlier records or obtained copies of them, or his work being first undertaken when he had reached manhood, he gathered the traditions from his elders and "worked back" so far as he could do so accurately, the object either then or before being to establish some system of chronology for the use of the nation. It has not, in the late condition of the Indian country, been possible to reach him since the discovery of Clément's copy, and no one has yet been found who can intelligently state whether there exists any similar but earlier arrangement of symbols. Publication of the facts now collected may prove of use, if it shall lead persons having opportunity to pursue the subject, and perhaps to obtain annals more ancient and valuable.*

A query is naturally suggested whether intercourse with missionaries and other whites did not first give the Dakotas some idea of dates and awaken a sense of want in that direction. The fact that the calendar begins at a time nearly coinciding with the first year of the present century by our computation may be due to such intercourse, or may be a mere coincidence. If the influence of missionaries or traders started any plan of chronology, it is remarkable that they did not suggest one

* To facilitate inquiry and verification, it may be useful to suggest that the name of the supposed chronologer, "Lone Dog", as given to the writer by an interpreter, may appear, from another interpreter, as the shade of meaning occurs to him, or as his taste may incline, in a different English form—*e. g.*, as "The-One-Dog", "One Dog", or even simply "The Dog" *par excellence*. Much confusion exists in the records and accounts of Indian personages from these varied translations, the actual name in the tribal dialect being seldom mentioned. Nothing appears in the office of the Commissioners of Indian Affairs about a "Lone Dog", though "Long Dog" was in recent times a prominent chief of the Blackfoot Sioux, and it is just possible that the writer caught the wrong sound in the dictation. Unfortunately, the Dakota name, though given at the time, was not reduced to writing, so as to be now verified.

in some manner resembling the system so long and widely used of counting in numbers from an era, such as the Birth of Christ, the Hegira, the Ab Urbe Conditâ, the First Olympiad, and the like. But the chart shows nothing of this nature. The earliest symbol (Fig. 1, in the center) merely represents the killing of a small number of Dakotas by their enemies, an event of frequent recurrence, and neither so important nor interesting as many others of the seventy-one shown in the chart, more than one of which, indeed, might well have been selected as a notable fixed point before and after which simple arithmetical notation could have been used to mark the years. Instead of any plan that civilized advisers would naturally have introduced, the one actually adopted—to individualize each year by a specific recorded symbol, or totem, according to the decision of a single designated officer and his successors, whereby confusion was prevented—should not suffer denial of its originality merely because it was ingenious, and showed more of scientific method than has often been attributed to the northern tribes of America. The symbolic record, being preserved and understood by many, could be used and referred to with sufficient ease and accuracy for ordinary purposes. Definite signs for the first appearance of the small-pox and for the first capture of wild horses may be dates as satisfactory to the Sioux as the corresponding expressions A. D. 1801 and 1812 to the Christian world, and far more certain than much of the chronological tables of Regiomontanus and Archbishop Usher in terms of A. M. and B. C. The careful arrangement of distinctly separate characters in an outward spiral starting from a central point is a clever expedient to dispense with the use of numbers for noting the years, yet allowing every date to be determined by counting backwards or forwards from any other that might be known; and it seems unlikely that any such device, so different from that common among the white visitors or settlers, should have been prompted by them. The whole conception seems one strongly characteristic of our “aborigines”, as we have been in the habit, perhaps wrongly, of styling the North American Indians, who, the autochthonic theory being now disputed, are classed by late writers with the Turanian or Mongolian race, for their membership in which this very use of symbols is no unimportant evidence.

Efforts were made to ascertain if the occurrences selected and represented were those peculiar to the clan or tribe of the recorder, or were either of general concern to, or notoriety throughout, the nation. This would tend to determine whether the undertaking was of a voluntary and individual nature, limited by personal knowledge or special interests, or whether the scope was national, and the work was so recognized as to become what might be termed official. All inquiries led to the latter supposition. The persons examined were of different tribes, and far apart from each other, yet all knew what the document was, *i. e.*, that “some one thing was put down for each year”; that it was the work of Lone Dog; and that he was the only one who “could” or was

allowed to "do it". The internal evidence is to the same effect. All the symbols indicate what was done, experienced, or observed by the nation at large or by its tribes without distinction, not by that of which Lone Dog is a member—no special feat of the Yanktonais, indeed, being mentioned—and the chiefs whose deaths or deeds are noted appear to have belonged indifferently to the several tribes, whose villages were generally at great distances each from the others and from that of the recorder. In estimating the weight of these facts, it seems necessary to consider the numbers and divisions of the Dakotas, and the extent of territory formerly and now occupied by them.

In comparatively recent times, they held the whole immense region bounded by the Rocky Mountains on the west, the Athabaskan tribes in British America on the north, and the present State of Arkansas on the south, while, in the east, they extended beyond the Mississippi River, pressing sometimes successfully upon the Algonquins. One division, generally known as Winnebago, but calling itself Hochengara, made a lodgment on the shores of Lake Michigan, ruling there for years by numbers and prowess in arms over several Algonquin tribes, and another body, the Quappas, styled by the Algonquins, Alkansas, or Arkansas, penetrated to the Ohio River, but, being driven back by the Illinois, turned down stream to the land included by the State of Arkansas, named after them. By treaties in 1837, 1851, 1863, and 1868, the nation ceded to the United States its land on the eastern side of the Missouri, and also the region lying west of that river and north of the Platte, finally restricting its claims to the limits bounded east by the Missouri River, south by Nebraska, west by the one hundred and fourth meridian, and north by the forty-sixth parallel, with hunting rights in parts of Nebraska and Wyoming. This remaining territory is by no means despicable, being as large as the State of Michigan. Many of the nation, however, prominent among whom was Sitting Bull, who had been at war with the whites ever since the Minnesota massacre of 1862, refused agreement to the later treaties, or to reside at the agencies, and maintained independent bands, hunting and robbing, after the manner of their forefathers. While the number of warriors permanently attached to the recusant faction was not large, probably in the winters diminishing to a few hundred, the force served every summer as a nucleus for the discontented or treacherous agency Indians to join, and thus there were sometimes from six to ten thousand warriors in the so-called "hostile armies", which, however, were not often concentrated. When restricted to his personal followers, Sitting Bull habitually honored Western Dakota and Eastern Montana with his presence, moving his tepees and travois about in the valleys of the Yellowstone and Powder Rivers; but when the main body of the nation was "out", only the old bucks and squaws, with the papooses, being left to draw the stipulated rations, and procure ammunition at the Agencies, which thereby became a convenient base of supplies, the tribes roamed at will through nearly all parts of Nebraska, Wyoming, Montana, and

Dakota, a region including over 470,000 square miles. The extent of this range can be forcibly presented to the Eastern mind by observing that it is equal to the whole of the New England and Middle States, with, in addition, Maryland, Virginia, West Virginia, North and South Carolina, Georgia, and Florida. Comparing with the Old World, its area is about those of France, Spain, Portugal, Belgium, Holland, and Greece united. This summary will explain the difficulty experienced by the United States troops, from the mere magnitude of the district, apart from its physical impediments, in surprising any bodies of the "hostiles" who do not see fit to be found except when posted at points and occasions selected for their own advantage. To subsist a large invading force during any long period in the Sioux country is of itself a hard task, and an almost impossible feat to overtake with it the nimble and cunning natives of the soil, while detached expeditions possessing sufficient mobility to accomplish that object are always liable to the fate of Custer. This may recall to military students the words of Henry IV. of France, when considering the waste tracts and guerrilla facilities of Spain, that "large armies would starve there and small ones would be beaten".

The word Dakota is translated in Riggs's Dictionary of that language as "leagued, or allied". Dr. J. Hammond Trumbull, the distinguished ethnographer and glossologist, gives the meaning to be more precisely "associated as comrades"; the root being found in other dialects of the same group of languages, for instance, in the Minitari, where *dáki* is the name for the clan or band, and *dakóe* means friend or comrade. In the Sioux dialect, *cota* or *coda* means friend, and Dakota may, liberally translated, signify "our friends". It is, however, interesting to note that the Dakota Indians met by the writer always insisted upon the meaning of their national appellation to be simply "men", or "Indian men", as distinct from white men. This assumption in the tribal name of predominance in race has been noticed among other divisions of the aborigines where it is better warranted by the etymology. *Real men* is the meaning of "Onkwe Honwe", used by the Hurons and Iroquois; of "Rennappe", "Lenni", "Illiniwek", "Irimi", and "Nethowuck", names of Algonquin tribes; also of "Tinne", of the Athabascans, and probably of Apache. The title Sioux, which is indignantly repudiated by the nation, is either the last or the last two syllables, according to pronunciation, of "Nadowesioux", which is the French plural of the Algonquin name for the Dakotas, "Nadowessi", "enemy", though the English word is not so strong as the Indian, "hated foe" being nearer. The Chippeways called an Iroquois "Nadowi", which is also their name for a rattlesnake (or, as Dr. Foster, the Indian historiographer, translates, adder); in the plural, Nadowek. A Sioux they called Nadowessi, which is the same word with a contemptuous or diminutive termination; plural, Nadowessiwak or Nadowessyak. The French gave the name their own form of the plural, and the voyageurs and trappers cut it down to "Sioux". The name Wenepkoak, corrupted into Winnebago, given by the Chippeways to the

body invading their lands on Lake Michigan, as before mentioned, signifies "Men of the salt water",* confirming the traditions of the Dakotas, that they migrated from the Pacific coast. In this connection, it may be noted that the Dakota language more nearly approaches the Mongoloid dialects than that of any other of the American Indians.

The more important of the existing tribes and organized bands into which the nation is now divided are as follows, being the dislocated remains of the "Seven Great Council Fires", not only famed in tradition, but known to the early white pioneers: †

Yankton, } both derived from a root meaning "at the end", alluding
Yanktonai, } to the former locality of their villages.

Sahasapa, or Blackfeet.

Ohinonpa, or Two Kettle.

Itazipcho, Without Bow. The French translation, Sans Arc, is, however, more commonly used.

Minneconjou, "Reeds around the Water", the physical features of their old home.

Sichangu, "Burnt Hip", or Brulé.

Santee, subdivided into Wahpeton, "Men among Leaves", *i. e.*, forests, and Sisseton, "Men of Prairie Marsh". Two other bands, now practically extinct, formerly belonged to the Santee, or, as it is more correctly spelled, "Isanti" tribe, from the root "Issan", "knife". Their former territory furnished the material for stone knives, from the manufacture of which they were called the "knife people".

Ogallalla, or Oglala. The meaning and derivation of this name, as well as of the one next mentioned (Uncapapa), have been the subjects of much controversy. Two letters appended to this paper furnish information, not before published, respecting them.

Uncapapa, the most warlike and probably most powerful of all the bands, though not the largest. Sitting Bull is its most prominent mem-

* Some authorities prefer the translation into "dirty" or "stinking water", as referring to lakes surrounded by shallow marshes or grounds impregnated with sulphur (cf. the name of Lake Winnepeg); but the "Jesuit Relations" of 1659-60 state that the same word (there spelled Ouinipeg) is used for the sea. It is proper to add that the Winnebagos themselves have no tradition beyond their residence on the Green Bay of Lake Michigan, and that, though of the great Dakota family, they are not certainly members of that Nation. Their name Hochengara or Hochunkora, signifies "People of the original or primitive language".

† Hale, Gallatin, and Riggs designate a "Titon tribe" as located west of the Missouri, and as much the largest division of the Sioux; the latter authority subdividing it into the Sichangu, Itazipcho, Sahasapa, Minneconjou, Ohinonpa, Ogallalla, and Uncapapa, seven of the tribes specified in the text, which he calls bands. The fact probably is that "Titon" (from the word *tintan*, meaning "at or on land without trees, or prairie") was the name of a tribe, but is now only an expression for all those tribes whose ranges are on the prairie, and that it has become a territorial, not a tribular, distinction. One of the Dakotas at Fort Rice spoke to the writer of the "hostiles" as "Titons", with obviously the same idea of locality, "away on the prairie"; it being well known that they were a conglomeration from several tribes.

ber, though he is not the chief, who rejoices in the cognomen of Chitan Wahkinyan, *Anglicè*, Thunderhawk. Neither is the troublesome warrior's name among his fellows, viz, "Tatonka", translated as we habitually render it, for it means simply "the buffalo"; but it is understood that in order to distinguish his totem from the multitude of other bisons and avoid confusion among their armorial bearings, he blazons it as upon its haunches, in the heraldic position of *sejant*. He is also familiarly known as Húnkashnee, "Can't Run". This is not a complimentary epithet of the "Stonewall" order, suggesting repugnance to retreat in battle, which, indeed, would not, in Indian tactics, be meritorious, but refers to his physical lameness, from a wound received in the leg when a young brave.

The usual difficulty in estimating the numerical strength of any Indian division is enhanced by the frequent confusion of expression between the Dakota family and the Dakota Nation proper. The official return of 1871 of the Dakotas or Sioux on reservations was 42,998, and in the same return the Missouris, Omahas, Osages, Kansas, Ottoes, Assiniboins, Gros Ventres or Minnetarees, and Crows, all of whom are included by ethnographers in the great Dakota family, are all enumerated separately from the Sioux; but the Poncas, Iowas, and Mandans, also so classed, are not mentioned. Perhaps the Poncas were embraced in the return of the Omahas, of which they are a branch, and as their present muster is only 700, while the Iowas have not for several years much exceeded 200, or the Mandans 400, it appears that the official return in this instance intended the figures before given to express the census on reservations of the nation and not the family; and adding the bands in the United States not on reservations and those in the British Possessions, the Dakotas proper would amount to 50,000 souls. The report of the Commissioner of Indian Affairs for 1875, in quite a different classification from the foregoing, arrives at nearly the same result, making the aggregate of the several tribes of the Sioux specially mentioned in this paper as about 50,000, exclusive of those in British America. When, however, it is suggested to receive *cum grano salis* any census of Indians made before all the results of the Forty-fourth or "investigating" Congress shall have been announced, the suspicious mind may detect an allusion to that condiment as part of the *ration* stipulated by treaty and delivered at the agencies, as upon the official returns is based the aggregate of rations drawn by the Indian agents, and the latter have sometimes been accused of taking a liberal view of the population under their charge.

The number of Dakotas at the beginning of the present century cannot be even approximately stated; but their rapid decrease since then, from whisky, the small-pox, and other gifts of civilization, is shown with melancholy certainty in the almost entire extinction of some of their tribes known to be powerful when the whites came into contact with them; for instance, the Quappas, a mighty horde, which, migrating from west of the Rocky Mountains, led the van of the irruption, and

forced its passage through hundreds of miles of hostile territory, was, in 1871, reduced to 225 individuals. It is considered within limits to estimate that, at the period first noted in the chart now submitted, the people to whom it relates comprised a quarter of a million souls, divided into distinct tribes, nearly all of which are referred to in the symbols, which also embrace events as they successively occurred in many and widely-separated parts of the vast region above described and its borders.

Figure 1.—Thirty Dakotas were killed by Crow Indians. By counting back from several well-known dates, this year is ascertained to correspond with A. D. 1800, or, more accurately, with the year ending when winter began in the latter part of A. D. 1799. The Dakotas count their years by winters (as is quite natural, that season in their high levels and latitudes practically lasting more than six months), and say a man is so many snows old, or that so many snow-seasons have passed since an occurrence. They have no division of time into weeks, and their months are absolutely lunar, only twelve, however, being designated, which are named from, or, more accurately, receive their names upon, the recurrence of some prominent physical phenomenon. For example, the period partly embraced by February is intended to be the “raccoon moon”; March the “sore-eye” moon; and April, that “in which the geese lay eggs”. As the appearance of raccoons* after hibernation, the causes inducing inflamed eyes, and oviposition by geese vary with the meteorological character of each year, and the twelve lunations reckoned do not bring back the point in the season when counting commenced, there is often dispute in the Sioux tents toward the end of winter as to the correct current date.

The symbol consists of thirty parallel black lines in three columns, the outer lines being united. In the chart, such black lines always signify the death of Dakotas killed by their enemies.

The Upsaroka or Crow tribe, although classed by ethnographers as belonging to the Dakota family, has nearly always been at war with the Dakotas proper since the whites have had any knowledge of either. The official tables of 1875 give the number of Crows then living as 4,200. They are tall, well made, bold, and noted for the extraordinary length of their hair. Some writers also credit them with a comparative degree of cleanliness; but, to an observer, the legal maxim “*de minimis non curat*” would seem applicable as to any comparison between Indians on that subject.

Fig. 2, 1801.—The small-pox broke out in the nation. The symbol is the head and body of a man, covered with red blotches.

Fig. 3, 1802.—Dakotas stole horses with shoes on; *i. e.*, stole them

* Although the raccoon is still found in the region once occupied by the Sioux tribes, and then gave its name to the month Wicatawi, it is a question whether it now inhabits their present ranges. As the badger comes out of its hole about the time mentioned, and is frequently met with, that animal's habits may be used instead of those of the raccoon to mark the change of season indicated.

either directly from the whites, or from some other Indians who had before obtained them from whites, as the Indians never shoe their horses. The symbol is a horseshoe.

Fig. 4, 1803.—They stole some “curly horses” from the Crows. Some of these horses are still seen on the plains, the hair growing in closely-curling tufts, resembling in texture the negro’s woolly pile. It is not, however, supposed that Frémont’s celebrated woolly horse was of this breed. The symbol is a horse with black marks for the tufts. The Crows are known to have been early in the possession of horses.

Fig. 5, 1804.—The Dakotas had a calumet dance, and then went to war. The symbol is a long pipe-stem, ornamented with feathers and streamers. The feathers are white, with black tips, evidently the tail-feathers of the adult golden eagle (*Aquila chrysaëtos*), highly prized by all Indians. The streamers anciently were colored strips of skin or flexible bark; now gayly-colored strips of cloth are used. The word calumet is a corruption of the French *chalumeau*, and the pipe, among all the Mississippi tribes, was a symbol of peace. Captain Carver, in his “Three Years Travels through the Interior Parts of North America” (Philadelphia, 1796), which travels began in 1766, after puzzling over the etymology of the word calumet (that honest “captain of provincial troops” obviously not understanding French), reports it as “about four feet long, bowl of red marble, stem of a light wood curiously painted with hieroglyphics in various colors and adorned with feathers. Every nation has a different method of decorating these pipes, and can tell at once to what band it belongs. It is used as an introduction to all treaties, also as a flag of truce is among Europeans.” The event commemorated in the figure was doubtless a grand council of the various tribes of the nation for settlement of all internal difficulties, so as to act unitedly against the common enemy. J. C. Beltrami, who visited the Sioux not long after this date, describes them, in his “Pilgrimage” (London, 1828), as divided into independent tribes, managing their separate affairs each by its own council, and sometimes coming into conflict with each other, but uniting in a general council on occasions affecting the whole nation.

Fig. 6, 1805.—The Crows killed eight Dakotas. Again the short parallel black lines, this time eight in number, united by a long stroke.

Fig. 7, 1806.—A Dakota killed an Arickaree (generally abbreviated into “Ree”), as he was about to shoot an eagle. This may be considered a non-transcendental illustration of Emerson’s “Brahma”, viz:—

“If the red slayer think he slays,
Or if the slain think he is slain,”

for the red slayer not only thinks he slays, but also has excellent reason to think he is slain. The sign gives the head and shoulders of a man with a red spot of blood on his neck, an arm being extended, with a line drawn to a golden eagle. The Arickarees, a branch of the Pawnee family, though now reduced to less than 1,000, were at the date given a powerful body, divided into ten large bands.

Fig. 8, 1807.—“Red Coat”, a chief, was killed. The figure shows the red coat pierced by two arrows, with blood dropping from the wounds. It is proper here to remark that throughout the chart the totem of the clan of the person indicated is not generally given, though it is probably always used in pedigree records, but instead a pictorial representation of his name, when it admitted of such illustration. The clans are divisions relating to lineage, and neither coincide with, nor are limited by, the political tribal organizations. The number of the clans, or distinctive totemic families, of the Dakotas is believed to be less than that of their organized bands, if not of their tribes, and considerably less than that of the totems appearing on this chart. Although it has been contended that the clan-totem alone was used by Indians, there are other specimens of picture-writing among the Dakotas where the name-totem appears, notably the set of fifty-five drawings in the library of the Army Medical Museum narrating the deeds of Sitting Bull. A pictured message lately sent by a Sioux at Fort Rice to another at a distant Agency, and making the same use of name-signs, came to the writer's notice. Captain Carver, who spent a considerable time with these Indians (called by him “Nadowessies”) in 1766-67, explains that “besides the name of the animal by which every nation or tribe (clan) is denominated, there are others that are personal, which the children receive from their mother. . . . The chiefs are distinguished by a name that has *either* some reference to their abilities *or* to the hieroglyphic of their families, and these are acquired after they have arrived at the age of manhood. Such as have signalized themselves either in their war or hunting parties, or are possessed of some eminent qualification, receive a name that serves to perpetuate the fame of their actions or to make their abilities conspicuous.” The common use of these name-signs appears in their being affixed to old treaties, and also to some petitions in the Office of Indian Affairs, their similarity in both character and actual design irresistibly recalling the signatures of Locksley, Wamba & Co. to the famous cartel delivered at the Castle of Ivanhoe.

Fig. 9, 1808.—The Dakota who had killed the Ree shown in Fig. 7 was himself killed by the Rees. He is represented running, and shot with two arrows, blood dripping. These two figures, taken in connection, afford a good illustration of the method pursued in the chart, which was not intended to be a continuous history, or even to record the most important event of each year, but to exhibit some one of special peculiarity. War then raging between the Dakotas and several tribes, doubtless many on both sides were killed in each of the years; but there was some incident about the one Ree who was shot as in fancied security he was bringing down an eagle, and whose death was avenged by his brethren the second year afterward. Hence the selection of those occurrences. It would, indeed, have been impossible to have graphically distinguished the many battles, treaties, horse-stealings, big hunts, &c., so most of them were omitted and other events of greater individuality

and better adapted for portrayal were taken for the calendar; the criterion being not that they were of national moment, but were of national notoriety.

Fig. 10, 1809.—A chief, "Little Beaver", set fire to a trading-store and was killed. The character is simply his totem. Like the ghost of King Hamlet, "he wore his beaver up".

Fig. 11, 1810.—Black Stone made medicine. Sir William Blackstone was accused of "making law" in his Commentaries, but this is not a similar accusation against his namesake for innovation on the "regular practice" of medicine. The "medicine-men" have no connection with therapeutics, feel no pulses, and administer no drugs, or, if sometimes they direct the internal or external use of some secret preparation, it is as a part of, and with main reliance upon, superstitious ceremonies, in which they "put forth the charm of woven paces and of waving hands", utter wild cries, and muddle in blood and much filth until they work themselves into an epileptic condition. Their incantations are not only to drive away disease, but for many other purposes, such as to obtain success in war, avert calamity, and very frequently to bring within reach the buffalo, on which the Sioux depend for food. The rites are clearly those of Shamanism, and form another link between the North American Indians and the North Asiatic tribes. Symbol—the man-figure, with the head of an albino buffalo held over his own. In the ceremonial of "making medicine", a buffalo head always holds a prominent place.

Fig. 12, 1811.—The Dakotas fought a battle with the Gros Ventres and killed a great many. Symbol—a circle inclosing three round objects with flat bases, resembling heads severed from trunks, which latter the lithograph shows too minute in this symbol for suggestion of what they probably represent; but they appear more distinct in Fig. 65 as the heads of enemies slain in battle. In the sign-language of the plains, the Sioux are always denoted by drawing a hand across the throat, signifying that they cut the throats of their enemies. The Dakotas count by the fingers, as is common to most races, but with a peculiarity of their own. When they have gone over the fingers and thumbs of both hands, one finger is temporarily turned down for *one ten*. At the end of the next ten, another finger is turned, and so on to a hundred. *Opawinge*, one hundred, is derived from *pawinga*, "to go around in circles", or "make gyrations", and contains the idea that the round of all the fingers has again been made for their respective tens. So the circle is never used for less than one hundred, but sometimes signifies an indefinite number greater than a hundred. The symbol in this instance therefore, though at first sight purely arbitrary, clearly expresses the killing in battle of many enemies.

There are two wholly distinct tribes called by the Canadians Gros Ventres. One, known also as Minnetarees, is classed in the Dakota family, and numbered in 1804, according to Lewis and Clarke, 2,500

souls. The other "Big Bellies" are a division of the Arapahoes, from whom they separated in the early part of this century, and, wandering eastward, met the Dakotas, by whom they were driven off to the north. It is probable that this is the conflict recorded, though the Dakotas have also often been at feud with their cousins, the Minnetarees.

Fig. 13, 1812.—The wild horses were first run and caught by the Dakotas. The symbol is a lasso. The date is of interest, as showing when the herds of prairie horses, descended from those animals introduced by the Spaniards in Mexico, or those deposited by them on the shores of Texas and at other points, had multiplied so as to extend into the far northern regions. The Sioux undoubtedly learned the use of the horse and perhaps also that of the lasso from southern tribes, with whom they were in contact; and it is a curious fact that, notwithstanding the tenacity with which they generally adhere to ancient customs, in only two generations since they became familiar with the horse they have been so revolutionized in their habits as to be utterly helpless, both in war and the chase, when deprived of it.

Fig. 14, 1813.—The whooping-cough was very prevalent and fatal. The sign is ludicrously suggestive of a blast of air coughed out by the man-figure.

Fig. 15, 1814.—"A Dakota killed an Arapaho in his lodge." So said the interpreter, Clément; and the first impression of the symbol was that the object above the victim's head was a miniature tepee, with the smoke streaming out, but it better represents a tomahawk or battle-ax, the red being blood from the cleft scull. The Arapahoes long dwelt near the headwaters of the Arkansas and Platte Rivers, and in 1822 numbered 10,000.

Fig. 16, 1815.—The Sans Arcs made the first attempt at a dirt lodge. This was at Peoria Bottom, Dakota Territory. Crow Feather was their chief, which explains the fairly-drawn feather of that bird protruding from the lodge top.

Fig. 17, 1816.—"Buffalo belly was plenty." The symbol rudely portrays a side or perhaps hide of buffalo.

Fig. 18, 1817.—La Trombois, a Canadian, built a trading-store with dry timber. The dryness is shown by the dead tree.

Fig. 19, 1818.—The measles broke out, and many died. This symbol in the copy is the same as Fig. 2, relating to the small-pox, except a very slight difference in the red blotches; and though Lone Dog's artistic skill might not have been sufficient to distinctly vary the appearance of the two patients, both diseases being eruptive, still it is one of the few serious defects in the chart that the sign for the two years is so nearly identical that, separated from the continuous record, there would be confusion between them. Treating the document as a mere *aide mémoire*, no inconvenience would arise, it probably being well known that the small-pox epidemic preceded that of the measles; but such care is generally taken to make some, however minute, distinction

between the symbols, that probably the figures on Lone Dog's robe show a more marked difference between the spots indicating the two eruptions than is reproduced in the copy.

Fig. 20, 1819.—Another trading-store was built, this time by Louis La Conte, at Fort Pierre, Dakota Territory. His timber, as one of the Indians specially mentioned, was rotten.

Fig. 21, 1820.—The trader La Conte gave "Two Arrow" a war-dress for his bravery. So translated an interpreter, and the sign shows the two arrows as the warrior's totem; likewise the gable of a house, which brings in the trader; also a long strip of black tipped with red, streaming from the roof, which possibly may be the piece of particolored material out of which the dress was fashioned. This strip is not intended for sparks and smoke, as the red would then be nearest the roof, instead of farthest from it.

Fig. 22, 1821.—This may represent a comet, as one did appear in that year, being No. 133 of Galle's Catalogue. It was discovered January 21, at Paris, by Nicollet, observed in Europe until March 7, and, after its perihelion passage, from April 1 to May 3 at Valparaiso. It was not, however, a very conspicuous object to the naked eye, as its tail was but from 2° to 3° long. The character more resembles the falling to earth of a very brilliant meteor, and though no such appearance is on record, there were in 1821 few educated observers near the Upper Mississippi and Missouri who would take the trouble to notify scientific societies of the phenomenon; so it may well be that many Indians on the plains saw it, without its being recorded save on Lone Dog's chart. The Dakota language not being rich in astronomical terms, all cross-questioning failed to settle the case of meteor *versus* comet.

Fig. 23, 1822.—Another trading-house was built, which was by a white man yeleft "Big Leggings", and was at the mouth of the Little Missouri or Bad River. The drawing is distinguishable from Fig. 20.

Fig. 24, 1823.—White soldiers made their first appearance in the region. A man is represented clothed, wearing a hat, firing a carbine, and standing by a structure like the gable of a barrack, though perhaps a tent.

Fig. 25, 1824.—"Swan", chief of the Two Kettle tribe, had all of his horses killed. Symbol—a horse pierced by a lance, blood flowing from the wound, which, apart from the interpreter's rendering of the tradition, would not have suggested anything about the ruler of the Two Kettles and his loss in stock. We must, however, imitate good Peter Quince's acceptance of another equine appearance—"Bless thee, Bottom! bless thee! thou art translated!"

Fig. 26, 1825.—There was a remarkable flood in the Missouri River, and a number of Indians were drowned. With some exercise of fancy, the symbol may suggest heads appearing above a line of water, or it may simply be the severed heads, several times used, to denote Indians other than Dakotas, with the uniting black line of death.

Fig. 27, 1826.—“An Indian died of the dropsy.” So Basil Clément was understood, but it is not clear why this circumstance should have been noted, unless the appearance of the disease was so unusual in 1826 as to excite remark. Baron de Lahontan, a good authority concerning the northwestern Indians before they had been greatly affected by intercourse with whites, although showing a tendency to imitate another baron—Munchausen—as to his personal adventures, in his “Nouveaux Voyages dans l’Amérique Septentrionale,” specially mentions dropsy as one of the diseases unknown to them. Carver also states that this malady was extremely rare. Whether or not the dropsy was very uncommon, the swelling in this special case might have been so enormous as to render the patient an object of general curiosity and gossip, whose affliction thereby came within the plan of the calendar. The symbol merely shows a man-figure, not much fatter than several others, but distinguished by a line extending sidewise from the top of the head and inclining downward. It is hazarded that this may indicate a swelling from the natural size to fill a space extending to the extremity of the line.

Fig. 28, 1827.—“Dead Arm” was stabbed with a knife or dirk by a Mandan. The illustration is quite graphic, showing the long-handled dirk in the bloody wound and the withered arm. If Banquo had been a spectator then and there, he would probably have repeated his remark, “So withered and so wild!” Though the Mandans are also of the great Dakota family, the Sioux have pursued them with special hatred. In 1823, their number, much diminished by wars, still exceeded 2,500.

Fig. 29, 1828.—A white man named Shardran, who lately was still living in the same neighborhood, built a dirt lodge. The hatted head appears under the roof.

Fig. 30, 1829.—“Bad Spike” killed another Indian with an arrow. Nothing in the symbol shows the archer’s name, but the pierced victim would doubtless have been willing to swear that it was a case of very “bad spike”.

Fig. 31, 1830.—Bloody battle with the Crows, of whom it is said twenty-three were killed. Nothing in the sign denotes number, it being only a man-figure with red or bloody body and red war-bonnet.

Fig. 32, 1831.—Le Beau, a white man, killed another named Kermel.

Fig. 33, 1832.—“Lone Horn” had his leg “killed”, as the interpretation gave it. The single horn is on the figure, and a leg is drawn up as if fractured or distorted, though not unlike the leg in Fig. 9, where running is depicted. The crippling injury may be called the “blast of that dread Horn,” though not the one “on Fontarabian echoes borne”.

Fig. 34, 1833.—“The stars fell”, as the Indians all agreed. This was the great meteoric shower observed all over the United States on November 12 of that year.

Fig. 35, 1834.—The chief “Medicine Hide” was killed. The symbol shows the body as bloody, but not the war-bonnet, by which it is distinguished from Fig. 31.

Fig. 36, 1835.—“Lame Deer” shot a Crow Indian with an arrow, drew it out, and shot him again with the same arrow. The hand is drawing the arrow from the first wound. This is another instance of the principle on which events were selected. Many fights occurred of greater moment, but with no incident precisely like this.

Fig. 37, 1836.—“Band’s Father”, chief of the Two Kettles, died. So declare the notes of Basil Clément’s interpretation; but it is by no means as satisfactory as the ancient efforts of Daniel in that direction, and no one else knew anything on the subject. The symbol is the same as Fig. 17, denoting plenty of buffalo belly; and while the original may have some mark or color contra-distinguishing the two, omitted in the copy, the question remains what the buffalo belly had to do with the demise of the lamented chieftain, unless he suffered from a fatal indigestion after eating too much of that delicacy. The writer is inclined to adopt Mr. Tennyson’s belief that “some one had blundered”; there being an obvious error in the symbol, or the interpretation, or both.

Fig. 38, 1837.—Commemorates a remarkably successful hunt, in which it is said one hundred elk were killed. The drawing of the elk is quite good enough to distinguish it from the other quadrupeds in the chart.

Fig. 39, 1838.—A dirt lodge was built for “Iron Horn”. The other dirt lodge (Fig. 16) has a mark of ownership which this has not. Perhaps it was not so easy to draw an iron horn as a crow feather, and the distinction was accomplished by omission. A chief of the Minneconjous is mentioned in General Harney’s report in 1856, under the name of The-One-Iron-Horn, which is probably but another translation of the name of this owner of “a lodge in some vast wilderness”.

Fig. 40, 1839.—The Dakotas killed an entire village of Snake Indians. The character is the ordinary tepee pierced by arrows. The Snakes, or Shoshones, were a numerous and wide-spread people, divided into Shoshones proper and Utahs. The former inhabit Southeastern Oregon, Idaho, Western Montana, and the northern portions of Utah and Nevada; the latter occupy nearly the whole of Utah and Nevada, extending into Arizona and California.

Fig. 41, 1840.—The Dakotas made peace with the Cheyennes, a well-known tribe belonging to the Algonquin family, with which at the present time the leaders of the insurgent Sioux are still on the best terms. The symbol of peace is the common one of the approaching palms of two persons.

Fig. 42, 1841.—“Feather-in-the-Ear” stole thirty spotted ponies. The spots are shown red, distinguishing them from those of the curly horse in Fig. 4. “Feather-in-the-Ear” was evidently a “ticklish” character, the Autolycus of his tribe.

Fig. 43, 1842.—“One Feather” raised a large war-party against the Crows. This chief is designated by his long solitary red eagle feather, and holds a pipe with black stem and red bowl, alluding to the usual ceremonies before starting on the war-path. The-Red-War-Eagle-Feather was at this time a chief of the Sans Arcs.

Fig. 44, 1843.—The Sans Arcs made medicine to bring the buffalo, the same being absent without leave. The medicine-tent is denoted by a buffalo's head drawn on it.

Fig. 45, 1844.—The Minneconjous built a pine fort. A pine-tree connected with a tepee.

Fig. 46, 1845.—Plenty of buffalo-meat, which is represented as hung up on poles and trees to dry.

Fig. 47, 1846.—“Broken Leg” died. There is enough difference between this symbol and Figs. 33 and 9 to distinguish each.

Fig. 48, 1847.—“Two Man” was killed. His totem is drawn,—two small man-figures side by side.

Fig. 49, 1848.—Humpback was killed. An ornamented lance pierces what the chief's brother potentate Richard III styled the “envious mountain on his back”.

Fig. 50, 1849.—The Crows stole a large drove of horses (it is said 800) from the Brulés. The circle appears denoting multitude, at least one hundred, and a number of horse-tracks.

Fig. 51, 1850.—The character is a distinct drawing of a buffalo containing a human figure. Clément translated that “a buffalo cow was killed in that year, and an old woman found in her belly”; also that all the Indians believed this. Good Wood, examined through another interpreter, could or would give no explanation except that it was “about their religion”. At first, the writer suspected that the medicine-men had manufactured some pretended portent out of a fœtus taken from a real cow, but it is now ascertained, on the excellent authority of Prof. J. W. Powell, that the Sioux have long believed in the appearance from time to time of a monstrous animal that swallows human beings. This superstition was doubtless suggested by the bones of mastodons, often found in the territory of those Indians; and the buffalo being the largest living animal known to them, its name was given to the legendary monster, in which nomenclature they were not wholly wrong, as the horns of the fossil *Bison latifrons* are ten feet in length. The medicine-men probably announced, in 1850, that a squaw who had disappeared was swallowed by the mammoth which was then on its periodical visit, and must be propitiated. This demon buffalo is an object of worship, but polytheism prevails to such a degree, according to Rev. Stephen R. Riggs, who treats of the subject in the Introduction to his admirable Lexicon, published in 1852, that there are also religious ceremonies for the sun and moon; gods of the north and south, earth, air, and water, woods and prairie. Other and still earlier authorities explain that the Indians of this nation called the great spirit “Wakou” or “Tongo Wakou”, and regarded him as the source of all good, but they also believed in an opposing bad spirit, whom they worshiped in a manner reminding of Manicheism. They adored also various good spirits of a less degree, presiding over all the extraordinary objects in nature, such as lakes or mountains of uncommon magnitude, and likewise whatever

beasts, birds, fishes, and even vegetables or stones, were distinguished by size or singularity. If Saint Paul had extended his travels to visit the Dakotas, he might not have found them resembling the Athenians in other respects, but equally entitled to the ambiguous compliment so lamely translated in the English New Testament, “κατὰ πάντα ὡς δεῖσιδαίμωνιστέρους”.

Fig. 52, 1851.—Peace with the Crows. Two Indians with differing arrangement of hair, showing two tribes, are exchanging pipes for a peace-smoke.

Fig. 53, 1852.—The Nez Percés came to Lone Horn's lodge at midnight. The symbol shows an Indian touching with a pipe a tepee, the top of which is black or opaque, signifying night, and perhaps, also, that the chieftain visited, suspecting something wrong about the untimely “surprise party”—notwithstanding the peace-offering of a pipe—had put out his fire and lights as “not at home”, while he watched developments in the vicinage. The newspapers veraciously tell how Sitting Bull perfects himself in strategy by studying the campaigns of Napoleon in the original French, so they may authorize a conjecture that Lone Horn, in his consultation of Virgil about the siege of Troy, had been struck by Laocoön's shrewd suggestion, “Timeo Danaos et dona ferentes”. There was doubtless some incident or result to this nocturnal visitation, which the Indians examined did not recall, or the interpreters did not translate. Why the Nez Percés are so styled is not understood, as they never have been known to pierce their noses, and they call themselves Numepo. The tribe is still large, dwelling chiefly in Idaho.

Fig. 54, 1853.—Spanish blankets were first brought to the country. A fair drawing of one of those striped blankets, held out by a white trader to tempt purchasers.

Fig. 55, 1854.—“Brave Bear” was killed. This warrior had already invested in the new style of blanket.

Fig. 56, 1855.—General Harney made peace with a number of the tribes or bands of the Dakotas. This was at Fort Pierre, Dak. The figure is an attempt at an officer in uniform shaking hands with an Indian.

On first examining the records, it seemed as if the chronology were faulty about this great peace council at Fort Pierre, as the most important occasion of the kind was in 1856. Executive Document No. 94, Thirty-fourth Congress, first session, Senate, contains the “minutes of a council held at Fort Pierre, Nebraska Territory, on the 1st day of March, 1856, by Brevet Brigadier General Wm. S. Harney, U. S. A., commanding the Sioux expedition, with the delegations from nine of the bands of the Sioux, viz, the Two Kettle band, Lower Yankton, Onepapas, Blackfeet Sioux, Minneconjous, Sans Arcs, Yanctonnais (two bands), Brulés of the Platte”. The great council was in fact opened on the 1st of March, 1856, closing on the 5th; but the chronologer made no mistake,

for in the same proceedings General Harney *loquitur*, "I told the people who were here a *hundred days ago*, &c." This brought to attention the earlier preliminary council held in the latter part of 1855, for which the peace symbol having already been used in the chart could not be repeated or changed, though the meeting in 1856 was larger and its results more momentous.

Fig. 57, 1856.—"Four Horn" was made a calumet or medicine man. This was probably the result of an important political struggle, as there is much rivalry and electioneering for the office, which, with its triple character of doctor, priest, and magician, is one of far greater power than the chieftainship. A man with four horns holds out the same kind of ornamented pipe-stem shown in Fig. 5, it being his badge of office, and not referring to any "pipe-laying" that might have occurred in the election, although Four Horn, being skilled in "buffalo medicine", may have *bull-dosed* some of his constituents. He was one of the sub-chiefs of the Uncapapas, and was introduced to General Harney at the council of this year by Bear Rib, head chief of that tribe.

Fig. 58, 1857.—The Dakotas killed a Crow squaw. The fashion evidently was for the stripes on the blankets of ladies to be worn horizontally, Brave Bear's, Fig. 55, and Swan's, Fig. 67, being vertical. She is pierced by four arrows, and the peace made with the Crows in 1851 seems to have been short-lived.

Fig. 59, 1858.—"Lone Horn", whose solitary horn appears, made buffalo medicine, probably on account of the scarcity of that animal. Again the head of an albino bison. "One Horn", doubtless the same individual, is recorded as the head chief of the Minneconjous at this date.

Fig. 60, 1859.—"Big Crow", a Sioux chief, was killed by the Crows. The crow, transfixed by an arrow, is drawn so as to give quite the appearance of a heraldic crest. To complete B. Crow's signet-ring, his engraver needed only to add in a scroll, by way of motto, the fragment of Juvenal's familiar line, "dat veniam corvis".

Fig. 61, 1860.—Symbol—the head and neck of an elk, like that part of the animal in Fig. 38, with a line extending from its mouth, at the extremity of which is the albino buffalo head. "The elk made you understand his voice while he was walking."

"I cannot tell how the truth may be;
I say the tale as 't was said to me."

The interpreter persisted in this oracular rendering, probably not being able to fully catch the Indian explanation from want of thorough knowledge of the language. The ignorance of professed interpreters, who easily get beyond their philological depth, but are ashamed to acknowledge it, has occasioned many official blunders. This symbol and its interpretation were unintelligible to the writer until examination of General Harney's report above referred to showed the name of a prominent chief of the Minneconjous set forth as "The-Elk-that-hollows-

walking". It then became probable that the symbol simply meant that the afore-said chief made buffalo medicine.

Fig. 62, 1861.—Buffalo were so plenty that their tracks came close to the tepees. The cloven hoof-mark is cleverly distinguished from the tracks of horses in Fig. 50.

Fig. 63, 1862.—"Red Feather", a Minneconjou, was killed. His feather is shown entirely red, while the "one feather", Fig. 43, has a black tip.

Fig. 64, 1863.—Eight Sioux were killed. Again the short parallel black lines united by a long stroke. In this year, Sitting Bull fought General Sully in the Black Hills.

Fig. 65, 1864.—The Dakotas killed four Crows. Four of the same rounded objects, like severed heads, shown in Fig. 26, but these are bloody, thus distinguishing them from the cases of drowning.

Fig. 66, 1865.—Many horses died for want of grass. The horse here drawn is sufficiently distinct from all others in the chart.

Fig. 67, 1866.—"Swan", father of Swan, now chief of the Minneconjous, died. With the assistance of the name, the object intended for his totem, over the head of the gentleman draped in the Spanish blanket, may possibly be recognized as a swan swimming on the water, but it is rather a trial for the imagination.

Fig. 68, 1867.—The flag represents the power of the United States Government appearing in the visit of the peace commissioners, among whom were Generals Sherman, Terry, and other prominent military and civil officers. Their report appears in the Annual Report of the Commissioner of Indian Affairs for 1868. They met at Fort Leavenworth, August 13, 1867, and between August 30 and September 13 held councils with the various bands of the Dakota Indians at Forts Sully and Thompson, and also at the Yankton, Ponca, and Santee Reservations. These resulted in the Great Sioux treaty of 1868.

Fig. 69, 1868.—Texas cattle were brought into the country. This was done by Mr. William A. Paxton, a well-known business-man, now resident in the Territory.

Fig. 70, 1869.—An eclipse of the sun. This was the solar eclipse of August 7 of that year, which was central and total on a line drawn through the Sioux country. This symbol has been criticised, because the Indians believe an eclipse to be occasioned by a dragon or aerial monster swallowing the sun, and it is contended that they would so represent it. An answer is that the design is objectively good, the sun being painted black as concealed, while the stars come out red, *i. e.*, bright, and graphic illustration prevails throughout the chart where it is possible to employ it. In addition, it is learned that Prof. Cleveland Abbé, who was famed as an astronomer before he became so as a meteorologist, was at Sioux Falls City with a corps of assistants to observe this very eclipse, and explained the subject to a large number of Indians there at that time, so that their attention was not only directed specially to that eclipse, but also to the white men as interested in it, and to its real appearance as apart from their old superstition.

Fig. 71, 1870.—The Uncapapas had a battle with the Crows, the former losing, it is said, 14, and killing 29 out of 30 of the latter, though nothing appears to show those numbers. The central object in the symbol is not a circle denoting multitude, but an irregularly-rounded object, clearly intended for one of the wooden inclosures, or forts, frequently erected by the Indians, and especially the Crows. The Crow fort is shown as nearly surrounded, and bullets, not arrows or lances, are flying. This is the first instance in which any combat or killing is portrayed where guns explicitly appear to be used, though nothing in the chart is at variance with the fact that the Dakotas had for a number of years been familiar with fire-arms. The most recent indications of any weapon were those of the arrows piercing the Crow squaw in 1857 and Brave Bear in 1854, while the last one before them was the lance used in 1848, and those arms might have well been employed in all the cases selected for the calendar, although rifles and muskets were common. There is also an obvious practical difficulty in picturing by a single character killing with a bullet, not arising as to arrows, lances, dirks, and hatchets, all of which can be and are in the chart shown projecting from the wounds made by them. It is, however, to be noted that the bloody wound on the Ree's shoulder (Fig. 7) is without any protruding weapon, as if made by a bullet.

Here ends the copy in Clément's possession, but it was clearly understood by all the Indians examined that Lone Dog was engaged in continuing the series, though none of them had seen him or his work since 1871. The year 1876 has furnished good store of events for his choice, and it will be interesting to learn whether he has selected as the distinguishing event the victory over Custer, or, as of still greater interest, the general seizure of ponies, whereat the tribes, imitating Rachel, weep, and will not be comforted, because they are not.

Measures have been taken to obtain, when the condition of the Sioux country shall allow, a perfect copy of the chart in its latest form, further general information regarding it, and a correction of several parts of the present explanation, confessed to be unsatisfactory.

In conclusion, it is submitted that the production is shown to be not narrative in design, the noting of events being wholly subordinated to the marking of years by them; and the symbolized serial arrangement of sometimes trivial, though always notorious incidents, being with special adaptation to use as a calendar. If it had been a complete national history for the seventy-one years, its discovery would have been far more valuable; but it is the more curious and unique, because it is only an attempt, before unsuspected among the nomadic tribes of American Indians, to form a system of chronology. We may adopt regarding it Pope's remark about the objects found in amber:—

"The things, we know, are neither rich nor rare,
But wonder how the devil they got there"—

i. e., among the generally-despised Sioux.

APPENDIX.

Washington, March 12, 1877.

DEAR SIR: * * * In the preface to the "Dakota Grammar and Dictionary", published, under the auspices of the Minnesota Historical Society, by the Smithsonian Institution, a notice of all the bands of the Teton Sioux is concluded thus:—

"And the Oglala and Hunkpapa, the meanings of which names have not been ascertained."

By which we are to understand only that the missionaries, all adepts in the Dakota language by an over twenty years' residence in the Nation, had not been able to agree among themselves as to their precise meanings, some holding one theory and some another.

To speak, first, of the last-named Sioux band (which appears in the official reports of the Indian Office travestied into "Oncpapa"), the spelling of the missionaries, as to the preliminary "H" forming an integral part of the name, has the *prima facie* prestige of probable correctness. The traders and the "unlearned", however, more commonly, in writing the name, drop the "H", and the interpretations of it have been various, as "Dried-Beef-Eaters", because "päpü" by itself means dried or parched meat, the prefix "un" being the sign of causation or use; also, as "Those-who-make-Dried-Beef"; while still others interpret "Unkpapa" as meaning the Noisy or Wild Band, from "un", causation, and paⁿpaⁿ (the *a* vowels being both nasal), this last word meaning to "yell", or "make a noise by shouting". If we adopt the missionary "Hunkpapa" as being the true form of the name, a solution of the derivation is more difficult, though it may mean, in that case also, somewhat the same as already explained in the last solution of the first form of the name, that is, the Yellers or Shouters; perhaps from *hoonkah*, having the sense of brother or brethren, and the beforementioned paⁿpaⁿ, to yell.

There is another translation of Unkpapa or Oonkpahpah, a vulgar one, having allusion to noisy defecation, and another of Hunkpapa or Homkpahpah, which refers its derivation to their manner of dressing buffalo-robos.

I incline, without being decided about it, to Unkpapa or Oonkpahpah as the true form of the name, and "Those who shout" as the better interpretation; that is, "The Yellers" or Wild Band, a name which perfectly describes them, as they are even now the wildest Tetons of Sitting Bull's wild forces.

The O-gla-la, as the missionaries write it, the O-gay-lah-lah, in English notation, or Ogalalla in the common style of spelling the name, is the designation of another sub-band of the Teton tribe of the great Dakota-Sioux Nation. One of the most distinguished of the authors of the Dakota Lexicon, the Rev. Gideon J. Pond, has expressed in writing the

opinion that the name of this Teton band meant "Always Moving", those of no fixed habitations, the Nomads, particularly and especially, of the Nation. In analyzing the name, the vowel "o" is the prefix which converts Dakota verbs into nouns; "hda" in the Santee or Eastern Sioux dialect means "to go home", and this in the Yankton dialect changes to "kda", while in the Teton it becomes "gla", for in this last Sioux dialect "g" hard is used for "h" of the Santee and the "k" of the Yankton, and rejecting "d" altogether they use "l" in its place. The duplication of *hda* or *kda* or *gla* implies "more homes than one", and therefore conveys the idea of *unsettled* and *wandering*. Or it may be that the word *hdah-hdah* (the italic *h* representing a guttural), meaning a rattle, or some thing that is "loose", "not secure", "unsteady", better represents the original idea under which their name was first bestowed. O-glah-glah is perhaps an orthography that conveys more exactly the Indian sound of the name to English-educated people.

Very respectfully,

THOMAS FOSTER.

Col. GARRICK MALLERY, U. S. A.

HARTFORD, *January 19, 1877.*

DEAR SIR: * * * The origin of these names is often very obscure and the meaning is sometimes lost, or in doubt, to those who bear the name. It is easy to *guess* at the meaning, but the guess is as likely to be wrong as right, even when the etymology seems to be plain.

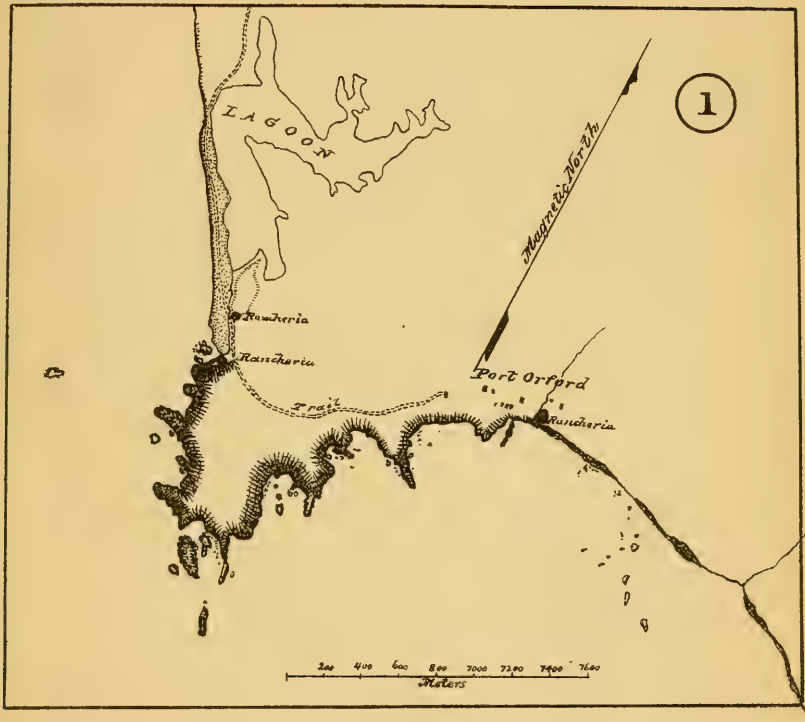
I have little doubt that the first half of "Hunkpapa" is the representation of *Hunka*, "parent or ancestor", as Riggs translates it, with the explanation that it is applied to "one who has raised himself in the estimation of the people so as to be considered as a kind of benefactor or parent"; hence "the *sun*" as a parent or benefactor. This seems to be, though Mr. Riggs does not note the fact, the same term which is used in the name of the Water-god, "Unktehi", and of the spider (mythic), "Unktomi". The thumb is *nape hunka*, *i. e.*, the elder finger or parent finger. The same root is found in *hunku*, mother, *tunkan*, father-in-law, and, I think, in *uncu*, grandmother. As it characterizes ancestry in the maternal line, it probably indicates totemic (or clan) relationship. *

* * *

Yours, truly,

J. H. TRUMBULL.

Col. GARRICK MALLERY.



Map of Port Orford, Oregon and vicinity.

ART. II. — RESEARCHES IN THE KJÖKKENMÖDDINGS AND GRAVES OF A FORMER POPULATION OF THE COAST OF OREGON.*

BY PAUL SCHUMACHER.

PLATES 2-8.

With two hired men and a camp outfit, I left San Francisco toward the end of September, 1875, on board of the United States revenue-cutter Richard Rush, Captain Baker, having received permission to take passage on one of her northern cruises. We made landing at Port Orford, in Oregon, September 27, and the following day pitched our first camp near the fresh-water lagoon, a little to the north of the point.

From here I dispatched one of the men 45 miles down the coast to Pistol River to bring pack-animals, for which arrangement had already been made; I also engaged, in addition to the help already employed, two Oregonians in my party, whom I knew to be good packers and able hands for an expedition full of hardships, exposure to the elements, and hard labor, all of which I justly anticipated.

Before the arrival of men and animals, I, with one man left, investigated the neighborhood of the lagoon, so advantageously adapted for the location of aboriginal settlements. Near the mouth of the outlet of the lagoon, we discovered the site of a small settlement (Map 1) [Plate 2], the location of the huts being still indicated by several circular depressions, with an embankment around it of 1 or 2 feet above the average level of the somewhat elevated position, which, toward the sea, abruptly terminates in a bluff of nearly 50 feet. Across the river, dunes border the ocean for about a mile to the northward. Looking in that direction, we gain a good view, although a part of the lake, or lagoon, is hidden by the heavy timber on the right, while to the southward the steep ascent of the high rocky point immediately obstructs any view in that direction; leaving a grassy, steep cañon to the eastward, with a small running stream of good water, which passes at the foot of the settlement. About half-way from this station to the lake, and on the county trail, we find another small deserted *rancheria*. The

[This and the succeeding article by the same author are the outcome of explorations conducted under the joint auspices of the Smithsonian Institution and the Indian Bureau, for the purpose of making a representation of the archaeology of the California coast at the United States Centennial Exposition. The articles are furnished by the Smithsonian Institution for publication by the Survey. The illustrations are from maps, sketches and plans furnished by the author.—ED.]

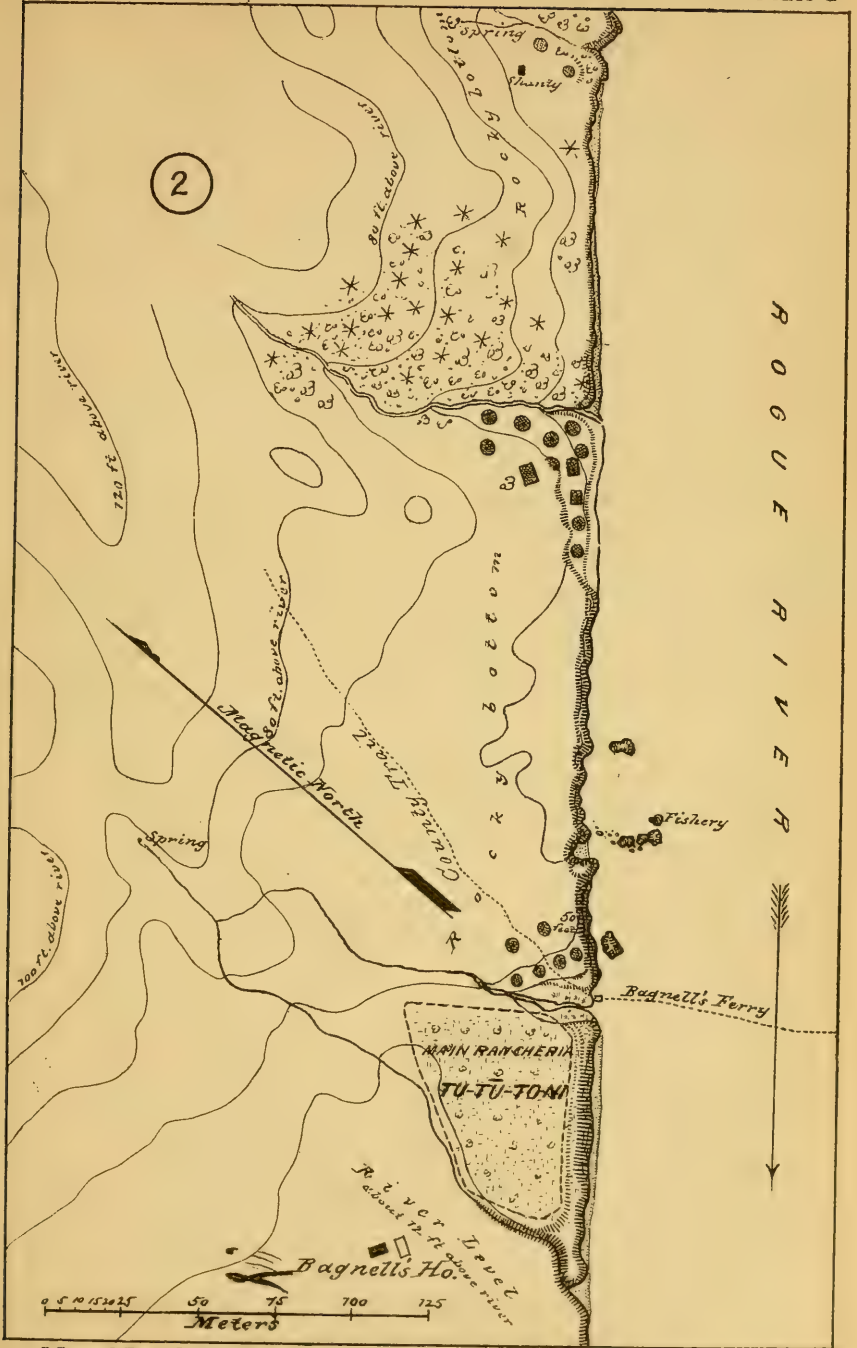
shells, which are at the first more mixed with sand and overgrown with grass, are here quite bare on the surface, which adds a fresher appearance. I looked for graves, employing the methods suggested in my southern tour, but all failed; and as even the house-sites yielded no skeletons I was inclined to believe that no graves exist here, where, by the signs, dwellings had existed only for a short time. At the mouth of the creek which supplies the small scattered town of Port Orford with water, is seen a moderately large shell-mound, partially washed away by the waters of the creek and the ocean as well, while back of the bluff, where the ground gently descends, several buildings and a garden cover the site of the deserted Indian town, thus making an exploration of the place impracticable.

During our reconnaissance, the Indians still dwelling in several places northward from here, and many others, well armed with rifles, who were passing on hunting excursions, watched our proceedings rather suspiciously, but made themselves welcome in our camp, and enjoyed our somewhat aboriginal dinners with much gusto. The meeting with Indians is not pleasant to an explorer of their forefathers' deserted hearths, as their friendly feeling is easily disturbed, and their superstitions alarmed by researches among the remains and graves of their ancestors; for this reason we did not visit Elk River, Sixes River, and other localities north of Port Orford, where Indians still live.

Our animals had in the mean time arrived, and after experiencing the first rain of the winter season, we started, on October 6, upon our way to Rogue River.

About 10 miles south of Port Orford, in the neighborhood of the rocks called "Three Sisters", on the bank of a creek, and close to the abrupt shore, we find the *kjökkenmöddings* of a former people located on a small flat—now covered with an orchard—bordered by the creek, and toward the sea by the ascending shore, the close proximity of which is only revealed by the roaring of the ocean, while an open view is had back in the valley. This station, I think, was the northernmost *rancheria* of the *Yu-kwā-chi*, while another one is found at Mussel Creek, about 5 miles farther south, and the largest of all at Yukwa Creek (which stream is now usually termed Euchre Creek, being a more familiar expression to the Oregonians of the present day). All these places are now under cultivation and partially occupied by building, whereby the signs, save the kitchen-refuse of the former inhabitants, became obliterated and covered. From Yukwa Creek, the trail trends back from the coast, and we could not observe the smaller settlements said to exist between here and Rogue River. A thick fog was also a strong impediment to our observations during the entire trip from Port Orford to Rogue River.

Arriving at Rogue River, we went into camp below the ferry, located at the place where the main *rancheria* of the *Tu-tū-to-ni* once existed (Map 2) [Plate 3], about five miles from the mouth, and on the right or



Map of Rancheria of the Tu-tu-to-ni Rancheria & Vicinity on Rogue River.

north bank of the river. Over the main *rancheria*, marked by a thick layer of kjökkenmöddings, we find the usual obstruction, an orchard; while across the rivulet (the efflux of a spring issuing but little over 150 yards farther up on the rocky rise), the house-sites remained well defined; which we also notice 150 yards farther up the river, in an indentation of the steep shore, and still in another similar nook at a distance of 100 yards farther on. These places were still inhabited at the time of the Rogue River war in 1856, when here, on the left bank of the river, just across from the main *rancheria*, peace was accepted by the leader of the United States Army, and the Indians were accordingly removed to reservations. The present owner of the land and ferry, a "squaw-man", liberally gave us permission to dig in his orchard, where all signs of former houses were obliterated by the plow and obstructed by high weeds and trees. Although we made a careful search for graves, the many test-holes we dug revealed only sites of houses; the kitchen-refuse consisting of all kinds of shells (see Smithsonian Report of 1873) and a great many bones of elk and of deer, averaged about 8 feet in depth at the main station, while none were found across the rivulet on the rocky ascending bottom, where it is likely the rains had washed them into the river, and very few, not enough even to form a layer, at the two upper town-sites. The houses we excavated were square; that is to say, the subterranean part reached to a depth of about 4 feet below the surface, and measuring variously from 6 to 10 feet square. The casing of the excavation consisted of boards arranged horizontally, contrary to the vertical position in the houses of the present Klamath Indians, and was kept in its place by posts along the front. The general impression which the traces of an old aboriginal town-site makes is that of a group of huge mole-hills inverted or sunk to a small rim at its base (Sketch A) [Plate 4]. Although the excavation was found to be square, the remaining concavities, always shallow, and hardly ever more than 3 feet deep, were circular, which is attributed to the circular embankment that still surrounds it, and to the natural action of the elements in filling up a depression in loose ground. No doubt, the superstructure of the hut was of a circular shape, corresponding to the remaining embankment, and was probably placed in such a manner as to meet conically, and was covered with earth, &c. The fireplace we find on one side of the floor in a small excavation, and the smoke escaped through a draft-passage, as shown in section sketch (B) and the plan (C) [Plate 4]. We find among these house-sites a few well-preserved ones, exceptionally with square embankments (compare the sites of the first branch settlement, Map 2 [Plate 3]), but they are no doubt of recent date, and a modification between an aboriginal hut and a white man's shanty, such as we had occasion to witness among the present Klamaths at the mouth of the Klamath River, one of which I show in sketch (D), as also an inner view (E), a plan (F), and a section (G) [all on Plate 5]. The inner view shows the depression, which is in this case pentagonal, incased by boards placed

horizontally, with a fireplace in the center. The excavation is reached by a notched board, after entering the house through a circular door near the ground. The remains of the square structures of the Tu-tu-to-ni show, as at the Klamath, the marks of an ax, while the wooden parts of the older circular ones are charred at the ends and split with elkhorn wedges, of which we find so many among the *débris*.

In one of the ruins we excavated on the main *rancheria* was found a boat-shaped vessel, or dish, about nine inches in length, made, like those of our collection obtained on the islands of Santa Barbara Channel, of magnesian mica, showing also strong marks of having been exposed to fire, seemingly for the purpose of cooking food in it; furthermore, a beautiful ladle of stone, a nicely finished wedge of slate as used for repairing canoes; and among the *kjökkenmöddings* we dug over, arrow-heads and knives of stone, and many bone-carvings, were uncovered.

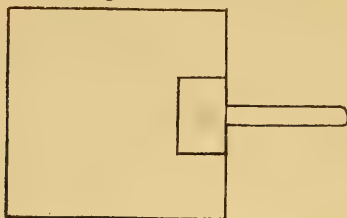
I cannot account for our utter failure in finding any skeletons in the main *rancheria* (the ground being well adapted for graves), either in a regular cemetery or buried in houses, as we gave our attention to both modes of interment. A cemetery probably existed in front of the *rancheria*, near the brink, where the *kjökkenmöddings* steeply descend to the edge of the river, which had, since the depopulation of the *rancheria*, risen very high, and nearly reached the top of the kitchen-middings, according to the mark set by the present owner of the place, and washed away a large part of the refuse.

About two miles up the river from the main settlement, another *rancheria* existed, in a nice spot, sheltered by a ridge, and bordered on one side by a small stream at the foot of a steep rising, while in front the beautiful Rogue River displays its picturesque scenes (Map 3) [Plate 6]. The *kjökkenmöddings* average here a depth of two feet only. While searching for the burying-ground, we sunk many test-holes all over the place, and finally came upon a grave. It was dug three feet into a sandy soil; the sides of the lower part were lined with boards; the skeleton, doubled up in the usual manner, was resting on its back, facing the east, and was covered by a board secured by several stones, and the hole filled even with the surface of the surrounding ground. Nothing was found with the skeleton.

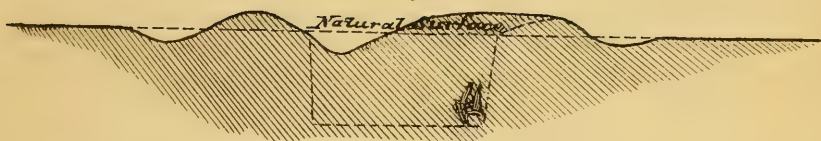
Rogue River was alive with trout and thickly stocked with salmon at the time of our visit; hundreds of them could be seen splashing at short intervals on the surface of the water, or resting motionless in the deep eddies near rocks and bluffs. In front of the lower or main settlement are several rocks above water, of which the farthest one out was the principal fishery of the Tu-tu-to-ni, and gave rise, it is said, to many disputes and quarrels. The rock is but eight feet above the surface of the river at common height, which elevation is well adapted for the spearing of fish by torch-light; the torch was placed in a crevice near the water-mark of the rock's face to attract the fish from out the deep holes near enough to the surface to be in easy reach of the expert spearsman.



C



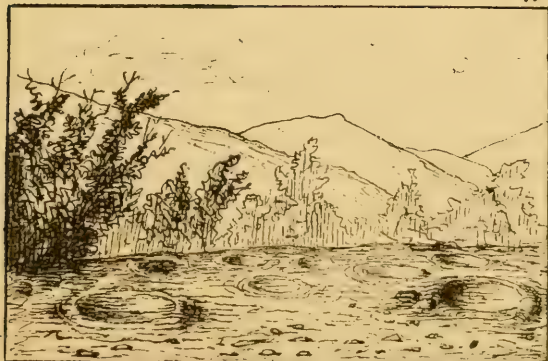
H



I



A



Sketches, plan and section of excavation at Tu-tu-toni and Chétl-é-skin Rancherías

As the adjoining country of the Rogue River is also an excellent hunting-ground, of course the favorable places along its banks had been settled by Indians. This is demonstrated by several deserted camps, formerly inhabited by the *Me-ka-nē-ten*, before the mouth of the Illinois River is reached, where the main tribe of the *Shis-ta-kūs-ta* dwelt. On both banks of the mouth of the Rogue River were the *Yā-sut* stationed. That place is now obliterated by buildings and improvements.

While at Rogue River, the weather had become threatening, and rain set in on the morning of October 17 while we were finishing our preparations to move down to Pistol River. It was tedious, disagreeable work that day: the miserable trails had become slippery, and in consequence almost impassable even for our mules, which showed much opposition to carry a heavy load, made more so by a soaking rain. But all went on as well as could be expected under such disadvantageous circumstances, thanks to our experienced packers, until dark night set in, when we neared the roaring ocean, where the trail, almost at our destination, trends down a steep bluff, and passes at its base over bowlders; there our animals became terrified by a loose pack to such a degree that nothing could check them, and they darted off in a full stampede, scattering the packs along the beach. This caused us considerable trouble during the rainy night in searching for and removing the stuff out of the reach of high tide.

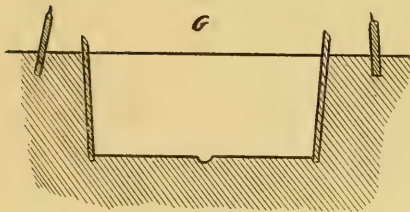
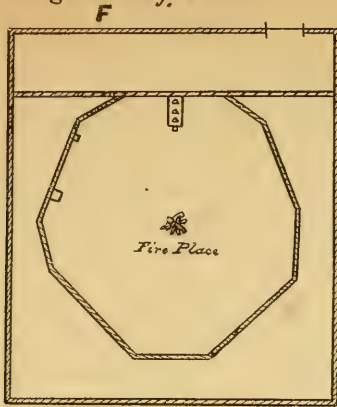
The next day we established our camp, and began excavations at the main *rancheria* of the *Chētł-ē-shīn* on the elevated ground at the last bend, near the mouth and north of the stream called Pistol River (Map 4) [Plate 7].

The tribe of the *Chetl-e-shin* once occupied the country between Cape Sebastian in the north and Mack's Arch in the south, a very prominent arch-rock lying about a mile to the southwest of Crook's Point, and nearly as far from the shore—in all about eight miles in a straight line southward of Cape Sebastian. Almost opposite of Mack's Arch, from which the tribe received its name (*Chētł-ē-shīn*, meaning *big rock*, as I was informed by a *Chetko* Indian), are found the extensive remains of their southernmost village. The next important one going north is at Crook's Point, a minor one at the eddy of the Pistol River, whence the stream runs parallel with the ocean beach for about a half mile to its outlet, where the main settlement is located. To the north of Cape Sebastian was the hunting-ground of the *Ya-sut*, having had their main station on both banks at the mouth of Rogue River, as already mentioned. South of Mack's Arch, the range commences which was formerly claimed by the *Khust-e-nēt*.

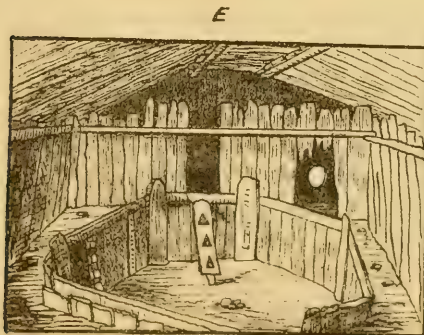
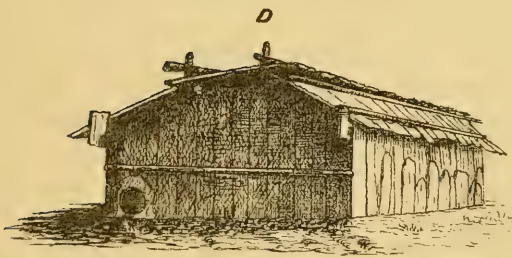
There are still visible at the main station of the *Chetl-e-shin* about fifty depressions of former houses, some of them obliterated by others of a subsequent occupation, and others again filled in by the Indians as if on purpose, and not by the action of time. After considerable work was done in searching for a cemetery, but without the desired result, we

again resorted to the house-sites, and especially to those filled up by human hands, which was proven to be a fact by finding human skeletons interred at the bottom of the excavation. The corpses were found without exception in the subterranean part of the ruined houses, which were here like those at Rogue River in size and wooden linings, but without the draft-passages for the smoke to escape. Doubled up, the skeletons were resting near the wall of the excavation, and faced the fireplace, as indicated in sketches (H and I) [Plate 4], which part was the most deeply covered with earth, whereby the remaining surface-indentation of such a house-site was easily discernible by an enlarged embankment, in contrast to those which were not shaped through a burial, but had adopted the form of an inverted mole-hill by the natural action of filling-up, caused by time and the elements. In one instance, two skeletons were found buried in one house, where a re-opening seemed to be evident by the flattened and unusually enlarged covering earthwork. Such a singular indentation in which a burial was made will be better understood by comparing the section diagram (H) [Plate 4] with that of a common formation (B) [Plate 4], in which latter no burial had occurred. The earth covering the skeletons was strongly mixed with charcoal, pieces of charred wood, fragments of animal bones, and shells blackened and partially consumed by fire. On the floor on which the skeletons rested was found a layer of ashes of several inches in thickness. But the fire had not affected the skeletons, as in no instance was any such damage observed, and even the remains of matting, furs, and other similar perishable material were not injured by it. It seems, therefore, evident that the hut was demolished by fire, after the owner had expired, and was buried in the ruins, covered with rubbish and earth surrounding his house. Except some glass beads found with a female skull, and three roughly-cast copper buttons with that of a male, nothing was unearthed that had apparently been deposited with the dead. Of course, in the mass of *débris* we worked over, divers articles were found, but not in such a position as to indicate an intended deposit of property of the dead in accordance with a religious or superstitious rite.

We find another large shell-mound located on loose sand about four hundred yards northward from the main settlement, where all the characteristic indications of a permanent settlement are noticed, excepting the house-sites, which likely had become filled up and obliterated by the sand drifts to which this place is exposed, as well as by the heavy rains during the winter. A stream of water passes the base of the dune, but disappears in the sandy beach. Back of the shell-mound, the ground rises gradually for a distance before it reaches the foot of a steep ridge extending back from the shore, and defining the lower boundary of an almost impenetrable country by its rough topography, its forests, and dense growth of underwood, the safe home of all kinds of game, panther, and bear. A few hundred yards up the coast from the shell-mound, near



F & G - 8 feet to 1 inch



Sketches, plan and section of present Klamath dwelling.

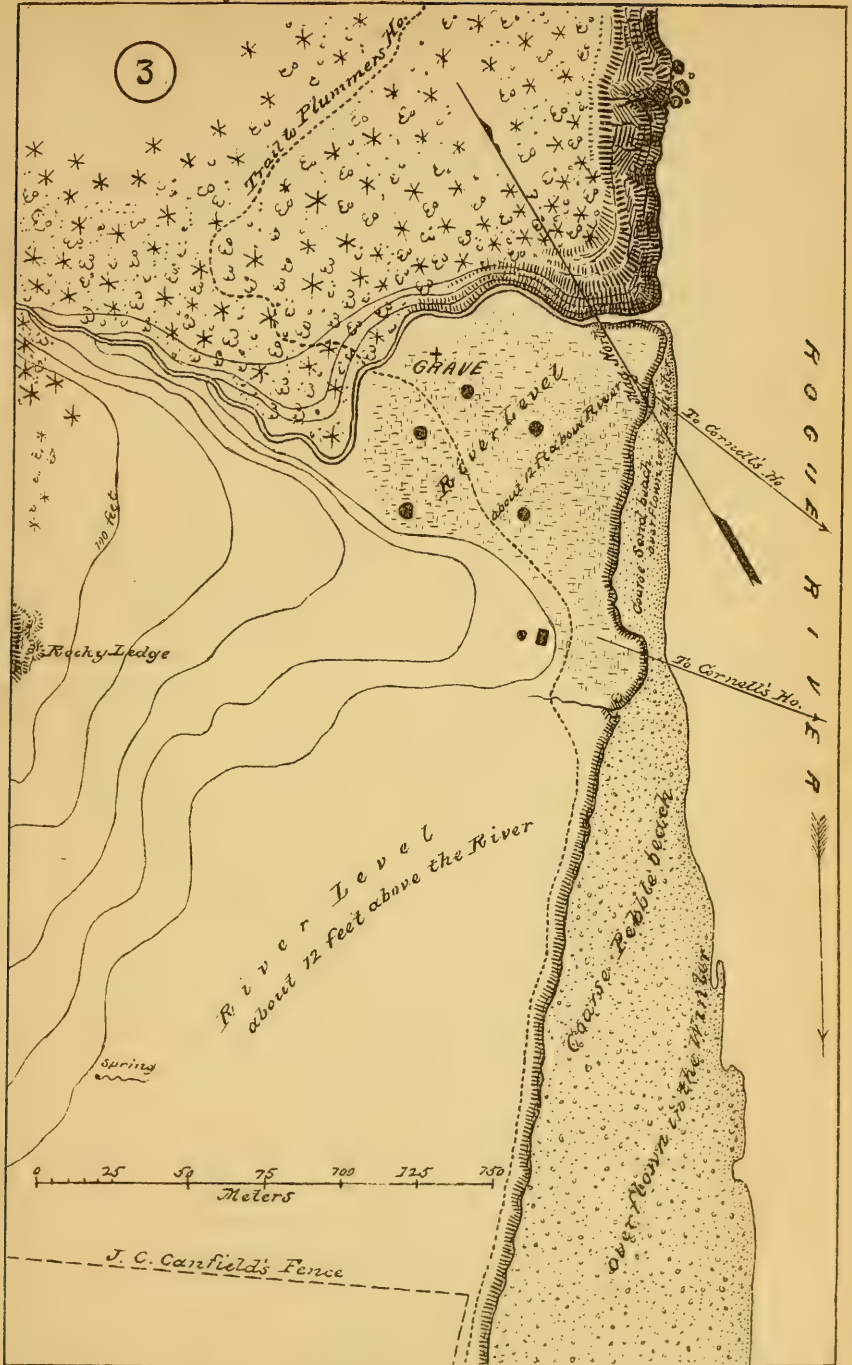
the bluff, we find indications of several house-sites, and much decayed shells and animal bones, mixed with sandy soil, producing that peculiar ash-like appearance. Neither at this place nor at the shell-mound did we discover any skeletons; and only a small addition to our collection was obtained in surface findings. In the right bank of the Pistol River, on the elevated bluff running parallel with the ocean beach, several small shell-mounds were met with; as also on the bare dunes across the river, &c.; but of these I have spoken in the Smithsonian Report of 1873.

At Pistol River, we were detained for several days by heavy rain, during which time I made a trip ten miles (by the trail) down the coast, to a place known as Hustenate, where the old *rancheria* of the *Khust-e-nēte* is located (Map 5) [Plate 8]. Here the well-defined cemetery was readily found. Mack's Arch is the northern boundary of the *Khust-e-nēte*, and Whale's Head, a prominent landmark on the ocean shore, about eight miles southward, is the southern boundary, whence the territory formerly occupied by the Chetkos extends southward. The next day we moved a light camp to Hustenate over a very rough trail, and reached that place in a heavy fall of rain of a winter storm just setting in. During the night, our tent was blown down, and shelter had to be sought for in a small shanty open to rain and wind. The location of the *rancheria* is sheltered toward the south by a rise and outreaching bluffs, while back of it, and to the northward, the ground rises rapidly, leaving a steep opening, from which issues a creek of considerable volume, which was much swollen by the rains at the time of our visit. The ground on which the *rancheria* is located has been disturbed by many slides, some of which evidently occurred since the place was abandoned by the Indians. Decayed shells and bones, mixed with sand brought up from the beach, a mass of vegetable mold and rubbish, and all sizes of beach-stone, constitute the compost of the surface-layer to a depth of two to five feet, below which dark humus is found, over a soft slaty formation of a grayish color, which is coal-bearing. The house-sites are, as usual, irregularly located over a space of a hundred yards in length and something less in width. Considering the condition of the ground upon which we find the aboriginal settlements on the Oregonian coast visited by our expedition, the opinion I have expressed in my previous report of such settlements on the southern coast of California holds good for this locality also: that all such stations had been established either on sandy ground, or that the nature of the ground had been artificially changed by layers of sand carried thither when it was rocky or hard. Sandy soil was necessary to the rude and imperfect tools for the erection of houses, which were partially dug in the ground, and surrounded by embankments. It was also a requirement for cleanliness, and healthful through its absorption of moisture in rainy seasons. About fifteen feet from the creek as well as from the shore, and but fifteen to twenty feet above the sea, are two rows of graves, dug in dark, coarse soil, bare of shells and sand, each grave being distinct one from another. On digging, the graves were found to be

very shallow, the skeletons being interred but one and a half to two feet below the surface. The sides of the excavations were lined with split redwood boards, about four feet in length and a foot in width, placed edgewise, and reaching to the floor of the grave, which was covered with beach-sand to the thickness of about one inch; the width was not over two feet, and both ends of the excavation were open, that is to say, without lining. The corpses were found doubled up in the usual manner, lying on their backs, or sideways, and facing the *rancheria* in a southeastward direction, although some were found just in an opposite way. Immediately above the body was placed a board resting on the lining, to which it was secured by cobble-stones of various sizes, some weighing as much as fifty pounds. The grave was then filled up with earth, and covered with another wide board to an even level with the surface, and probably, if we trust the remains of a few redwood stakes in close proximity to the grave, was also fenced in. I entertain no doubt that the worldly goods of those buried here, of which we did not find anything in the graves (excepting a few money-shells and glass beads), were placed on the top-board of the grave, a custom made evident by the habits of the present Klamath Indians. I lay before the reader a grave of the last-named tribe (Sketch K) [Plate S], and give also a plan (L) [same plate], with some tools placed on the top-board, as copied in their *rancheria* at the mouth of the Klamath River, which might be well accepted as the restoration of a Khust-e-nēte grave, of which but the surface-board remained, while time and elements annihilated a part of the articles deposited over the grave, and casual visitors destroyed and carried away the rest. With babies' skeletons, and a young woman's corpse, we found some much-decayed money-shells (*Dentalium entalis*), which served to ornament the living, and were probably intended as a means for the frail little ones to pay the ferryman of the Indian Styx. A few glass beads were also found with skeletons of grown females. The shape of the skulls is remarkable for the artificial deformity, the forehead receding and the occiput protruding disproportionately.

We moved back to Pistol River in stormy weather, which increased during the following day to one of those heavy Oregon winter storms that define epochs in the chronology of the country people. Pistol River swelled rapidly, and overflowed most of the valley near its mouth. Large tracts of the river-bank were washed away, and countless trees, among them gigantic spruces, were seen floating in rapid drifts to sea or ramming in at some bend of the river, soon forming floating islands. The stream being impassable even with a boat, it took five days before we ventured to cross with the pack-train on our way to Chetko; which place, 30 miles distant by trail, we reached after two days, as the trails were bad and much obstructed by fallen timber.

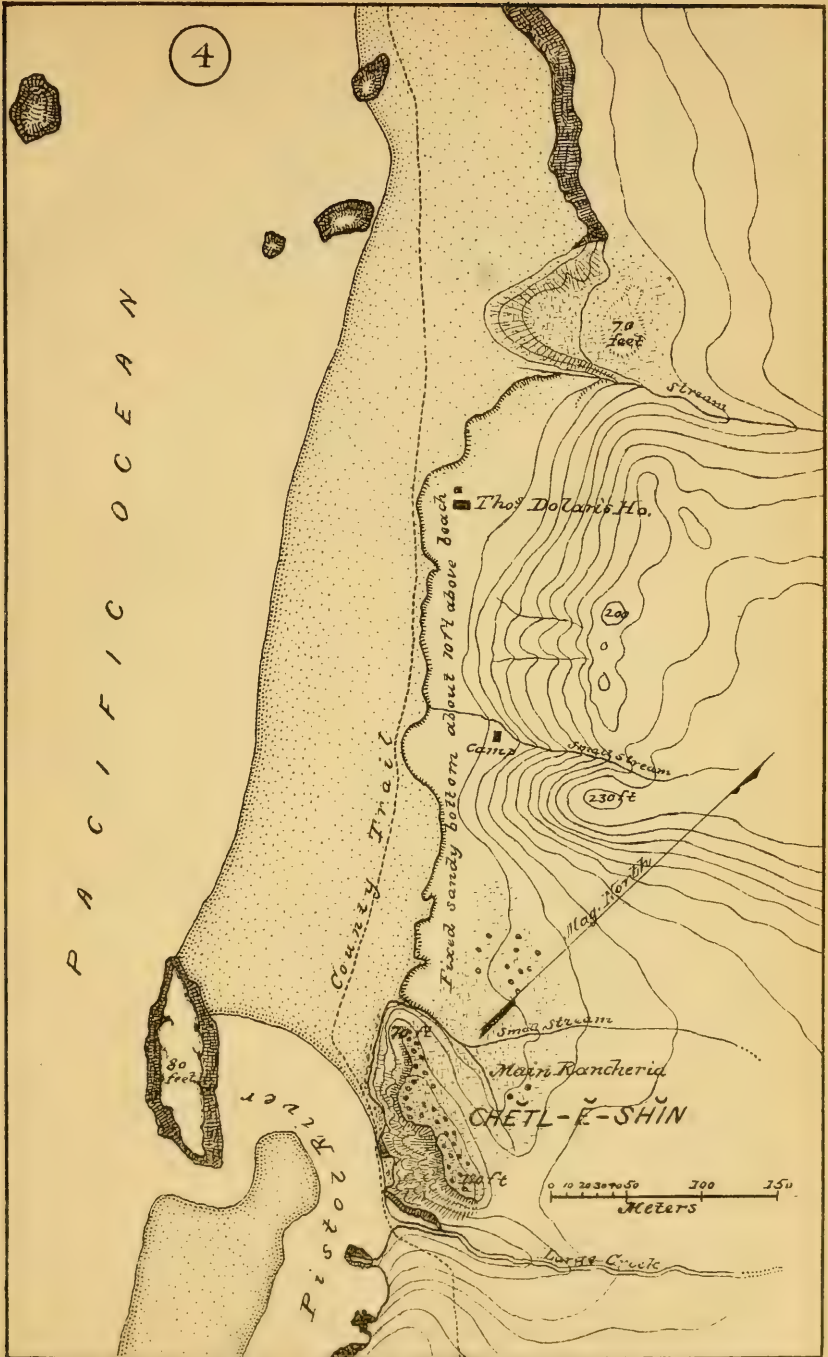
At the mouth of Chetko River we opened eleven graves, and found the dead buried in the same manner as noticed at Kustenēte; only that



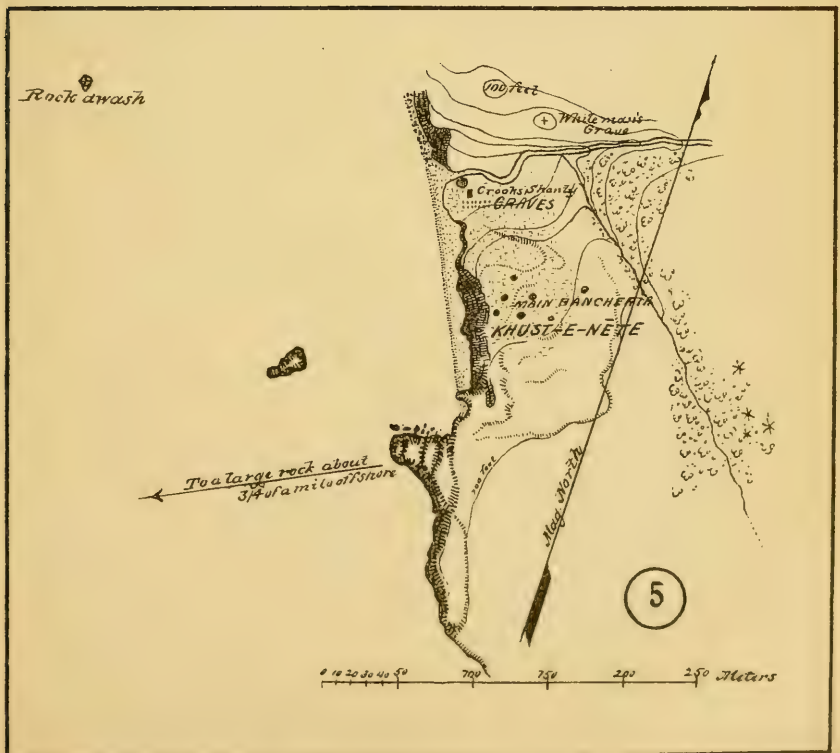
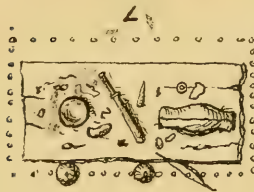
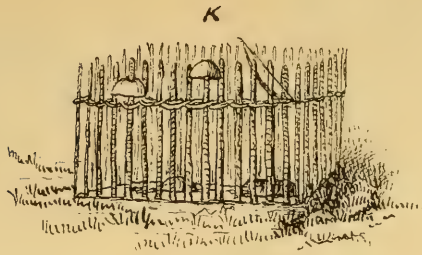
Map of Rancheria and Vicinity near main Settlement on Rogue River.

each grave was, in addition, marked with a small heap of beach-worn rocks, whereby its location was easily recognized. Nothing was found buried with the dead, though several articles were discovered among the rubbish. The graves were located about 20 yards northwestward of those described in the Smithsonian Report of 1873.

From Chetko we moved, on the 4th of November, our camp-equipage and collection down to Crescent City for shipment with the first schooner. The steamboat connection between this place and San Francisco had already ceased for the winter, and we were compelled, as no schooner was at anchor and none soon expected, to go overland to Humboldt Bay, and thence by steamer to San Francisco.



Map of the main Rancheria of the Chetl ě shin and vicinity near the mouth of Pistol River.



Map of Rancheria of the Khust-e-nête at Hustenate.

ART. III.—RESEARCHES IN THE KJÖKKENMÖDDINGS AND GRAVES OF A FORMER POPULATION OF THE SANTA BARBARA ISLANDS AND THE ADJACENT MAINLAND.*

BY PAUL SCHUMACHER.

PLATES 9-22.

In compliance with instructions from the Smithsonian Institution, given April 11, 1875, I at once made preparations for the early start of an expedition to Southern California, to the group of islands in the Santa Barbara Channel and the neighboring mainland (Map 1) [Plate 9]. The principal aim of the expedition to this region was the collection of implements left by the former inhabitants, the observation of particulars in connection with such finds, the description of the mode of burial practiced by these people, and the delineation of topographical characteristics, together with the preparation of sketches of such former settlements.

With three hired men and a camp-outfit, I left San Francisco on May the 4th, on board of the United States revenue-cutter *Richard Rush*, Captain Baker. On the following day, we were landed on the island of San Miguel (Map 2) [Plate 10], the most western of the group in Santa Barbara Channel, and seeming to be a barren bank of sand rising from the ocean when approached from the northwest. From the northern bold point to the eastern end, with the exception of a break formed by Cuyler Harbor, the shores are rocky and high; and from here along the southern side, toward the low, sandy west end, a smooth ridge, about 500 feet high, abruptly ends in a bold shore-line. On the north side this brown, dry, and dusty-appearing elevation slopes steeply, and is arrested by immense dunes of drifting sand, which extend from the west end in innumerable ridges of most varied formation, and nearly half the width of the island, to the north point. Sand driven by northwest winds is drifting into the bay, which is being gradually filled in at its northwest side, where the dunes descend in a steep decline to the water's edge, and their base is washed by the ocean. At the entrance of the neat little bay, in which vessels may find good anchorage and shelter lies an islet, and between it and the eastern end of the bay extends a reef, over which heavy swells usually break, leaving a channel between the rocky islet and the western terminus of the harbor.

[* See note to Art. II, p. 27. A portion of this paper was published in a German periodical (*Archiv für Anthropologie*, vol. viii, p. 223). The descriptions are mainly topographical, rather than archæological.—ED.]

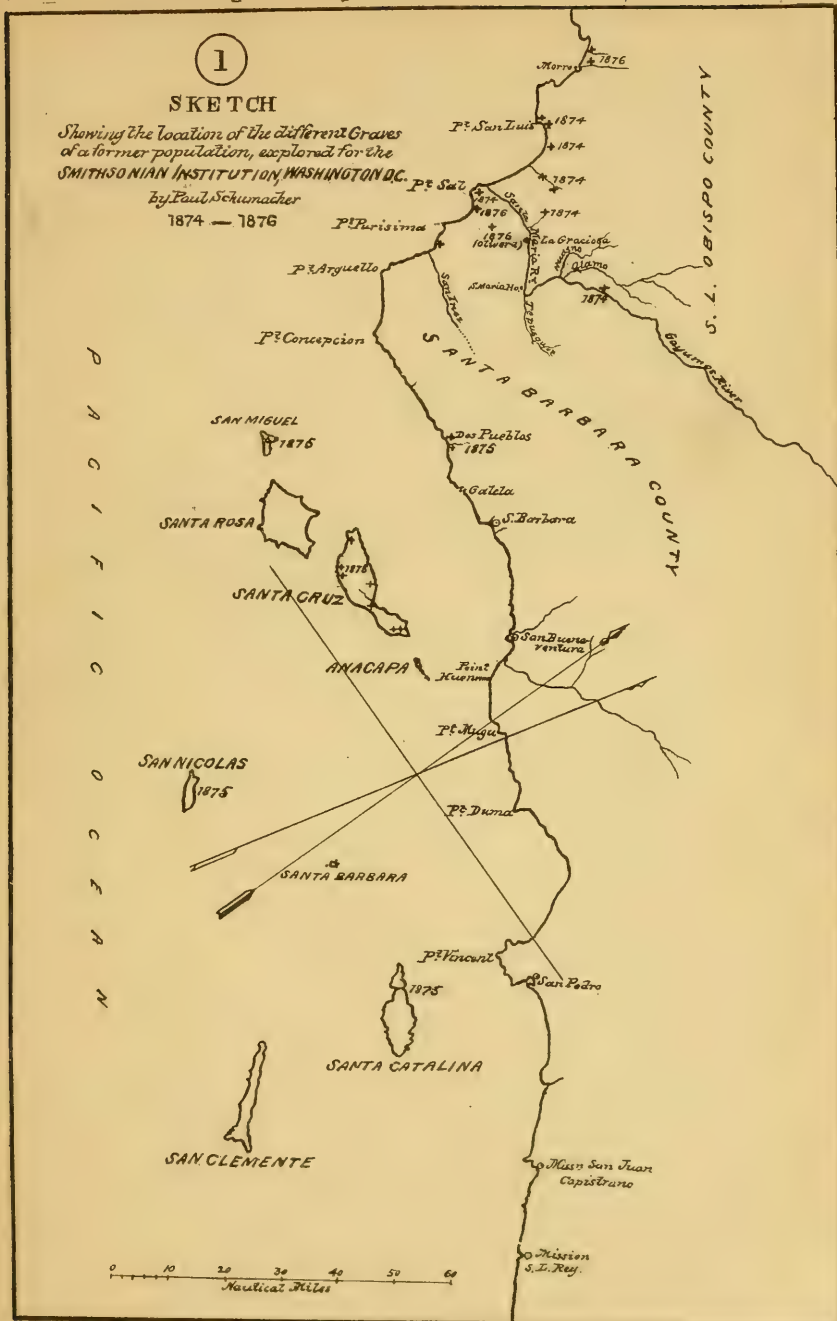
On San Miguel Island are two small perennial springs; one is situated several hundred yards below the *adobe* building at the bay, and the other, with a little better quality of water, on the elevated northern point.

The vegetation consists of low bushes, cactus, and grass, but no trees. At our visit, the island, which is a Government possession, was "dried up", being overstocked with starving sheep.

With much difficulty we moved our camp through the shifting sand up the western shore of Cuyler Harbor, where the best boat-landing is offered, and found there on shell-mounds room enough to erect our tents.

The kitchen-middings, or *kjökkenmöddings*, of a former people are found all over the island where sandy ground is met with. This singular mixture of all kinds of shells, bones, rocks, and flint-chips, spread usually over a space of about a hundred yards square, and to a depth of five feet, although the extent and depth of such shell deposits vary greatly, is found on both sides of the harbor, especially over its northern point, also along the northwest side to the west end, and covers in great masses the low, sandy, western extremity of the island. The deposits of the *kjökkenmöddings* are much exposed to the strong northwest wind, and, as they are located on loose sand, are laid bare by its action, offering therefore good facilities for surface collections. But of these the casual visitors to the island, mostly persons interested in stock-raising, excursionists, and amateur curiosity-hunters, have picked up or destroyed the best, and much of what was left had been collected several months previously to our visit by Mr. Dall, of the United States Coast Survey, during a short visit to this island. Of the small surface collection made here, I consider an unfinished mortar the most interesting article, showing in its partially rough and incomplete state the mode of manufacturing such a utensil by the aborigines. But my attention was especially given to the finding and exhuming of the old cemeteries, which, as my experience taught me, promises the richest reward. About half-way, and almost in a line between the two springs, near Cuyler Harbor, I found a grave-yard, and soon another close by, which yielded about 250 skeletons, and many utensils, implements, and ornaments of stone, bone, and shell. Not far from the upper spring, another burial-place was discovered, which hardly returned any results.

The mode of burying was similar to that previously observed on the mainland, on the coast of California, which I described in the Smithsonian Report of 1874. The bodies were buried in the *kjökkenmöddings*, because the kitchen-refuse offered here the only ground which is firm enough to resist caving, and also to prevent the winds from uncovering the dead, as would occur with loose sand. The skeletons were found from three to six feet under ground, and often from three to four resting one above the other, separated, if at all, by the bones of the whale. The bodies were deposited without any order as to position and direction of



Map of Islands in the Santa Barbara Channel, and neighboring mainland.

the face, being sometimes found face downward, lying on one side, or on the back, or face to face, or crosswise, and the bones in nine cases out of ten disturbed and displaced. This confirms my former opinion that the graves had been re-opened, and the bones disarranged while fresh bodies were being added. The bodies lay so closely together that at first, they seemed to have been the victims of a fierce battle, buried promiscuously in a pit. Close observation, however, indicates that the interments were made at different times, as implements of shell and bone, skeletons, and remains of perishable partitions, often plainly show by their more or less advanced decay, and by the position in which they are found. It is likewise evident that the burial took place before the decay of the body, although such was not the custom of some interior tribes, because we found the bones of some skeletons buried the deepest, and especially such as were interred separately from the others, in perfect order. Some were even still enwrapped in matting. To find a skeleton at the bottom of a pit, at the depth of about five or six feet, especially if there be none above it, is considered by the practical digger a lucky hit, and causes him to work carefully in the removal of the slabs and whale-bones, and to look for stone-knives, spear-points, or strange stone implements, as it is supposed to be either the grave of a warrior, a chief, or a "medicine-man".

While on this island, we were much exposed to the grinding sand, driven in our faces like so much hail by a brisk northwest wind that lasted day and night during our four days' stay. The preparation of food at an open fire became impossible, and most of our provisions were thickly coated with sand. Although we could have secured a boat be longing to the schooner *Matinee*, then in port, attending to the wants of a number of shearers and awaiting a cargo of wool, a visit to the northwest and west ends of this island was prevented by a heavy sea, which made a landing impossible. Our party left on May 9, on the before-mentioned schooner, and landed in Prisoner Harbor on the island of Santa Cruz.

Santa Cruz (Map 3) [Plate 11] is probably the prettiest island of the group; in picturesqueness it equals and in vegetation excels Santa Catalina. It is mountainous, with large stretches of rolling land, especially near the eastern and the western ends, where fine valleys, picturesque bluffs, and ravines occur. It is, according to the works of the United States Coast Survey, $22\frac{1}{2}$ miles long, running almost due east and west, and from $1\frac{3}{4}$ to $6\frac{1}{2}$ miles wide. Its greatest height is 1,700 feet. It has a fair shelter in Prisoner Harbor and in several places along the east, south, and west sides, such as Smuggler's Cove, Coche Prieto, Forney's Cove, and others. There is good water in the different springs and creeks found all over the island the year round. Timber is found in many places, and quite extensive groves of conifers occur west of Prisoner Harbor, while stunted oak-trees grow on the high rocky hills and sides of the steep gulches, and low willows in the cañons. It

is owned by the Santa Cruz Island Wool Growing Company. Near a good wharf at Prisoner Harbor stands a substantial *adobe* building, and back of it extends a beautiful valley, about 8 miles in length, which afforded us, near its mouth and on the banks of a running stream under old oaks, an excellent camping-ground.

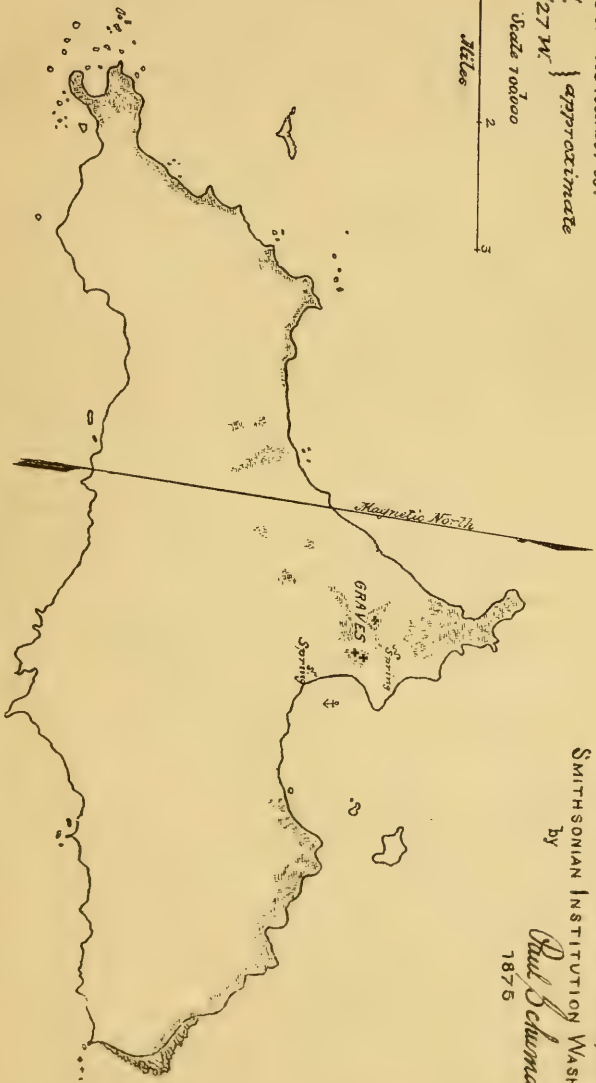
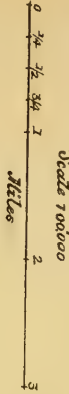
Our party spent about one month, from May 10 to June 12, on this island, during which time we made explorations all along its shores 65 miles in extent. Here we found the United States Coast Survey steamer Hassler, Captain Taylor, engaged in making soundings round the island; and as the Superintendent of the United States Coast Survey, Capt. C. P. Patterson, in view of the fact that the expedition was made at the expense of the Government, gave permission for the transport of our party to such places as lay in the route of sailing of the courteous and obliging Hassler party, it gave us a great advantage in prosecuting our work, and saved much expense in sparing the necessity of chartering a vessel or hiring pack-animals.

Our main attention was again directed to the finding and examining of graves. From our camp at Prisoner Harbor we made trips to different places on the island, taking only the necessary provisions, water, and blankets along with us. We also carried some boxes in shooks, in which temporarily to pack our finds.

Our first station was at Tinker's Cove (Map 4) [Plate 12], a narrow fiord-like shelter for small craft only, with high walls on both sides that seem to exclude all possibility of a farther advance. Proceeding from our temporary camp among the rocks near the sand beach of Tinker's Cove, we climbed the western face of the gorge, and approached the shell deposits first observed while passing on our way from San Miguel Island to Prisoner Harbor. We found the *kjökkenmöddings* located on a plane about 50 feet above the sea, which is arrested a little ways from shore by a steep ascent with rocky outcroppings. The ground is rocky, and terminates at the beach in an apron of horizontal stratification, washed by the ocean, and, at low water, quantities of eatable mollusks can be gathered. Two hundred yards to the westward, on the bight of a shelter similar to Tinker's Cove, but with an inferior landing, is a small spring supplying drinkable water. Great masses of kelp exist in the adjoining inlet and among the outlying rocks (of which but one appears on the map), where we may watch the motions of a great number of seals and sea-lions in catching fish, very abundant in these waters. One of the two burying-grounds discovered here was still well marked with whale-bones above the ground, probably not so conspicuous as shown in the sketch (A) [Plate 21] for the sake of illustration. Both were in the deposits of the accumulated kitchen-refuse, as the surrounding bottom below its shallow subsoil was impenetrable for the tools of these people. In the arrangement of the graves, nothing was observed that materially differed from those on San Miguel. We only found here more wood in the walling-up of the graves and more char-

N.W. Rock

NOTE: This is a reduced Map from the Work of the United States Coast Survey. The Geographical Position of the spring at the S.W. part of the harbor is: Lat. $34^{\circ}03' N.$ Long $120^{\circ}20'27'' W.$ } approximate



2

SAN MIGUEL ISLAND
SANTA BARBARA CHANNEL

Showing the location of the Graves and Yoktan
Middings of an extinct race explored for the
SMITHSONIAN INSTITUTION WASHINGTON D.C.
by
Paul Schumacher
1876

Map of San Miguel Island.

coal among the *débris*. The graves yielded about 225 skeletons and a moderate addition to our collection in stone and bone articles. From this place we made a reconnaissance in the surrounding country, and noticed many shell-mounds located, rather singularly, on high ridges and mountains, where water is distant and the place bare and much exposed. The shells on such places are better preserved, and it seems as if these people had moved up here the better to avoid contact with the whites while hunting otters around these islands. The deposits, although very conspicuous by their bright color when seen from the sea, and scattered over large areas, are not deep, and we found but very few flints, some beach-rocks, but no skeletons, and therefore they may be safely termed temporary camping-grounds, as described in the Smithsonian Report of 1874. After almost a week's stay in our picturesque camp, the passing Hassler party took us up and brought us back to Prisoner Harbor.

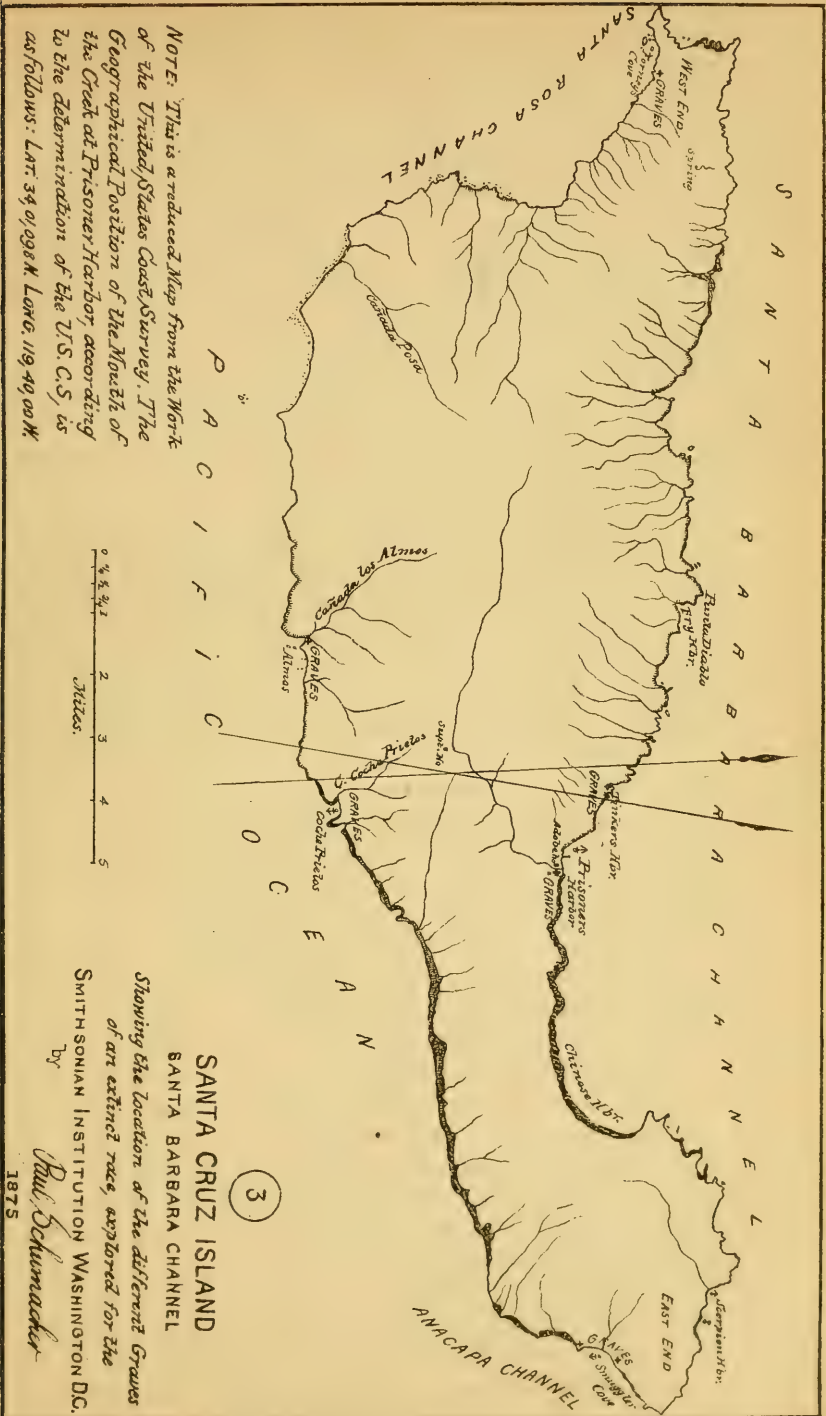
We intended to make our next station at Smuggler's Cove, but the heavy breakers prevented us from landing, and we went on to Coche Prieto (Map 5) [Plate 13], a small cove on the south side of the island, of which Prisoner Harbor lies due north across the neck of the island. We found shell-mounds at the mouth of a dry creek ascending gradually toward the east side of the cañon, while an older layer was found opposite on the west side, or the right bank of the creek. Here again, as in fact all over the island, with but one exception, the reason of digging the graves into the kjökkenmöddings, was the difficulty of working the ground which surrounds them, as only the beach is sandy, while back of it the bottom is gravelly and the rising ground hard and rocky. The western cemetery was the larger one; but, although we exhumed 140 skeletons, we made only a moderate addition to our collection of ethnological finds. The first fish-hooks of shells were found in the graves eastward on the small ridge. They are ingeniously made, and I shall speak of them more explicitly farther on. We dug up a square board (*a*) [Plate 22], about $1\frac{1}{2}$ by 2 feet, pretty well preserved, painted with a bright red color, and having small indentations in a depression which is bounded by a raised border. I was told by an old *vaquero*, with some Indian blood, that the board was used in connection with hot ashes to whiten the money-shell (*Olivella biplicata*) by a sieve-like action. The same individual explained the use of a perforated stone (*b*) [Plate 22], commonly found, and so readily taken for a war-club head, as a weight to the shaft of the wooden spade. If one is at the first glance inclined to take this implement as the ball of a club, we also must admit the fact that we found many of them split in two, as if caused by the wedge-like action of the spade-handle, and that no stone spades were found, which speaks in favor of the theory that it was used for the purpose stated by the half-breed, who was very positive, and earnestly tried to impress on us the idea by roughly making the implement used by his ancestors as a spade. We also found some wooden relics, which appeared to me to have belonged to a canoe, made of board sewed with strings, and well

painted with asphaltum. But, in the opinion of the *vaquero*, it was a part of a cradle. I may add here that the same half-breed assured me that he was present, some forty years ago, when the last few Indians were taken from their *rancheria* at Prisoner Harbor to Santa Barbara by the missionaries.

After two days' stay, we returned again to Prisoner Harbor. The next few days we spent in properly packing our collection made thus far on Santa Cruz Island, and also in examining the shell-mound located on the right bank of the stream, at its mouth, and where it forms a small fresh-water pond, or lagoon, before disappearing in the loose sand. Avoiding carefully the last resting-place of a sailor buried here some years ago, we found the graves a little south of the supposed astronomical station of the United States Coast Survey. Here we dug up about 40 skeletons, but hardly any implements, except 14 finely-made fish-hooks with barbs, some of bone and some of shells; also some of the tools and many flakes of shells required for the manufacture of such hooks.

Joining again the Hassler party on their way to the south side of the island, we made a landing in a small cove designated as Los Alamos (Map 6) [Plate 14]. This place is very much the same in appearance, location of the mound, and of the two graves, as that at Coche Prieto. The returns were poor, although we unearthed about 100 skeletons. I will mention a piece of fishing-tackle, which was here, as on previous occasions, repeatedly found in connection with fish-hooks and bone fish-spears. It is a piece of a bright shell, varying, say from 2 to 4 inches in its longest measurement, differing in shape, but similar to the design (c) [Plate 22], which was fastened at the end of a line, and used, I am convinced by observations in exhuming it and by the explanations of old Mexicans and Indians, to attract the fish somewhat as in our present mode of trolling with a "spoon-hook".

Next morning we again undertook to land at Smuggler's Cove (Map 7) [Plate 15], near the east end, and this time with success, although the utmost skill of the officer in the boat was required to avoid an accident. Here we readily found the cemetery on the gradual ascent of the left bank of the creek, in a thicket of thorny cactus growing all over this extensive shell-heap. Among the articles discovered, my attention was again arrested by a deposit of shell-flakes, as first found at Coche Prieto, and afterward at Prisoner Harbor, some of which were partially worked into fish-hooks, others finished. Other kinds of implements were found, such as double-pointed borers, of coarse, gritty sandstone, flint points, and a whetstone shaped something like a double-edged knife. All of these kinds of articles had been found before, but never such a full assortment in one place. I had before suspected that these objects were used in the manufacture of fish-hooks. I now was convinced of it, and as the tools comprise a complete set, I will illustrate them with several figures taken from the originals, which will be found among the



NOTE: This is a reduced Map from the Work of the United States Coast Survey. The Geographical Position of the Mouth of the Creek at Prisoners Harbor, according to the Determination of the U.S.C.S., is as follows: LAT. 34° 01' 09" N. LONG. 119° 49' 00" W.

0 1/4 1/2 1 2 3 4 5
Miles.

SANTA CRUZ ISLAND
SANTA BARBARA CHANNEL
Showing the location of the different Graves of an extinct race, explored for the
SMITHSONIAN INSTITUTION WASHINGTON DC.
By
Paul Schumacher
1875

(3)

Map of Santa Cruz Island.

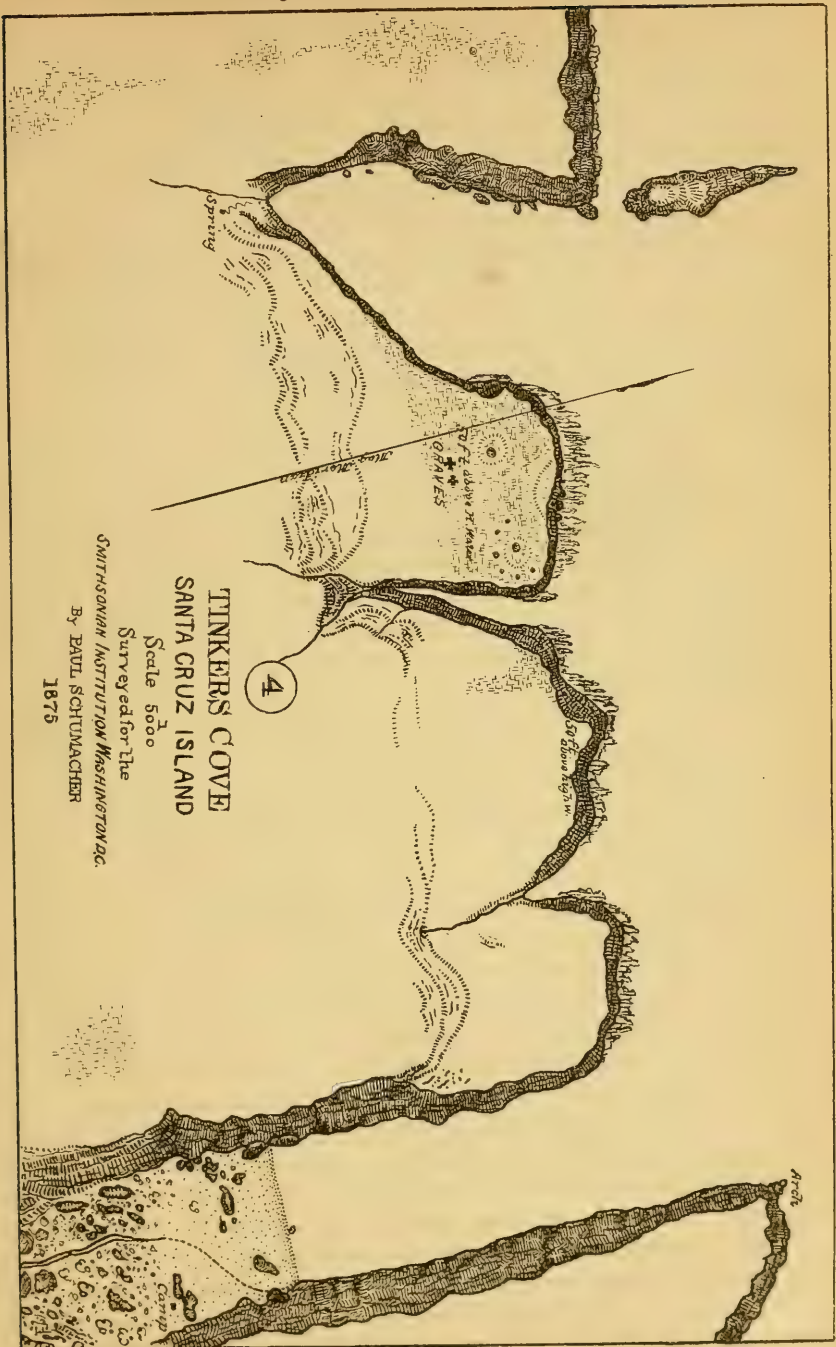
collection sent to the Smithsonian, and will describe the manufacture of the fish-hooks.* The figures *d* to *h* [Plate 22] represent the shell-flakes usually of the red-back abalone, as found in its different stages of finish, while *i* and *k* show finished hooks. The pieces were broken from the *Haliotis* shell in coarse flakes, *d*; then perforated like *e* with the flint-point *l*; the hole rounded, as shown in *f*, by the double-pointed borer of coarse, hard sandstone *m*; then its rim worked into the shape *g*, for which any flat sandstone may have been employed. This done, the knife-like whetstone *n* was required to work out the part shaded in *h*. With some additional touches, the hook *i* was finished, and fastened for use to a line, as shown in *k*. I have purposely illustrated in *k* a beautiful hook of bone, because remarkable for its barb projecting, contrary to the modern style, from the outside of the curve of the hook. The shank of this rare hook showed still a part of the line, attached in the manner as shown, thickly coated and preserved by asphaltum. [These figures are all on Plate 22.]

While the excavation was being prosecuted by experienced and careful workmen, I searched the neighborhood, and discovered at the point of the cove, which lies about three-fourths of a mile almost due south from the burying-place, unusual signs of a former settlement, and the head-stones of the graves, consisting of huge whale-bones, nearly covered up by a luxuriant growth of cactus, so omnipresent on this island. The slope of the extreme point, which ends abruptly in a high bluff, with detached rocks washed by the sea, was leveled for the better erection of the few houses. Cobble-stones had been planted in a row as an embankment, and the space filled up with earth removed from the elevated portion back of it. This afforded room for a few houses, whose former existence was still plainly indicated by the several depressions. In the graves at the point, a wooden sword of a Roman pattern was found, having its hilt richly inlaid with shells, but in such a decayed condition that it had to be thickly coated with varnish for preservation, whereby the brilliancy of color of the shells and the good appearance in general were much injured. Anything made of shells will part in flakes as soon as exposed to dry atmosphere, and is therefore easily lost, or at least disfigured. The two grave-yards at Smuggler's Cove yielded about 200 corpses and several boxes of implements.

Our last camp pitched on this island was at Forney's Cove (Map 8) [Plate 15]. Before examining this place, I entertained the hope of a rich harvest, as the shell-deposits are abundant here, and glisten on almost every eminence along the slopes, and even on the tops of the [main ridge]. The reef that extends from the outer end of the cove to a rock island, the singular formation of the point with its subterranean passages washed by the sea, and the rocky surroundings on all sides, with its masses of kelp and sea-weed, make this the best portion of the island as to the

* I have given a full illustrated description of the manufacture of fish-hooks in the "Archiv für Anthropologie", vol. viii, page 223 *seq.*

multitude and variety of mollusks and fishes. But as water is distant, the nearest being found only in a spring on the other side of the ridge, about two miles to the northeastward from the cave, not considering the climb, I was not surprised to find all these shell-deposits, with but two exceptions, the remaining witnesses of a temporary camp of those people who came here from the other side of the island to supply themselves with fish and mollusks. The largest shell-mound close to the cove is surrounded by a fence for a sheep-fold in the time of wool-clip, and we can no longer find any signs of houses or graves, although much of the characteristic material which stamps such places as permanent settlements, such as water-worn rocks, flint chips, whale-bones, &c., is found. About a mile's walk along the shore to the eastward, we found two shell-mounds moderate in circumference, but considerable in height. We found graves on the eastern shell-mound. They were, strange to say, dug in the sites, or depressions, of former houses, three of which contained skeletons. It seems that this shell-mound was the first deserted, and was afterward used for a burying-ground (for which the depressions of the houses suited), to the neglect of the older cemetery, which could be traced, by several remaining skeletons, near the brink of the bight adjacent to the graves. The kjökkenmöddings, as we had occasion to observe them at Tinker's Cove, Coche Prieto, Los Alamos, and especially here, appear to be located on a sand-bank built by the hands of the aborigines. If the underlying bank had been built by drifts, the winds, in connection with the adjoining sand-beach, would have caused a different shape, if not a different location, of the bank, as it occurs at the above-named places, or would leave traces of its action beyond the limits of the shell-deposits, which is not the case here. This observation was made only on settlements where the ground is rocky. About five miles to the eastward, at the mouth of Cañada del Pozo, but difficult to reach by land on account of its rough topography, is reported an extensive shell-mound, which I readily noticed from the steamer, but, as a landing is not possible at all times, we were prevented from visiting it. On the north side of the mainland, between Punta Diablo and the spring near the west end, may doubtless be found some graves among the many shell-mounds, although most of them, especially those located on high slopes, served as temporary camping-grounds. Between the two before-mentioned places, at the shore, and water-mark, a cave is reported, "filled with human bones and curious implements". I was able to trace the report to a fisherman, who pretended to have discovered the cave by accident. In consideration of the great work required to search all the indentations of a most irregular and dangerous shore at least eight miles in length, accessible only by boat, where the cliffs and innumerable cave-like recesses form such picturesque sights, and spuming, thundering spout-holes reveal hidden abysses, I thought it wise to offer a reward for his guidance to the cave, but even after I had doubled the amount, which was more than a week's good luck in fishing, he failed to put in an appearance



Map of Tinker's Cove, Santa Cruz Is!

for a passage over to the island. It may be that the cave is in existence, but as to human bones and curious things I found myself often deceived.

While at Forney's Cove, we enjoyed the visits of Dr. J. T. Rothrock, Dr. Oscar Loew, and Mr. H. W. Henshaw, all members of the scientific corps of Lieutenant Wheeler's exploring expedition. Being on their way to Los Angeles, the rendezvous for the members of that expedition, they made a close connection with the island by steamer Hassler, and having a few days' spare time, joined us in our rough camp at Forney's Cove, to observe our excavations, and also do some work themselves in their respective branches.

Returned again to Prisoner Harbor, we finished the packing of our collection, which amounted already to twenty-five large boxes, and had them properly addressed to a warehouse in San Francisco, with which arrangement for their reception had previously been made.

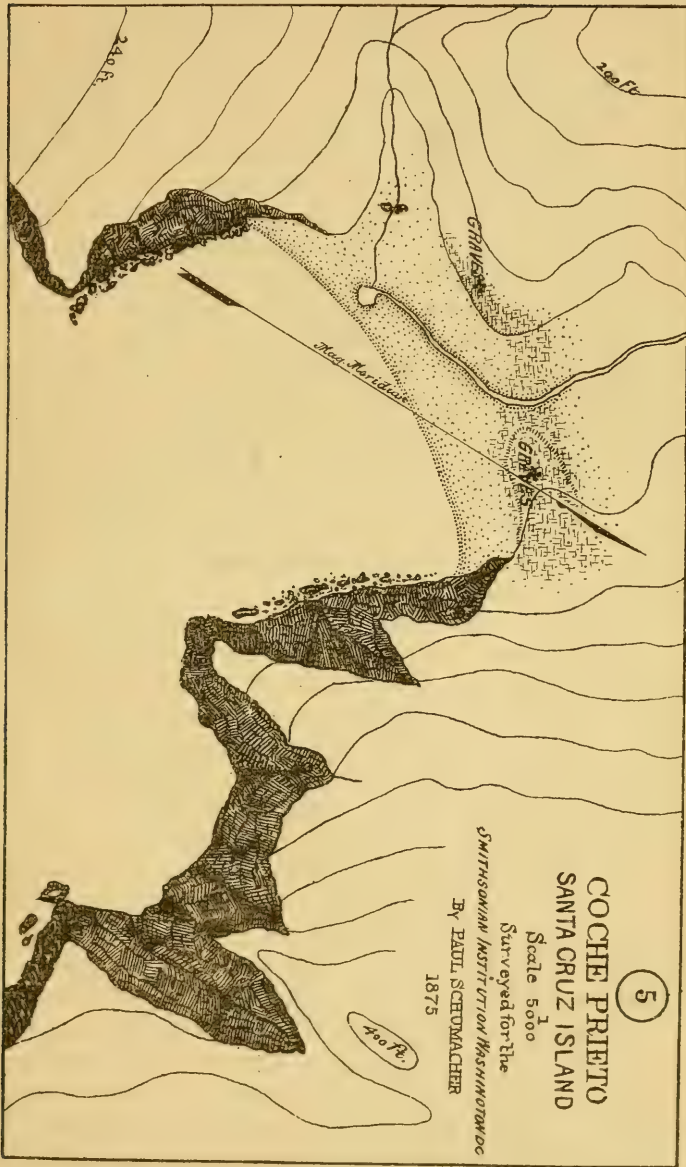
I wish to say a few words in relation to the early history of the two islands already worked up. Santa Cruz, Santa Rosa, and San Miguel, it is well known, were discovered by Cabrillo in 1542, and named by him San Lucas. He died in a harbor in one of these islands. The record says:—"He sailed from Monterey Bay, and anchored on the 23d of November, 1542, in a harbor in one of the group mentioned before, and named by him San Lucas" "On San Lucas, Juan Rodriguez Cabrillo was buried on the 3d of January, 1543. The port in which he died was called Juan Rodriguez." There seems to be hardly any doubt that the port selected by Cabrillo among the group as a shelter was the present Cuyler Harbor, which is the only well-protected port in the three islands. Water is obtainable in two springs the year round, and is plentiful in the season in which his stay occurred. Further, the record says:—"Ferrelo, his pilot (forced by strong winds to return from his northern trip, made in compliance with the wishes of the dying commander to proceed as far to the north as possible), dared not to re-enter this port on account of dangerous breakers at its entrance." This corresponds entirely with the appearance of Cuyler Harbor during the time of rough sea, because from the eastern side of the bay to the rock-islet heavy breakers roll over the partially exposed reef and the rocks in the bay a little to the westward of it, so that, coming from the northwest, its way of approach, the entrance seems barred by breakers and impassable. Taking Cuyler Harbor and the ports in Santa Cruz and Santa Rosa into consideration as shelters, and comparing their natural formation with the historic record, there seems to be no doubt that the harbor on San Miguel, and not Prisoner Harbor on Santa Cruz, as some believe, is the port in which Cabrillo died. We did not spend any time in searching for his grave on San Miguel, where the best location is offered between the spring below the house and the east end of the harbor, but, to satisfy my curiosity, we dug in a place at Prisoner Harbor, which was well described to me in a letter of a southern gentleman, and in a very positive manner, as

the grave of Cabrillo, but in vain did we try to enable the Spanish nation to erect for him a monument in commemoration of his noble deeds.

I left Santa Cruz Island on June 12 for Santa Barbara, where I met Dr. H. C. Yarrow, in charge of Lieutenant Wheeler's scientific corps, making researches on the mainland for Indian remains. I joined him for a day while working at Galeta, and found this place yielding large quantities of all kinds of implements.

In the mean time, the schooner *Star of Freedom*, which I had chartered, arrived with a party on board to convey us to San Nicolas Island (Maps 9 and 10) [Plate 16]. We reached this island at night-fall on June 19, with the wind blowing lively, which compelled us to anchor at the south-east end of the island. We expected a campaign worse, if possible, than that at San Miguel, as the island appeared to be a faint lump in a thick fog-like cloud of sand, which was whirled densely over our neat craft, although we were a half mile off shore. On the low sandy flat, not far off, the breakers for a distance of half a mile rise to a great height, and cause a roaring like thunder; at intervals, when the burst had passed away and the infuriated wind slackened in the rigging, we heard the howling sea-lions in the kelpy waters, if not at their rookery on the near shore, all of which failed not to impress with its wild charms. In the morning we made our landing, though the sea was rough, and as the swells, caused by a strong current that passes, sweep the shore at an angle, care had to be taken to prevent the boat going broadside on, which would have been sure to capsize her.

The island, a Government possession, is a mass of soft, coarse, yellowish-gray sandstone, about 600 feet in height; its length is considered 7 miles, and its width 3 miles. The plateau, which seems almost level, falls off on both sides in steep gulches and ravines, where the eye is met by innumerable cave-like outcarvings done by the grinding sand. The northwest end is sandy; dunes stretch across the island as far as the depression, on the end of which the *adobe* house is located. The vegetation is like that of San Miguel, and also ruined by overstocking it with sheep, which are here found in a like starving condition. Near the house on the northeast side we found some malva-bushes cleared of their foliage to the reach of a sheep, which gave them the appearance of scrub-oak trees when seen from a distance. There are few trees near the house, where a strong never-failing spring supplies the necessary water, which has, as on San Miguel, a mawkish alkali taste. The shifting sand has almost buried the house erected by the stock-raising company, and with it its old and only inmate, the superintendent. Farther on to the northwest, at the so-called Chinese Harbor, is another spring, with good water. It was on the northwest end, on the dunes, that we found the shell-mounds abundant, although some are found at intervals all along the shore toward the sandy flat on the southeast end, beyond which but few small ones exist. None exist on the southwestern shore; but they appear again at the northwest end



Map of Coche Prieto, Santa Cruz Is!

about the Chinese Harbor. The mode of burial on this island is different from that on islands previously investigated. The bodies rest in separate graves, which we found were not marked by whale-bones, stones, or other material elsewhere usually employed, and lie on their backs, the feet drawn up, the arms folded over the chest, and the head either resting on the occiput or on the side or sunk to the breast. The skeletons, as a rule, were facing the east, although other directions were observed. Many of the bodies show signs of having been buried in matting coated with asphaltum.* Most of the skeletons and implements are laid bare by the winds, and those are often much worn by the grinding action of the sand. In a mound one mile northward of the sand-flat, at the southeast end, we found the whale-bones apparently indicating the last resting-place of those that accumulated the kitchen-stuff, but by digging into it found the ribs of whales to be the remains of houses rather than the marks of graves, planted in a circle, and their natural curve so adjusted as to form the frame of a hut in shape not unlike a bee-hive, which was in some instances quite well preserved.

Our *modus operandi* was here changed; spade and pick were dispensed with, and our party went over the shell-mounds and carried the relics to heaps, which afterward were conveyed by horses procured from the superintendent to our boat in the small cove, and thence taken by water to our camp for a careful packing. On this island two mortars were found, with the ornaments in high relief, the largest and best made pestles and sculptures in serpentine, representing sea-lions, fishes, and birds, and other objects, showing a superiority in the manufacture of stone implements over the inhabitants of the two islands before mentioned. Remains of fish-hooks were found plentiful, but, weathered out as they were, could not be saved. Together with the above-mentioned sculptures, several specimens of a hook-like implement were collected, made of serpentine; also a tube and pestle of the same material, the use of which I was unable to trace. The money deposits of shells and stone on this island are very remarkable. They were found before only in graves, buried with their former owner, but here we found in some places on the shell-mounds, apart from the skeletons, numerous small heaps of the shell *Olivella biplicata*, and some of the land-shell *Helix strigosa*; also pebbles of uniform size, about as large as a pigeon's egg, apparently coated with asphaltum, or burnt and blackened by fire; they averaged in quantity from a half to one cubic foot, and were evidently stored there and afterward exposed to the drifts of sand, forming conspicuous diminutive hillocks. We found as many as sixty of these deposits on one shell-mound. This, with the position of some of the implements we observed, seems to point to the fact that the last inhabitants left or were taken off suddenly. We found, for instance, instead

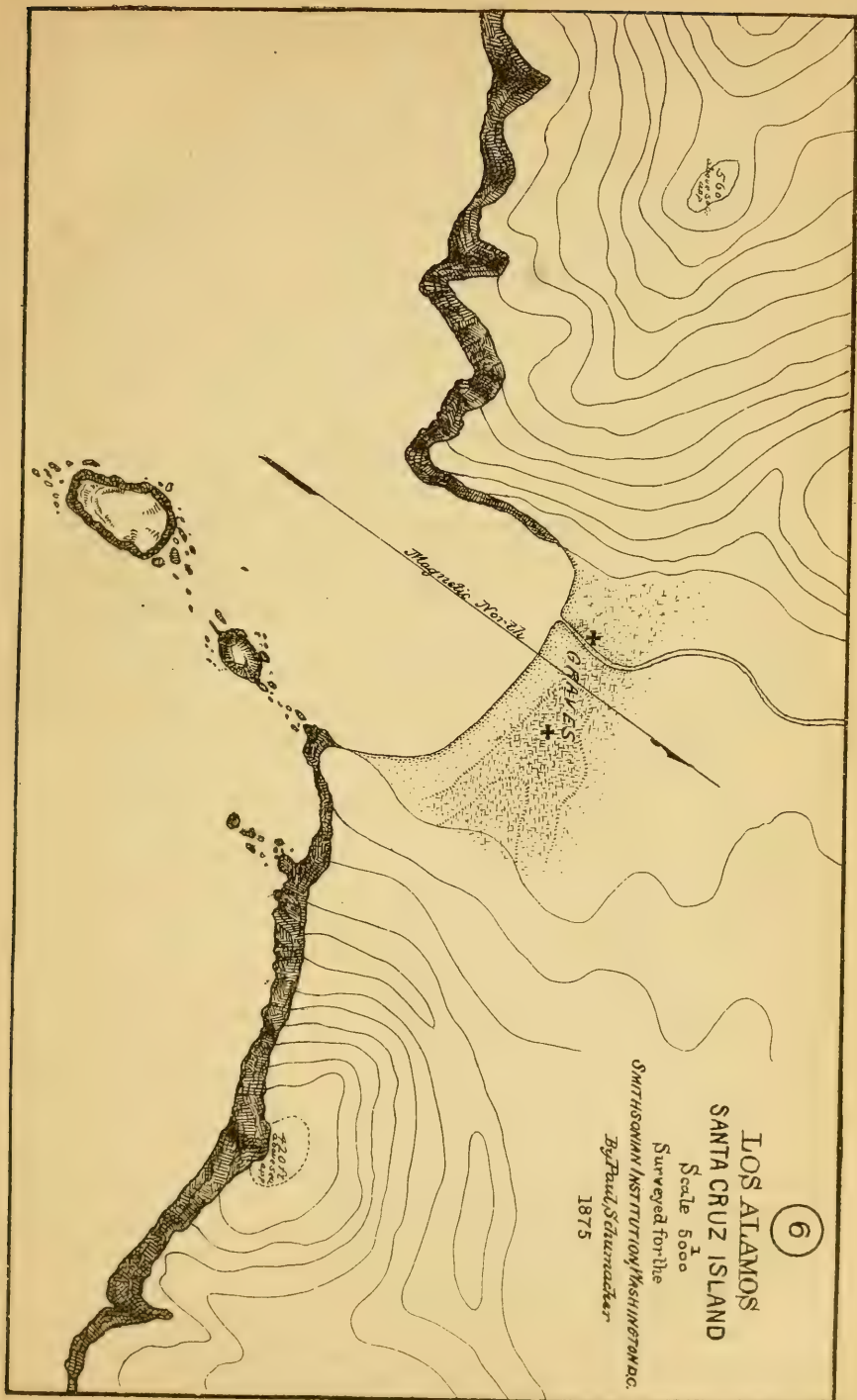
* Asphaltum is plentiful on all the islands, washed ashore among the rocks. A submarine spring of it exists in the channel between Prisoner Harbor and Santa Barbara, and at several places along the adjoining mainland.

of being buried with the dead, many mortars set in the ground to the rim, the pestle either in its opening or lying alongside, as if it had done its duty only some days before. On this island, more dog skeletons were found among the *debris* of the deserted hearths than on any preceding one, although in only one instance were we able to collect many of the parts of a full skeleton; but we were more successful in obtaining good skulls. Tradition speaks of an extinct race of dogs that inhabited these islands. Even in 1857 a reliable gentleman thought he had seen some of these same dogs on San Clemente, which he described to me as large, slender, coarse, and hairy canines, resembling rather a coyote or wolf than our better-natured domestic species. Whether the aborigines feasted on this last resort of a starving modern traveler, we cannot tell, although we know that they were not epicures according to our taste, as the many bones of sea-fowls testify. The red-back abalone is abundant among the shell-heaps, although none of this species is found on the island at the present time, which is proven by the modern shell-deposits accumulated by the industrious Chinese, who dry this shell-fish here in great masses for exportation to China. The material for the manufacture of sandstone mortars and pestles is found among the water-worn bowlders on the beach; articles made of serpentine of course had to be brought from abroad. Pots of magnesian mica, or even fragments of them, were not found, and yet the presence of drift-wood permitted cooking, as plenty of charcoal bears witness. During our stay on this island, we obtained 127 mortars and about 200 pestles, and many boxes of smaller implements, trinkets, and ornaments, which swelled our collection considerably.

At the appointed time, the schooner *Star of Freedom* returned, and we left San Nicolas Island on June 30.

Although the time of two months, as proposed for this tour of researches, had nearly been consumed by the great ethnological results obtained on the islands already visited, and I was eager to do some work on the mainland to complete the series of my collections made in the previous year, I could not decide on passing Catalina, which, even by its historical records, promised such interesting additions to the island collection; yet I was aware of the magnitude of the work I had undertaken to do in eight days, the time the schooner was to come and take us off, a work which would require a month's diligent activity in order to be exhaustive. If our short visit has, therefore, left much to be done, the cause can easily be traced. But by our visit I was enabled to gather valuable information, and to give such hints as will make a search, if the necessary time is employed, a success, and reward a close observer with much that is new, and probably of still greater interest than the objects found on the other islands.

The island of Santa Catalina (Map 11) [Plate 17] appears to be a long mountain removed from its base and planted in the wide ocean, whose waters are here wonderfully transparent on account of the micaceous



6

LOS ALAMOS
SANTA CRUZ ISLAND

Scale 5000
Surveyed for the
SMITHSONIAN INSTITUTION, WASHINGTON, D.C.
By Paul S. A. Mearns
1875

Map of Los Alamos, Santa Cruz Is!

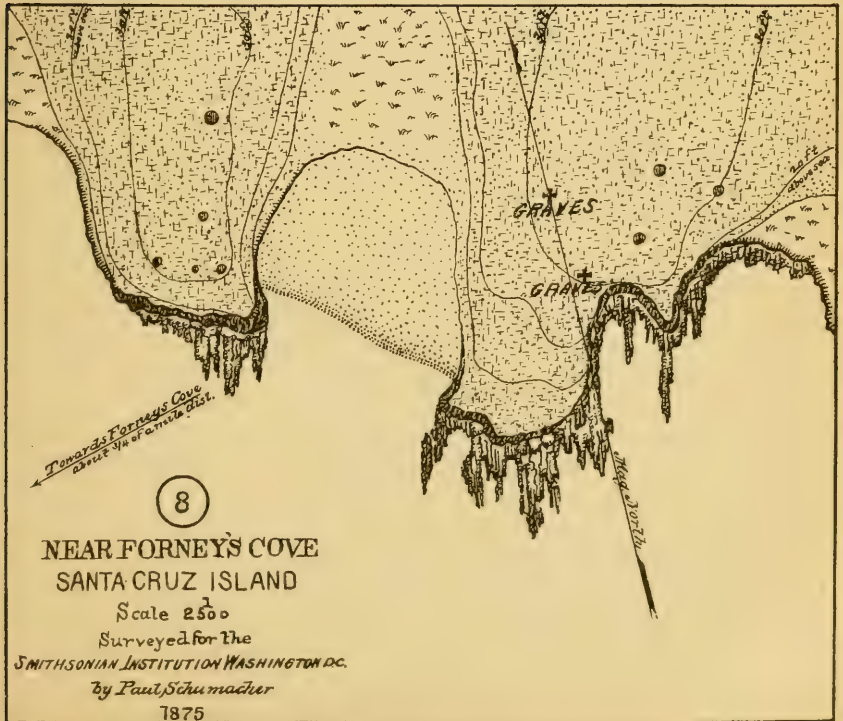
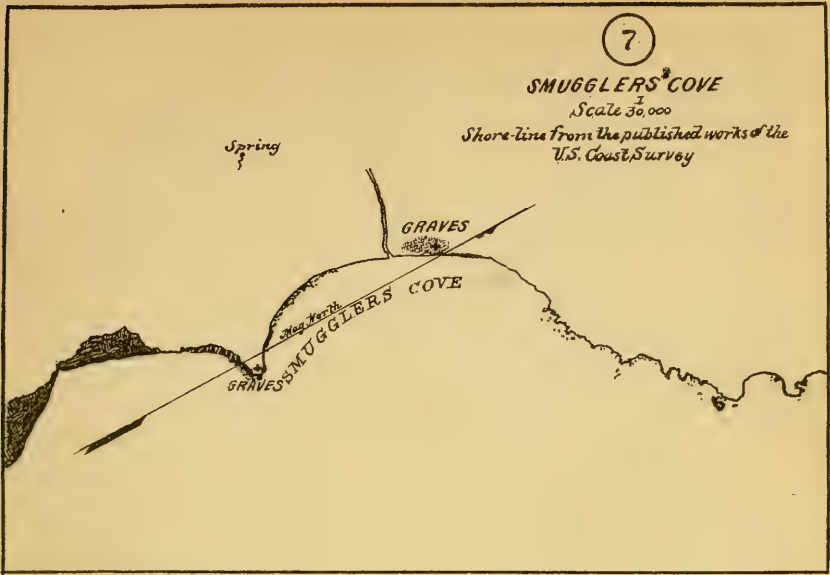
bottom. This mountain, about 18 miles in length and 3,000 feet high, descends in innumerable steep gulches and ravines, and often abruptly ends in perpendicular bluffs, some of which are nearly 1,000 feet high. About 5 miles from its northwestern end, the island is almost cut in two by a remarkable isthmus, forming on the northern side Isthmus Cove, and on the other, the southern side, the fine but narrow port of Catalina Harbor. The two parts of the island are connected only by a narrow strip of land not 40 feet above water, and about 600 yards from ocean to ocean. It is sparsely timbered with stunted oaks and some willows, with plenty of water in springs, and several wells. Some mining has been done, but to no advantage. The island, which was discovered by Cabrillo in 1542, belongs to James Lick, and is settled by a few squatters, mostly engaged in stock-raising, fishing, &c. The Government barracks at the isthmus—quite imposing buildings in this solitude—are still in good condition, and offer now shelter to picnic parties from the neighboring mainland, as also to sheep-shearers in the time of wool-clip, some signs of which it strongly bears in the remaining filth and kitchen-refuse of the shearer. Rattlesnakes and centipedes are not scarce, and the former we caught on the very porch of the barracks. In addition to the small gray fox,[*] the only wild animal on the other islands, we find here the ground-squirrel plentiful.

At the Isthmus Cove, we found quite extensive remains of a *rancheria*, but all our efforts to find the graves of its former people were of no avail. Back of the marshy bottom at this cove several marks of houses are still noticeable, and there we found some graves. In front of the barracks still can be traced, on the highest ground of the isthmus, some slight depressions in the earth, where formerly houses of the aborigines stood, probably the same which Padre de la Ascencion, chronicler of Vizcaino's voyage, mentions in describing a temple with an idol erected on this isthmus. The idol was much looked for, but we only found the hind part of a stone figure representing an animal like a dog. Some pieces of a mortar of a very hard, brick-colored porous rock were found, of which material none had been noticed before. On the other side of the isthmus, at Catalina Harbor, the sides rise steeply, and the ground is gravelly and rocky. Here we find no signs of a settlement. With our boat we made explorations to the northwest and southeastward, along the eastern shore of the island. Toward the southwest, within a distance of 6 miles from the cove, we found many minor and shallow shell-deposits over hard ground, and in connection with them very distinct marks of two, three, sometimes five houses, but failed to discover any graves. All these places had been overrun by miners, and we therefore found only fragments, where we otherwise could have made quite a collection in surface-finds. To the northward we visited a shell-mound, at Johnson's place, which returned no surface-finds, being so often visited by picnic parties, neither are graves traceable. Except a few skeletons

[* The animal here mentioned by the author is the *Urocyon littoralis* of Baird.—Ed.]

dug up at the isthmus, no others could we discover within the reach of our boat-excursions during the limited time of our stay. By all the information I could gather, and by the circumnavigation of the island, I am convinced that the southeastern end is the richest part of the island, and promises a good reward to a collector. There we find many small coves offering fine boat-landings, bold, rocky shores, with an abundance of shells and fish in the kelpy waters. Here also we may find the rocks used by the Indians for the manufacture of their house utensils, which are claimed to come from this island, where they were made and disposed of in canoe-loads among the inhabitants on the mainland, taking such necessities in return as the island was in want of. Only steatite is found about the isthmus, and, as it appears here, it was only used for making ornaments; but no magnesian mica, of which the cooking-vessels are manufactured, nor did we find any serpentine, of which the beautiful bowls and cups consist. But this island is very rich in varieties of minerals, and it is therefore probable such rock is found, which, no doubt, offered a great field of industry to the islanders, considering the many utensils we have found already made of this material. According to the reports, there is no doubt that factories existed on this island which supplied the Indians on the mainland, even as far as San Luis Obispo and Monterey, with their cooking pots, or *ollas*. The rock must be looked for at the southwest end; and if any manufacturing has been carried on there, fragments will be revealed at the different coves, and guide the investigator to the quarries and factories.

Before leaving the islands, I wish to mention those which I did not visit, the reason being want of time, and to explain why I gave preference to those explored. The first island I passed was Santa Rosa, which lies between San Miguel and Santa Cruz. It is 15 miles long and about 10 miles in its greatest width; is much the same in appearance as Santa Cruz, only not so high—being about 1,200 feet above the sea—and more of the rolling-hill order; yet much of its shore-line, which is about 50 miles in extent, is bold and difficult of access. Having had better information as to San Miguel and Santa Cruz when I began the research on the islands, I visited these two first; and as the channels between these islands and Santa Rosa are only 4 and 5 miles, respectively, I was satisfied that the large collection made comprises about all the forms that may be found on islands lying so close together; or at least I thought there was more probability of adding new forms at a distant island, as, for example, San Nicolas, which I therefore selected instead. I am well aware of the great deposits of *kjökkenmöddings* on Santa Rosa Island, as I was informed of them by the owner, who is a reliable man, and I observed some of them while passing by. I was also told that many implements are scattered over the surface, especially where the contents of a cemetery have become exposed by the winds, and the bare skeletons now bleach in the sun. Moreover, certain parties spoke of caves containing human remains, which may be



Map of Smugglers' Cove and locality near Forney's Cove, Santa Cruz Island.

authentic; but to this sort of promises I was treated on the two islands mentioned. My time and, what was more important, the amount appropriated for this work had to be taken in consideration, as well as my great desire to get all I could discover.

East of Santa Cruz, with a channel of $4\frac{1}{2}$ miles between, lies the bold and rocky island of Anacapa, parted in three by narrow passages. I passed this island from all sides, but could not discover any shell-deposits. It seems quite probable that there are none, as there exists no water on this island.

Proceeding 38 miles southeast, we reach Santa Barbara, the smallest island of the group. It has but 2 miles shore-line, is smooth-topped, and about 500 feet high. A small shell-mound is found on this island, with some fragments of pestles and mortars. There is no water, and it seems to have served as a way-station between some of the islands and Santa Catalina.

Thirty-five miles southeast from Santa Barbara, or about 20 miles due south from Santa Catalina, lies the island of San Clemente, one of those discovered by Cabrillo. It is a large island, measuring about 20 miles in length and 2 in width. The southeast end is high, bold, and rocky, and slopes toward the northwest terminus, which is covered with high dunes for many miles. I was informed by a gentleman of the United States Coast Survey of the existence of large shell-mounds on this island, especially of one located on the high dune, of great circumference. A whaler, who usually spends the months of May, June, and July on Clemente to kill sea-lions, told me of natural basins, worn in rock on the high plateau at the southeast end, in which rain-water of the winter is stored, the only water on the island. Although this natural reservoir may have been very convenient for the aborigines, it is well for the visitors to bring a water-supply from abroad, as it is no small task to reach the water here, and, indeed, on most of the islands. With the exception of Santa Rosa, Santa Cruz, and Santa Catalina, no island should be visited without bringing a supply of water. Even on San Miguel, although within easy reach, the water is distasteful. So, also, on San Nicolas, where a landing on the northeast side, near the house and spring, is not always practicable.

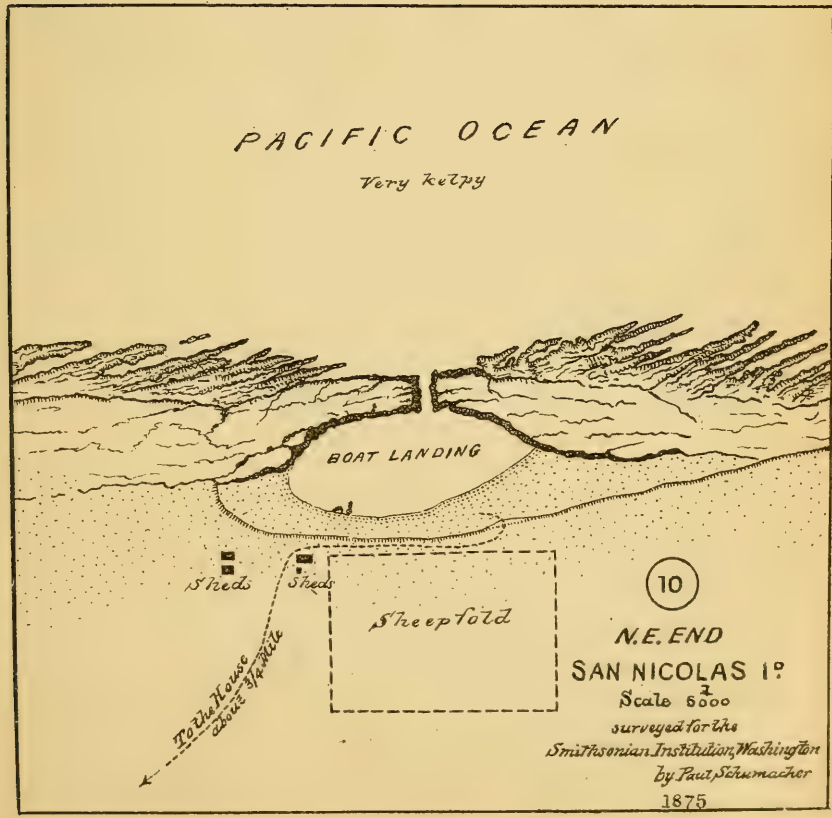
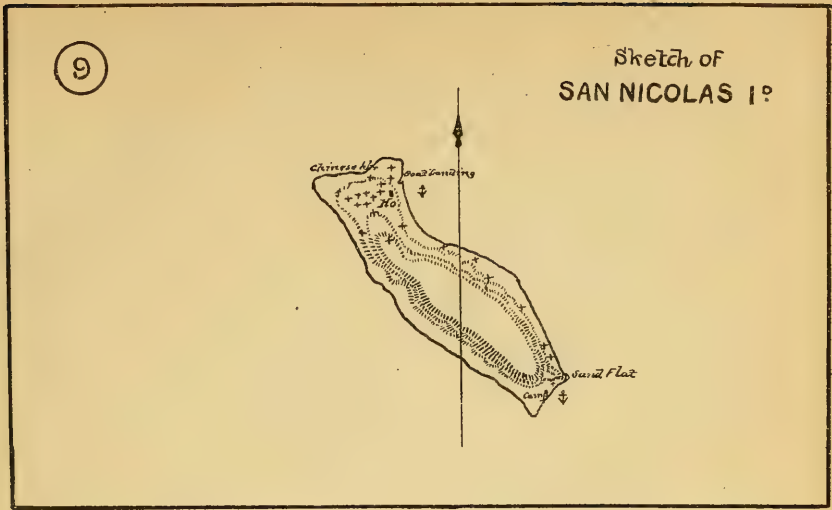
Finally, I will say a few words as to the age of the deserted settlements on these islands. According to the records, the southwestern islands were inhabited at the time of the discovery, but not the northwestern group. The appearance of the kjökkenmöddings, which I was enabled to compare with such remains occurring on the Pacific coast for a distance of a thousand miles, impresses me as not dating far back by the absence of that ash-like appearance which is due to the effects of time; and when I examined the shell-mound of Santa Catalina, corresponding to the very settlement which Viscaino mentions, I considered it slightly older than those investigated on Santa Cruz and San Miguel. I venture, therefore, to say that the islands in the Santa Barbara Chan-

nel were peopled in the sixteenth and seventeenth centuries by immigration of Indians from the neighboring continent, whose habits in building their towns, implements, weapons, and ornaments they retained, keeping up a close intercourse with the mainlanders. The depopulation of the islands certainly occurred about forty years ago, and is still well remembered by some people living on the adjacent mainland. The *padres*, about that time, took the Indians from Santa Cruz, Santa Rosa, San Miguel, Santa Catalina, and probably San Clemente; while Captain Isaac Williams, in the year 1836, then collector of the port of San Pedro, took the Indians from San Nicolas for the same end, viz, their subjection under the missions.*

We left Catalina Island on July 6, and anchored in Santa Barbara Bay on the 10th, having been detained by calm weather, which often prevails in the channel in this season. At Santa Barbara, I again met Dr. Yarrow and the other members of Wheeler's scientific corps, who told me of their great success at the place called Dos Pueblos. As their excavations had not been finished, and promised still great returns, I communicated the fact, and was requested to do some work there.

Dos Pueblos (Map 12) [Plate 18], on La Patera rancho, is said to be 18 miles distant from Santa Barbara by the northern coast-road, and, according to the United States Coast Survey map, 16 miles in a straight line. Here existed once two towns, or pueblos, which originated the name of this place. One town was very prominently located on the mesa-land, on the right side of the stream, near the shore; the other one, below, on the sloping left bank of the same creek. It is said that the creek had been the boundary-line between two tribes, distinct in language as well as in customs. There is also a speculation that this was the place seen by Cabrillo, and mentioned as *casas grandes*. However, we found this place remarkable for its kjökkenmöddings, the appearance of its town-site, its old worn trail along the face of the bluff, and, above all, its location, which comprises the cardinal features of a well-located aboriginal coast settlement, overlooking the wide ocean spread before it, with its offerings of fish and mollusks, water near at hand, a fine game country back of it, and a sandy soil easy to work with the primitive tools of these people. The yield of the cemetery was extremely rich in all kinds of implements, although a good part of it had already been worked out by my predecessor. It was observed that some parts of the grave-yard returned the more valuable relics, like utensils of steatite, spear-points,

* In 1811, a ship commanded by Captain Whittemore, belonging to Boardman & Pope, a Boston firm engaged in the fur-trade, brought down from Sitka thirty Kodiak Indians for the purpose of hunting otters on San Nicolas Island, and left them there for two years. A feud arose among the old settlers and the new-comers, which, it is said, caused the extirpation of the male islanders at the hands of the well-armed Kodiaks. When, in 1836, the last Indians were taken from San Nicolas by Captain Williams, a woman was accidentally left, and twelve years afterward discovered by Captain Nedever, giving rise to many newspaper accounts.



Map of San Nicolas Island.

&c., while other places in the same burying-ground compensated our labor with the common mortar and pestle.

The lower settlement does not indicate as long a period of habitation nor as large a town as the upper one. The graves are located in a sticky, dark ground, slightly mixed with gravel, and difficult to dig up as compared with the common soil of burying-places. The short time left us before the departure of the steamer, after finishing work at the upper cemetery, did not admit of an entire excavation; and, on the other hand, the aspect was not inviting enough, and promised not sufficient work to our enlarged party for a stay to await another steamer, even if my proposed northern trip had left us any time to spare. We had here five working-days for excavation and packing, during which time an addition of seventeen large cases was realized.

On the 18th and 19th of July, our party moved back to Santa Barbara, and I started on the following day to San Francisco.

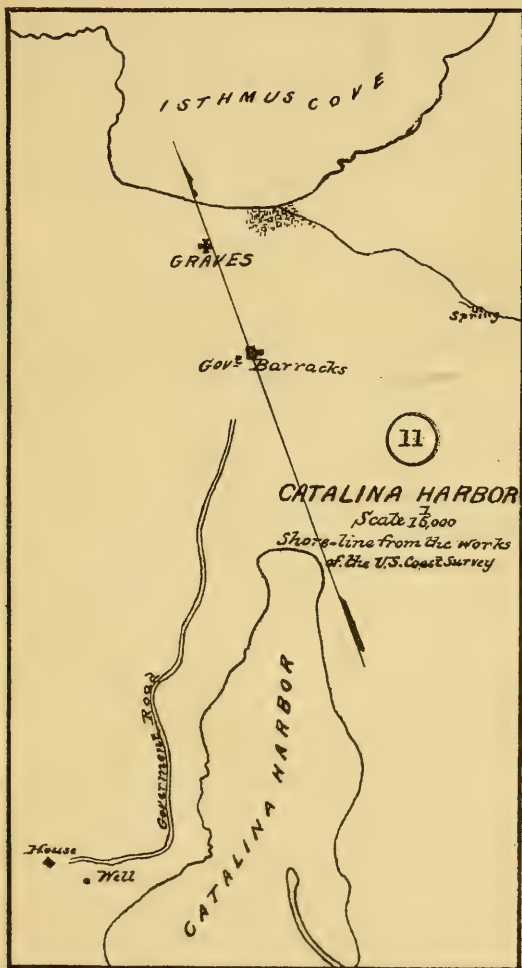
After a trip to Oregon, which I describe in another place, I returned again to the southern coast of California, to make some further researches. My starting-point for this trip was San Luis Obispo. I left this place in the beginning of January, with two men and the smallest camp-outfit possible, for the Rancho de los Alamos, on which several graves had been reported by one of the owners of the land. Unfortunately, it was not as represented. We also visited Alamo Pintado (painted alder), now known as Ballard Stage Station, which is said to have been once a great resort for the Indians in the early times of the missions. We made inquiry of the people at the station, and found them utterly ignorant of the existence of such a cave, which, as my informant said, ought to be "within a hundred yards or so" from the station. The geological stratification is not adapted to the formation of caves, and gives no hint where to look for them. After a short, useless search, we were compelled to return for quarters at Bell Station. We went back to La Graciosa, a small settlement at the boundary-line of Los Alamos grant, and about eleven miles from the ocean shores, near the Santa Maria River, and there hired a guide to bring us through the mountain-pass to a place at the beach about 5 miles to the southward of Point Sal. The existence of a shell-mound in that location was known to me, I having observed it two years ago with the aid of a telescope from the height of Point Sal, while engaged in the works of the United States Coast Survey. This *rancheria* is called *Os-bi* (Map 13) [Plate 19] by the old Spaniards. Its appearance is a grand sight to an eager collector, on account of the great masses of kjökkenmöddings found here. Along the shore are low dunes, and back of it a grassy flat, which extends toward the steep foot-hills of the Coast Range, and affords ample room for a settlement, which we still can trace in many house-sites. The sub-soil of the flat is deep, and consists mostly of decayed shells of an ash-like appearance, which are of a greater age than those on the dunes. The dunes, extending half a mile in length and about a hundred yards

in width, are covered with glittering shells, bones, great masses of flints, and hundreds of tons of broken rocks and cobble-stones. Stratified rocks on the shore reach out to sea, and must have been formerly, as they are now, rich in shells, the adjoining waters teeming with fish, of which the masses of kitchen-refuse offer convincing proof. The dunes toward the south are high, and partially covered with a luxuriant growth of chaparral and chemisal, the sheltered home of timid rabbits, quails, and other game. Water is especially plentiful in a stream south of the settlement, and of a better quality than in the gulch right north of it.

Early the next morning I went over the ground, studying the location of the settlement, the nature of the soil, and such signs as would guide me in the discovery of the graves; and, as their marks were still visible above the ground, I had no difficulty in finding a large cemetery close to the beach, which forms here a perpendicular bluff of 50 feet in height. In size, but certainly not in the yield of implements, this grave-yard could be favorably compared with the one on the *mesa* at Dos Pueblos, which returned about fifty boxes of relics, while here hardly four were filled. The large spear-points of chalcedony, one measuring $10\frac{1}{2}$ inches, of which eight were exhumed, were exceptionally valuable. The surface of the grave-yard, under which we found buried at a depth of 5 feet in the average nearly 400 skeletons, measured 600 square feet. If we now take on an average three skeletons one above another, we find that the surface space required for these three bodies was $4\frac{1}{2}$ square feet, or 3 by $1\frac{1}{2}$ feet, which would be the most convenient proportion to fit the doubled-up corpse of an aboriginal burial.

While in camp at *Os-bi*, we encountered a heavy winter rain-storm accompanied by snow and hail, from which we had much to suffer under our light shelter, and which deprived us even of our camp-fire.

On the 25th of January, we started out to San Antonio rancho, where a cemetery was reported, which we found to be situated opposite the house of the stock-raiser Olivera (Map 14) [Plate 20]. This place we found nearly all dug up by the Spaniards for the sake of obtaining some *ollas* and mortars, which are a great addition to their meager household utensils in such an out-of-the-way place. The result of our labors here was very poor. Much disappointed, but with hopes of a change for the better, we went along on our difficult trip toward the mouth of San Antonio Creek, over a country which was hardly ever traversed by a wagon, and, properly, should be reserved only for the roaming *vaquero*. About four miles from the mouth of the San Antonio and a mile from its right bank is Burton's place, an old, dilapidated, deserted *adobe* house, and back of it a small pond, near which a cemetery was reported. The house, the lagoon, and even some signs of former Indian huts, were readily found; but, with all the pains we had taken, the burial-place could not be discovered, and yet its location is clearly pointed out by the formation of the surrounding ground to be back of the pond. Likely, the



Map of Catalina Harbor.

loose and shifting sand of the dunes, between which it ought to be, covered it up. We remained that night in camp near the lagoon, and experienced another heavy rain and hail storm. Wet and freezing, we sallied out early the next morning to make the mouth of San Antonio Creek, which had much swollen, and had to be crossed at the beach, where its waters mingle with the breakers of the ocean. The crossing of the creek delayed us many hours, and was attended with some danger. We had hardly become dry after last night's exposure in endeavoring to save our light tent, and now we had to plunge into the water to save our equipage, and rescue team and wagon out of the sandy river-bottom. We passed Point Perdernales, and dragged over a chain of dunes to the Lompoc landing, now in course of construction. About a quarter of a mile to the northward of this landing, we found quite a shell-deposit, and some signs of houses near a spring, but no graves could be discovered.

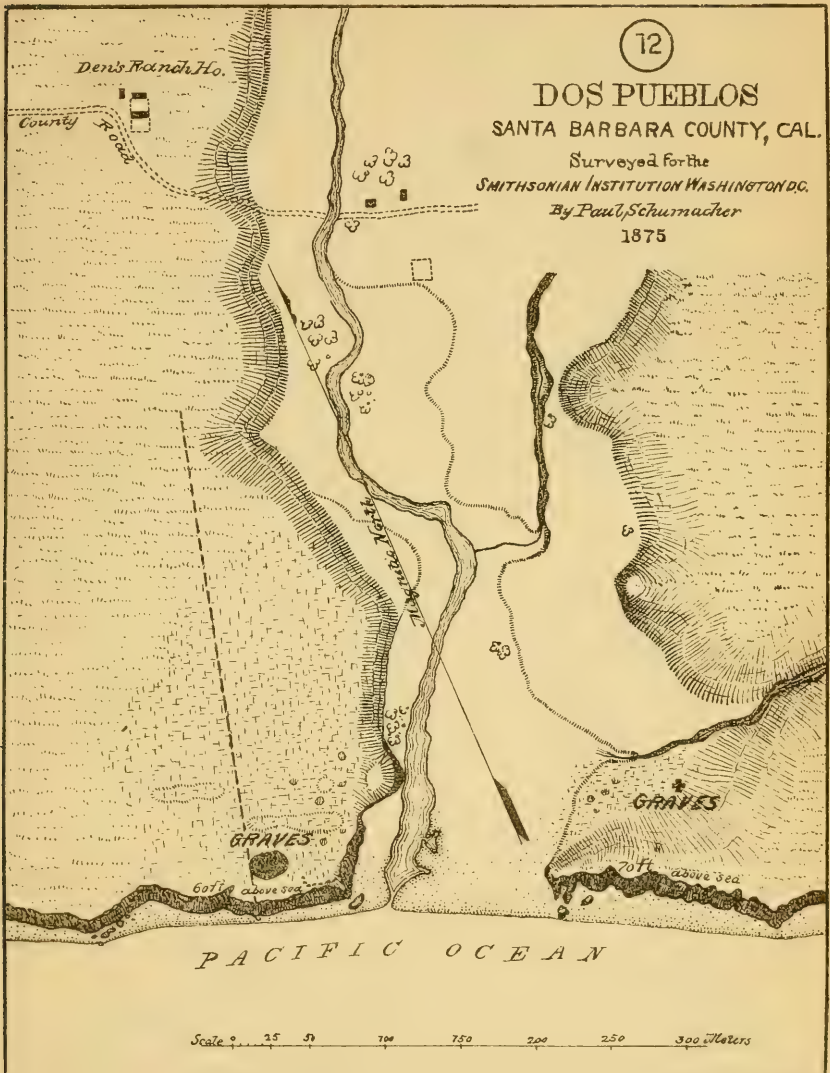
From this point, behind which is the landing, open to the southwest, but partially sheltered against northwest winds, toward the mouth of San Inez River, which is about four miles to the southward, we noticed old shell deposits, especially back of the wharf. The thick growth of chaparral prevents us from advantageously examining this place; perhaps the deposits were accumulated only by temporary visits of the Indians. At the right bank of San Inez, where a large *rancheria* was reported, we found no signs whatever. This river we could not cross on account of the late rains, and had to take our course up its banks. After a venturous travel over the hills and cañons, we reached the house of the Santa Lucia rancho, which estate, by the way, is very large, where another cemetery was reported. But I was soon convinced by the intelligent gentleman that holds it now at rent that nothing of the kind existed.

From the time we left Olivera's place, our trip was a chain of disappointments, and I therefore hastened to its conclusion. We returned again to La Graciosa, and without delay went to Guadalupe on our way to San Luis Obispo. At Guadalupe, a small jug of burnt clay was given to me by a hunter, who picked it up at a southern branch creek of the San Inez River, about 10 miles from shore, in a secluded place, where he thought could still be traced the remains of an old Indian hut. It was found alongside of an oven, or furnace, as he calls it, in which he thought it was baked. The furnace, he says, was about one and a half feet high, made of clay, round, and had but one opening—none for the draft. It was left by him undisturbed.

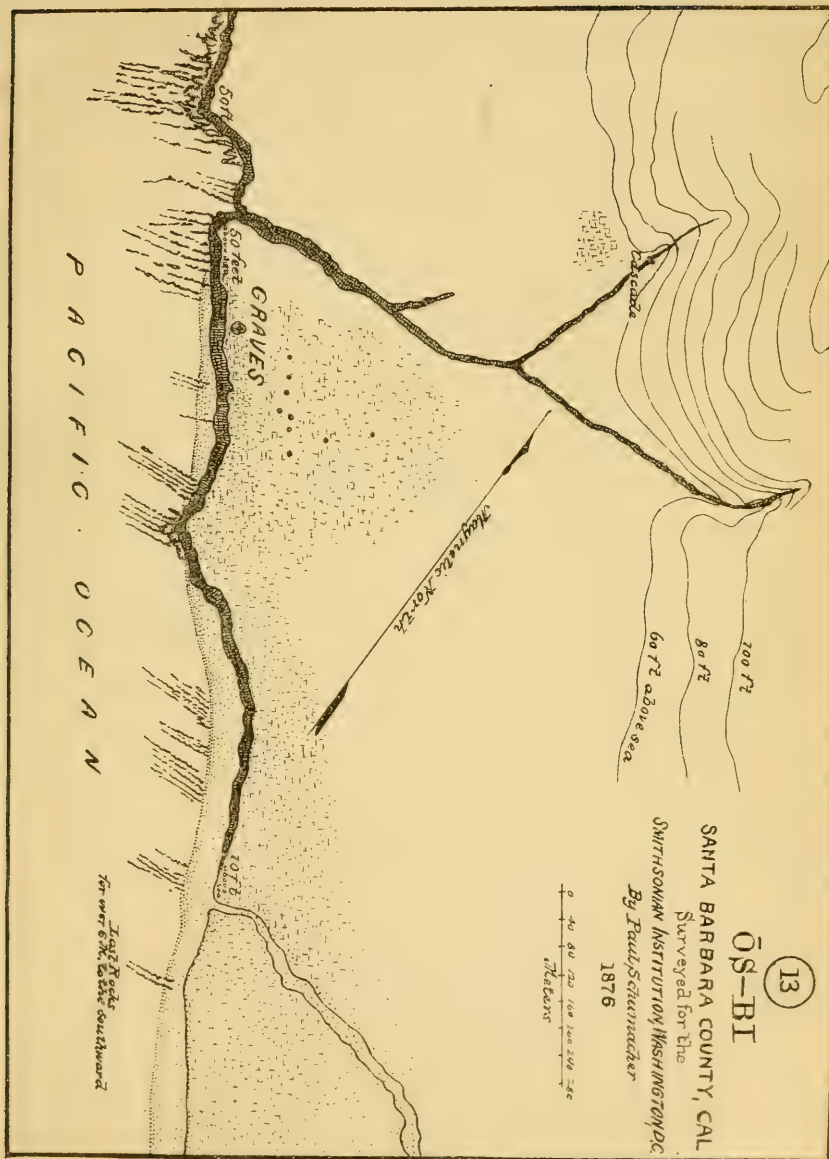
From San Luis Obispo we made a trip, at the beginning of February, to Morro Bay. We found at Morro Creek signs of an old *rancheria*. Farther north, at Old Creek, are extended shell-mounds, especially the one back of Stone's house, in the cultivated field, near the road leading back into the valley. Although plowed, permission was received for excavations. We found there, as if to give perfection to our ill-luck of

the last fortnight, the graves washed out by the creek. Three skeletons, one of which was laid bare and revealed the burying-ground, had still remained in the bank of the stream, which is very swift in the winter, and had worked out here a small bight. Some stone slabs were also found, but our spades soon worked the virgin soil of the bluff. We made search in the bed of the creek for some implements, which may have remained there, but found nothing. They were either washed to sea or carried away by passers-by.

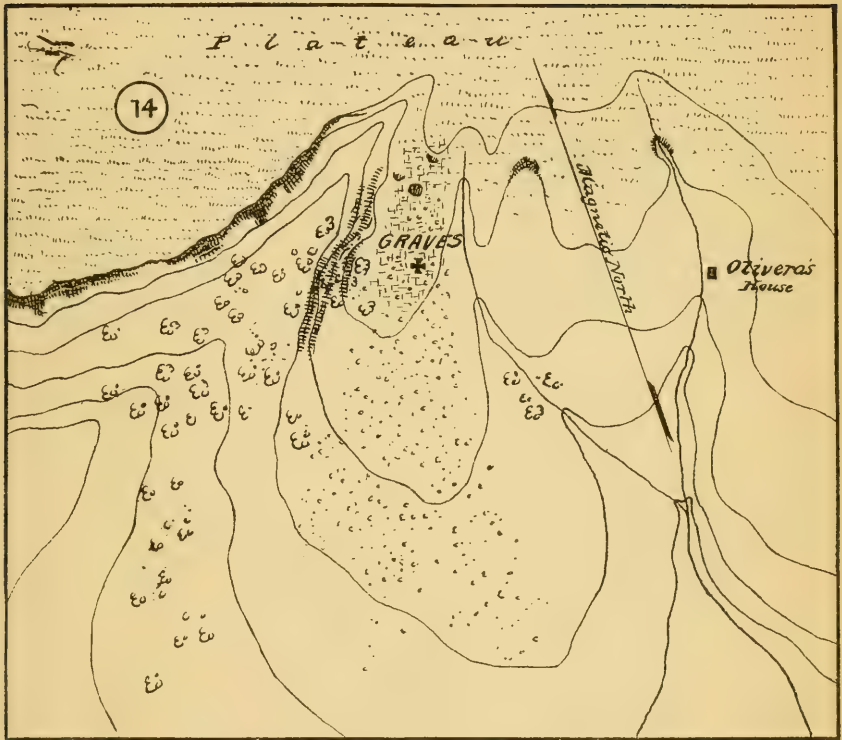
In conclusion, I will state my opinion that there are but few places left on our coast south of San Francisco Bay which promise returns in Indian relics so valuable as the results of my work during the last year, and that in a short time, say five years, when the plow of the settler shall have obliterated the last signs which now still guide the collector in finding the graves, the implements that come then to the surface will be destroyed or scattered among different people, and thus forever lost.



Map of Dos Pueblos, S^{ta} Barbara C^o Cal^a.



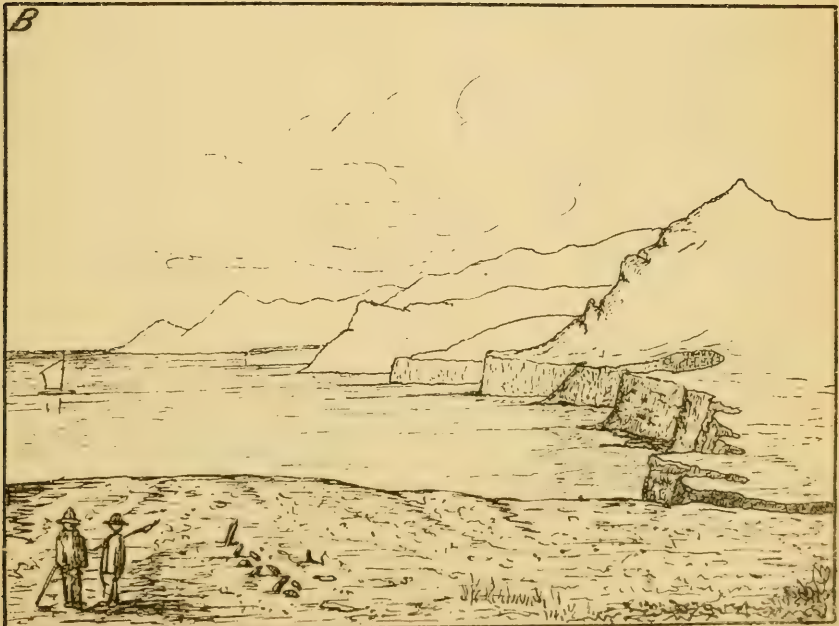
Map of Os-bi, Sta Barbara Co Cal.



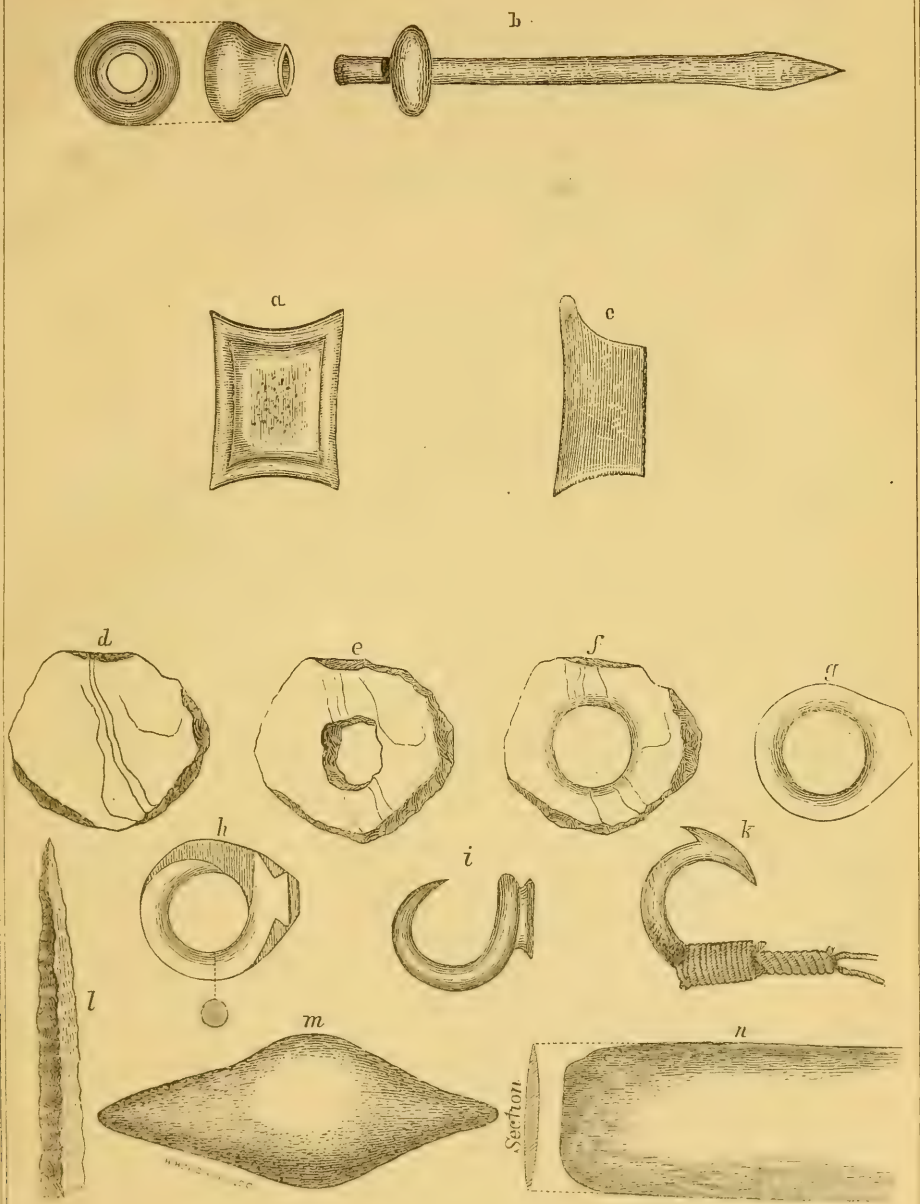
Map of San Antonio Rancho.



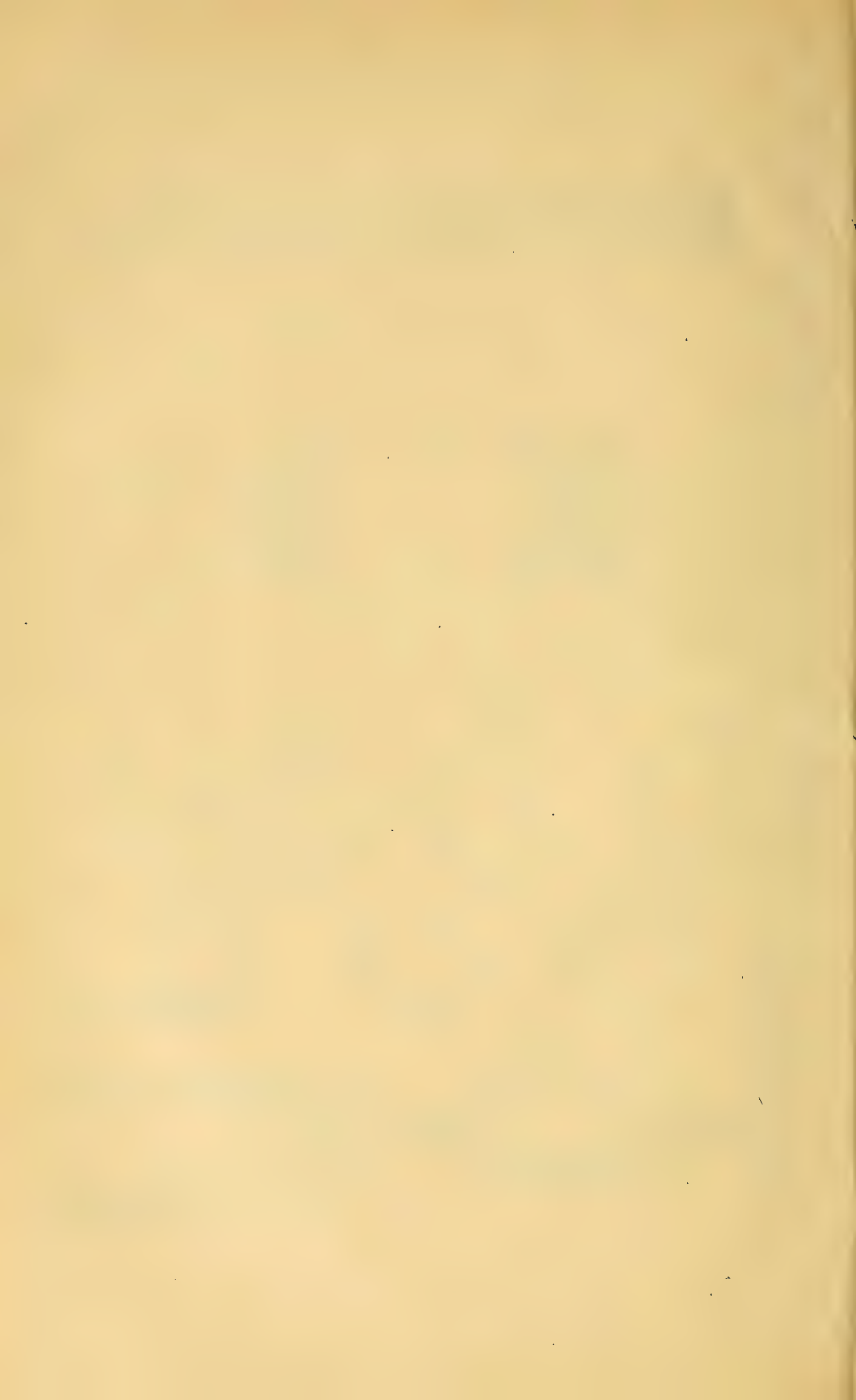
Looking Northward. Mainland in the distance



Looking N.W. Point of view in the distance



Implements from graves at Coche Prieto, Santa Cruz Island.



ART. IV.—THE TWANA INDIANS OF THE SKOKOMISH RESERVATION IN WASHINGTON TERRITORY.

BY REV. M. EELLS,
Missionary among these Indians.

PLATES 23-25.

INTRODUCTION.

The following account has been written in answer to questions asked* by the Indian Bureau, for the Centennial Exhibition and the Smithsonian Institution. If it is of any value, it is not altogether because it describes the Indians under their old native habits and customs, but because it gives an account of them in a state of *transition* from their native wildness to civilization. For the past sixteen years, a United States Indian agent and Government employés have been on the reservation. Previously to that, there were American settlers in this region for ten or twelve years, and previously to that, the Hudson's Bay Company were trading in the country for thirty years or thereabouts. They have therefore had contact with civilization for a long time, during which they have been adopting civilized customs more or less rapidly, and may be called about half-civilized. Hence, transition is marked in every department of their lives—in food, dwellings, clothes, implements of use, manners, customs, government, and religion; therefore it is very difficult to describe their primitive customs, especially in regard to their ancient ornamental dress, war and hunting customs, stone-work, adornment, secret societies, and tamanamus. There are very few, even of the old men, who know all these customs thoroughly.

The families have not all made equal advancement in civilization, and hence what applies to some will not apply to others, even at the present time; the younger, as a general rule, being further advanced than the older ones. On this account, it has also been difficult to describe all truthfully. On looking over the list of individuals, which number about sixty-five, forty-two of them are at least half-civilized in regard to eating-customs and houses, while of the remaining twenty-

[*In the publication entitled "Ethnological Directions relative to the Indian Tribes of the United States.—Prepared under direction of the Indian Bureau, by Otis T. Mason.—Washington: Government Printing Office, 1875."—8vo, pp. 32. The article is in the form of answers to the questions there asked, following the printed heads of subjects of inquiry very closely.—ED.]

three fourteen are either so old or so weak that they cannot work and earn money and obtain civilized food, and so are obliged to live more according to their old ways.

I have only been here about one year and a half, but I desire to say that I have been assisted very materially by the present agent, Mr. E. Eells, who has been here four and a half years, and by Mr. J. Palmer, a native Indian, who both reads and writes English, and has been interpreter here for about six years. Dr. R. H. Lansdale, the resident physician for the past two years, has written paragraphs A and B in Part I, B, C, and D in section 14, Part III, and a part of B in section 15 of Part III.

PART I.—MAN.

A.—PHYSICAL NATURE.

Measurement of the body with reference to each other and to a standard.—Eleven men were weighed and measured, with their clothes, and the following table is the average, both before and after deducting what we think to be right on account of clothes, hair, &c., and also the extreme limits under each head:—

	Before deducting.		After deducting.	
	Average.	Extremes.	Average.	Extremes.
Weight	151 7-11 lbs	124½ lbs.—174½ lbs. . .	142 lbs . . .	114 19-22 lbs.—164 19-22 lbs.
Height	5 ft. 6 in. . .	5 ft. 3¾ in.—5 ft. 9 in.	5 ft. 5 in. . .	5 ft. 2¾ in.—5 ft. 8 in.
Circumference of head	21 8-11 in. . .	21 in.—23 in.	21 in.	20 3-11 in.—23 3-11 in.
Circumference of chest	35 3¼-11 in. . .	32 in.—38 in.	34½ in.	31 2-11 in.—37 2-11 in.
Circumference of pelvis	35 2¼-11 in. . .	33¾ in.—37 in.	34 in.	32 3-11 in.—35 8¼-11 in.
Circumference of arm	10 2-11 in. . .	9 in.—11 in.	10 in.	8 9-11 in.—10 9-11 in.
Circumference of forearm	9 5-11 in. . . .	8½ in.—11 in.	9 3-11 in. . . .	8 2¼-11 in.—10 9-11 in.
Circumference of thigh	18¾ in.	17 in.—20 in.	17 in.	15½ in.—18½ in.
Circumference of leg	13¾ in.	12 in.—14½ in.	13 in.	11½ in.—14 in.
Length of upper extremities .....	.....	.....	27 8-11 in. . . .	26 in.—30 in.
Length of lower extremities .....	.....	.....	31 3-11 in. . . .	29 in.—34 in.
Length of trunk .....	.....	.....	23 7-11 in. . . .	22 in.—25 in.

Color of hair.—Black.

Color of eyes.—Black.

Blushing.—The same as white people, though not so sensitive.

Muscular strength.—Quite inferior to that of white men.

Characteristics of speed.—Not equal to that of white men.

Characteristics of swimming.—Superior to that of white men.

Characteristics of climbing.—Inferior to that of white men.

Senses.—They are a little inferior to those of white men.

Growth and decay.—Their growth is attained early in life, and their decay also begins early.

Child-bearing.—Very easy.

Reproductive power.—Much less than with whites.

Sterility.—This prevails to a large extent. They cause it early in life by various kinds of abuse.

Puberty.—In males at the age of fourteen, and in females about the age of thirteen.

Crosses.—They cross with all races.

Dentition.—The teeth come about the same as in white children, but they wear down early in life. They attribute it to eating dry salmon, though this is not the cause.

Loss of power.—It is lost sooner than with white persons.

Growing gray.—There are very few gray people among them. They do not grow gray as soon as white persons, owing to the freedom from mental care and strain, their out-door life, and the bareness of the head from covering.

Longevity.—I think it is ten years less than with white men.

B.—PATHOLOGY.

Diseases.—The principal ones are scrofula, consumption, bleeding at the lungs, scrofulous swellings and scrofulous abscesses, all of which are grafted on a scrofulous diathesis; also acute and chronic bronchitis, all forms of catarrh, diarrhœa, dyspepsia, conjunctivitis, skin diseases, all forms of syphilis, gonorrhœa, toothache, and chronic rheumatism. There are others, but they are not common.

Physical effect of diet, habit, and climate.—These have been the means of producing a scrofulous diathesis from generation to generation, and thus of shortening their lives, as previously stated. The dampness of the climate also produces rheumatism and consumption.

Pain and healing.—They are not sensitive to pain. Cuts and wounds heal easily. Scrofulous diseases are very difficult to cure.

Abnormalities and natural deformities.—There are no natural deformities.

C.—PSYCHICAL PHENOMENA.

Mental capacity for acquiring, remembering, generalizing, volition.—In school, the Indian children acquire on an average as rapidly as the white children in the same school, who have had the same advantages in the primary studies, but do not progress as well in the more advanced studies. The younger ones reason a little, and the older ones more, sometimes quite sharply. The strength of will in some of the older ones, who become leaders, is quite great, but that of the common people is not very great. Their memories are good.

Sagacity in tracking game, following bees, and other occupations.—They have no bees; but in tracking game, they will notice very little things, and follow generally until they find it. In obtaining fish, they have also a large amount of patience and good habits of observation. The greater portion of them have, however, of late years, left these pursuits as their principal means of support, and follow American forms of labor, chiefly logging and working for the whites, making gardens, and raising hay. At these things they are quite industrious, and on most

pleasant days a trip over the reservation shows most of them, both men and women, busy in some way. They still hunt some, and fish more; but the majority of them do not follow these occupations as the principal means of support.

Moral ideas.—Formerly quite low, in regard to theft, lying, murder, and chastity, but of late years they have been elevated very much. Formerly they would say it was wrong to steal; but if not found out it was all right. Now, both among Indians and whites, there are very few who accuse any of them of stealing. Lying is much more common. Murder of late years has been almost unknown on the reservation. In regard to chastity, they have improved very much, though there is still room for improvement.

Emotions and passions.—Generally strong; sometimes lasting and sometimes not.

D.—TRIBAL PHENOMENA.

Name.—Twana, spelled in the treaty between the tribe and the United States, made at Point-no-Point January 26, 1855, Too-an-hooch; but I much prefer Twana as being simpler and the one most in use here.

Their own account of their origin and relationships.—God made them soon after he made the world, and he placed them here, as they think he did the different tribes and peoples in the different countries. They believe in different centres of creation for themselves and all other tribes and peoples. God made them at first man and woman.

History of their increase, migrations, growth, and decay.—There is no reliable information about their increase, growth, or any migrations. Twenty years ago, when the treaty was made with them, they numbered about twice as many as they do now, although for the past four years their births have equaled or exceeded their deaths. According to the record of the physician, the deaths for two years previous to July 1, 1875, have been only sixteen. It has been impossible to keep any record of the births. As far back as there is any reliable information, they have always lived in this region. They have a tradition that at the time of the flood, which was only a few generations ago, one great mountain, Mount Olympus, was not wholly submerged, and that on it the good Indians were saved; that as the flood subsided a number of canoes with those in them broke from their fastenings on the mountain, and were carried away to the east and north, which accounts for there being but few people left here now.

Population, male, female, children, and causes affecting.—January, 1875, men, 80; women, 95; boys, 50; girls, 39; total 264. Till within about five years, they have been decreasing, owing chiefly to syphilitic diseases.

Invention, conservatism, and progress.—But little invention. Are generally more than medium about progress. Improving very much in dress, houses, names, food, and habits of industry, though but slowly

in Christian ideas ; learning more from example than from precept, but in both ways. They have had instruction in Christianity only about four years, and in the other matters for fifteen years, which accounts partly for the difference in regard to this. In almost all things, however, as they see the superiority of the white man, they are ready for progress, especially the younger ones ; the old ones being more conservative.

PART II.—SURROUNDINGS OR ENVIRONMENT.

A.—INORGANIC.

Outline and size of Territory—Elevation and Water-systems.—Reservation near the head of Hood's Canal on Puget Sound, in Washington Territory, and at the mouth of the Skokomish River. It is nearly square, and comprises about 5,000 acres ; two-thirds of it but a few feet above tide-water, the other third mountainous and several hundred feet high. The Skokomish is the only river which, coming from the north in the Olympic range of mountains, flows east on the south side of the reservation and north on the east side, when it empties into Hood's Canal. There are several sloughs running from the river to the canal across the reservation.

Geological environment, both stratigraphical and economic.—The stratigraphical environment has not been thoroughly studied. Both lava and granite evidently lie at the bottom ; the granite I think to be the oldest. Since the granite, evidently there has been a long washing either by salt-water or fresh, I do not know which, but presume it was salt, as the upland is mostly a gravel-bed. As the sea then went down, the river formed most of the soil good for cultivation.

Economic.—The soil of about two-fifths of the reservation is black, rich bottomland, very excellent for cultivation when cleared of the timber which covers it. One-fifth of the land is swampy, and 1,800 acres, nearly two-fifths, is gravelly and covered with fir timber, and is almost useless except as timber-land.

Climate.—Chiefly a dry and wet season, as in Western Washington and Oregon ; but little snow or cold weather generally during the winter, but a large amount of rain, which continues at intervals during the summer. The spring is generally backward, as the Olympic Mountains, some of which are snow-capped most of the summer, are but twenty miles distant to the north. Frosts in the fall generally not early, coming from the 1st to the 25th of October usually.

Remains of plants and animals found with relics of extinct tribes.—There are two shell-beds, which as yet have not been opened, at Eneti, on the reservation ; one is near the north line of the reservation, and is about 450 feet long, from 3 to 20 wide, and a foot or two thick ; the other, half a mile south of it, 300 feet long, and about the same width and thickness. They are both just above high tide, and are evidently

of recent formation, the shells being chiefly clam-shells. There is also said to be one at Big Jackson's place, eight miles up the canal, and another at Humhummi, 15 miles down the canal; and I think it very probable that there are such, and perhaps others about, as these are old camping-places of the Indians.

NOTE.—The vegetable and animal resources of the country being all mentioned under other heads, there is no necessity for a detailed enumeration here.

C.—SOCIAL.

Contact with civilized and uncivilized tribes, and its influence.—There are no civilized tribes of Indians with whom they have any contact. There are a number of tribes of half-civilized Indians, with whom they are in contact more or less, chiefly the Squaxons, Nisqually, Clallams, Snohomish, Lummi, and Chehalis tribes. Their relations are peaceful with them all, and their influence is to keep them in about the same condition, neither particularly elevating nor depressing.

There is much contact between them and white civilization, and has been for twenty-five years, and a little for twenty years previously. Its influence has been both good and bad; good with reference to food, clothes, houses, and habits of industry, and against theft, murder, and lying; bad with reference to chastity and temperance.

PART III.—CULTURE.

§ 1.—MEANS OF SUBSISTENCE.

A.—FOOD.

Methods of procuring.—Their food is a mixture of old Indian and civilized food, but principally the latter, varying, however, in different families; the younger and middle-aged using chiefly civilized food, and the old and poor ones a large amount of old Indian food.

Most of them have gardens, where they raise chiefly potatoes, corn, peas, onions, turnips, beets, carrots, parsnips, beans, and cabbages, and some fruits, as the raspberry, strawberry, gooseberry, and apple. Potatoes, however, are the principal crop. In the cultivation of their gardens, they do not equal the white man. They seldom plow the ground, as they have been accustomed to clear small patches of land, often too small to plow, and where also too many roots remain. The first season they dig it up with a spade or large hoe, but afterward do not always every year, but sometimes plant the seeds in the old ground, and cultivate with the hoe. As a general thing, they cultivate less than Americans.

They gather many wild berries, chiefly the wild raspberry, gooseberry, currant, sallalberry, strawberry, cherry, cranberry, blackberry, elderberry, salmonberry, thimbleberry, and red, blue, and black huckleberries. Most of these are eaten at once, both cooked and uncooked, but some

are dried for future use, chiefly the huckleberry, sallalberry, and blackberry, the last of which is pounded up and made into cakes, which are then dried.

They also gather fern-roots and three other kinds without English names, which grow in swamps, the sprouts of the thimbleberry and salmonberry, rush-roots, Indian onion, and hazelnuts.

They are fond of kamass; none, however, grows near them. Formerly they made long journeys in order to obtain it, but having other food now they have used but little of late years. Most of the roots named are eaten in their season, but few being kept for future use.

They have a few cattle, from which they get a little beef, but prefer to keep most of them in order to raise more cattle to use as work-oxen. They do but little milking, not seeming to think that it pays. They buy some pork, bacon, and hams, and hunt and obtain chiefly venison, bear-meat, pheasants and grouse, ducks and geese, rabbits and squirrels. Most of the hunting is done with the gun, the bow and arrow being entirely out of use, except as a plaything for children. At certain times of the year, ducks are very abundant, yet they have been shot at so often that they are very much afraid of canoes. The Indians, therefore, cover their canoes with green boughs, standing some upright. Hiding among these boughs, they paddle quietly among the ducks, which are not frightened at such things, when they are easily shot.

They fish and obtain salmon, salmon-trout, dog-salmon, herring, silver trout, rock-cod, flounders, smelt, halibut, and skates. Salmon-eggs and the eggs of all large fish are used for food. They fish with the hook, spear, net, and build traps across the Skokomish River. Their fish-spear is three-pronged generally, but sometimes they are only two-pronged. These are about two feet long, and made of iron, old rasps being preferred. When iron cannot be obtained, they are made of very hard wood. These prongs are tied to a very slim pole, from fifteen to twenty-five feet long, with strings or tough bark; and when a fish is still they are easily thrust into it by the Indian in his canoe. Their traps across the river are built of small sticks about an inch in diameter and six feet long, very close together, leaning down stream, which prevent the salmon going up, when they are easily caught and killed. They dry some of the fish, especially large quantities of the salmon, for winter use.

They dig for clams, which they dry in the smoke, and also obtain mussels and oysters.

Formerly they obtained oil from seals and porpoises, and bought whale-oil from the Makah Indians, but of late years they have ceased to use oil for food.

They use no grasshoppers, crickets, or insects for food.

They buy chiefly flour, sugar, rice, beans, coffee, tea, butter, yeast-powders, saleratus, salt, lard, spices, sirup, dried apples, and crackers, according to their means.

Division of labor, concerning.—The men and women both work in the

gardens. The men hunt and do most of the fishing; the women get a large share of the clams, mussels, berries, and roots, and do the cooking.

Amount eaten and frequency of eating.—They generally eat three times a day, and about the same amount as white people. Formerly they were very irregular, eating a large amount at times, and very often, and again very little for a long time.

Eating customs and rites.—Many of them have tables, chairs, and stools, plates, bowls, knives and forks, and eat in the American way. Sometimes they cook in a large pot, and a number sit around it and take out what they wish with spoons, knives, and their fingers. At feasts where there are a very large number present they spread mats upon the ground, in the open air or in a large house, place the food upon them, and sit on the ground around them while eating.

B.—DRINKS.

Methods of preparing decoctions and intoxicating drinks; occasions for their use, and their effects.—They make no intoxicating drinks. They sometimes get them of white people, drink secretly, and the effect is very bad—physically, pecuniarily, mentally, and morally.

There is a temperance society among them, and about one hundred have joined it, pledging themselves to abstain from all intoxicating drinks. Within the last year and a half since its organization a few have broken this pledge; but it is not known that any more have done so than when the same number of white people join such a society. The fact is also to be taken into consideration that in earlier years, when there was less restraint, the greater portion of them would get drunk.

They are very fond of tea and coffee, and use them as Americans do; and also make teas of cranberry-leaves and young blackberry and hemlock leaves.

C.—NARCOTICS.

Methods of using, and effects.—Tobacco is quite generally used. The older ones generally smoke; the younger ones both chew and smoke. A few of the women also use it. It makes them somewhat dizzy at first. No other narcotics are used to my knowledge. Tobacco is used much as Americans use it, and not to my knowledge as a calumet of peace.

The leaves of the killikinick, a small bush which grows a foot or two high, dried, and of laurel, dried, also the dried bark of ironwood, are used, when they are short of tobacco, to mix with it, but are seldom if ever used alone.

D.—SAVORS, FLAVORS, ETC.

They use salt, pepper, and some other American spices as Americans use them, but have no native ones.

E.—MEDICINES, POISONS, ETC.

Medicines, preparation and administration of.—Usually by old men or women, but by any one who is supposed to know. There is no class of physicians.

List of diseases sought to be cured, the medicine for each, and the effect.—Colds and biliousness: Eat alder-buds, and afterward drink salt water for an emetic.

To strengthen general debility: Heat rocks, throw water over them, place skunk-cabbage leaves on them, then get over the steam.

For a physic and tonic: Cherry-bark; grind it in water and drink the water.

For a tonic: Alder-bark; in same way as cherry-bark.

To purify the blood: Barberry-bark; in same way as cherry-bark.

Skin-diseases: Oregon grape root and bark; in same way as cherry-bark.

Burns and scalds: Potatoes; scrape and put them on.

Sore eyes: They make a cold tea from crab-apple bark, and wash the eyes with it.

This is a partial list, but is the best I can give, as they do not tell all they have.

Effect.—All of them cure sometimes, and at other times do not. At present, the Government furnishes them with a physician, who uses American medicines entirely. If, however, they are not cured immediately by him, they often cease to take the medicine sooner than he orders, and use their own. They sometimes also buy patent medicines. Thus their medicines are a mixture of American and Indian.

Poisons.—They have no native poisons which they now use, and very seldom obtain any from the whites. Formerly it is said that matter from sores was used, especially where there were two wives, one of whom became jealous. When this was so, the jealous one gave this matter to the other with her food.

§ 2.—HABITATIONS.

A.—DWELLINGS.

Are they permanent or movable?—Nearly all permanent; only occasionally one which is movable.

Natural refuge and habitations of degraded tribes.—These Indians cannot be called degraded, but about half-civilized. All have houses of some kind.

Location and laying out.—There is no order. Most of their houses are on their farms, which consist of from ten to forty acres. In a few places, there are quite a number of houses together, and where this is so they are generally near the water, in a single row facing the water.

Labor of construction.—The men build the houses with the help of the Government carpenter, when they can have his assistance.

Plans of interior arrangement; structures at different seasons.—Their best houses, which are built by Government help, are on their farms, most of them on the Skokomish River bottom, which is liable to overflow in the winter. Hence the houses are built on blocks about two feet from the ground, which renders them cold in the winter. Owing to this, most of them leave them in the winter, and go to some large houses at Eneti, that part of the reservation which is on Hood's Canal, and is not liable to overflow.

The summer houses are mostly about 16 by 22 feet, and generally divided into two rooms, one for a bed-room and the other for a kitchen and eating-room. Sometimes there is only one room, and sometimes there are the two and a shed-kitchen added. A few of the rooms are papered, and most of the houses have a cook-stove, one or two bedsteads, a cupboard, a few chairs and trunks, &c.

Their winter houses are much larger, four times as large often, or larger, generally 25 or 30 by 40 or 50 feet, and are for several families, but with no partition. There is no floor but the ground, excepting against the wall all around for about 6 feet from it. Above this floor there are bunks all around about $3\frac{1}{2}$ feet wide, on which they sleep. The doors are either in the middle of both ends of the house, or in the middle of one side, and in each of the four corners one or more families reside, building their fire on the ground, and letting the smoke escape through holes in the roof. Their trunks, provisions, &c., are stored on the small board floor. The workmanship of these houses is much poorer than of the summer houses. Each house is owned by one man, and he allows his friends to live in a part of it, but they pay him no rent. I shall speak of these two different kinds of houses as summer and winter houses, although they are not strictly such, as a few use each kind all the year round, and during the coming winter most of them expect to live in their new, better houses, which I have termed summer houses.

Ancient structures.—They were small, movable, and generally made of split cedar boards, poles, and mats. Occasionally, when they are off fishing, or away from home for a time, they build such now. They are 5 or 6 feet high, 14 by 18 feet or less; the door is a mat, and all the property is stored in this house, consisting of a single room, where they also eat and sleep. The fire is in the middle of the house, and when they are fishing, the fish are hung overhead, where they dry in the smoke. There is no floor but the ground, or sometimes a mat.

Out-buildings.—(1) A barn for hay, as they use no other kind of feed. This is either a shed made by setting posts in the ground, and covering it with split cedar boards, varying in size, according to the amount of hay, which is usually not more than three or four tons; or it may be one of their houses, for they sometimes store hay in a part and live in the other part, or they fill the house with hay and go away for the summer, either at work in a logging camp or fishing.

(2) A stable for work-oxen. This is generally built similar to the sheds for hay, or that is built larger, and answers for both.

(3) A few have stables for horses, when they have one, which they prize very highly, as a race-horse. Most of their horses and cattle, however, are not sheltered; the timber, according to their ideas, being sufficient for this.

Structures for observation, memorial, defense, burial, and ceremony.—There are none for any of these things except for burial, which are described under chapter III, section 15, B, "Manner of disposing of the dead."

Public buildings.—There are none, except when a potlatch is to take place, which may be only once in ten or twenty years or more. The last one took place seven years ago, a few miles off from the reservation. A large house, about 50 feet wide and more than 300 long, was erected. It was a frame building, inclosed with boards. The best part of the material was removed soon after, and the rest has gone to decay.

Sweat-houses.—These are used much as among most other Indian tribes. They are 3 or 4 feet in height, and a little more in diameter, being conoidal. Sticks are first driven into the ground, rather close together, which are covered with large leaves, as the maple, and these are covered with mud.

B.—APPURTENANCES TO DWELLINGS.

Doors.—For their best houses these are a plain American door, made by the Government carpenter. For their large winter houses, they are made by themselves, are smaller, and much rougher.

Fireplaces.—For their large winter houses and their fishing-houses, they have been described under the previous section. Most of their summer houses have no fireplaces or chimneys, but are furnished with cook-stoves, a part of the annuity goods of last year. A few have a rough chimney built of sticks and mud at one end of the house, and on the outside of it, and a few have cut a hole in the middle of the floor, filling it up with earth to the floor, on which they build the fire, cutting a hole in the roof, where the smoke escapes.

Windows.—Their winter houses have none. Their summer ones have one or two American windows.

Roofs.—These are made of split cedar boards. For some of their better houses, they are dressed smooth, something similar to shingles, and some are covered with shingles.

Fastenings, such as locks and latches.—Their winter houses are generally fastened with a wooden latch, which is worked with a string, and when they leave the house for the summer the door is usually nailed fast. The summer houses are provided with American locks and door-knobs.

Water-tanks.—They have none; but when they live some distance from

good water, which is not often the case, they generally carry their water in kegs and small barrels.

Totem-posts.—In the potlatch house which they began to build at Eneti more than a year ago, but which was not finished on account of the death of the principal man connected with it, there are five totem-posts, or tamanamus-posts, as they are called, which are about 8 feet long, about 1 foot through, some being round and some being about 6 inches through by 1 foot. They are intended to support the ridge-pole, as shown in Fig. A, Plate 23, and are 8 feet long, of the shape shown in Figs. B–E of the same plate, though there is not really much more art to them than there is to a wooden turned bedstead-post. They are not painted.

At the old potlatch house (see III, 2, A, “Public-houses”), there were originally twenty-six large cedar slabs set in the ground, which support the cross-pieces, thirteen on each side. Ten of these have been removed, and on four more there are no figures. Five were originally painted, but the weather has worn the most of the paint off. They are about 9 feet long above ground, $1\frac{1}{2}$ to $2\frac{1}{4}$ feet wide, and 5 or 6 inches thick. These posts are delineated on Plate 24, Figs. F–K, where the dark shading indicates figures in red paint on the inside of the posts.

The first four of these figures are simply painted on a smooth surface, but the last is carved, the darkest parts being raised the highest. These posts have been left exposed to the weather for seven years, but are still considered tamanamus-posts, and probably would be even if they should remain there until they should rot down.

Materials for building.—Everything is built of lumber, or occasionally split cedar boards are used, except some temporary structure of mats.

C.—FURNITURE AND UTENSILS.

Hammocks, beds, bedsteads.—They have no hammocks. Most of their summer houses are furnished with plain, unpainted bedsteads made by the Government carpenter. Those in the winter houses have been described in A of the present section. For beds they have straw, feathers, the head of the large mat-rush—sometimes called catstail—several thicknesses of mats or blankets. A few use sheets. For the covering they use blankets and quilts.

Pillows and head-rests.—They have feather-pillows or roll up their mats.

Cradles and pappoose-cases.—They have no cradles, but for young infants they have a small board about the length of the child, on which they place cedar bark, which is beaten up very fine, and on this they tie the child a large portion of the time. When the child is a little older, but not strong enough to hold on to its mother's neck, she wraps a blanket or shawl around it and herself, and thus carries it on her back.

Chairs, stools, and benches.—Last year a number of chairs were furnished them among their annuity goods. Previously to that they had

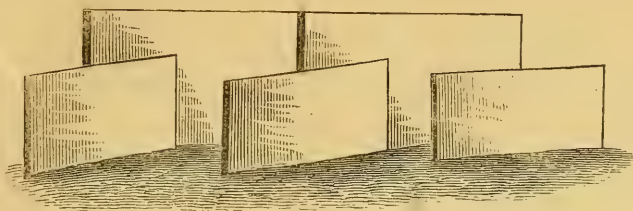


Fig. A.



Fig. B.

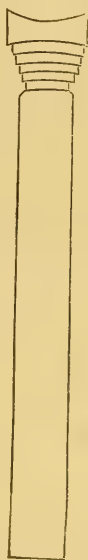


Fig. C.



Fig. D.

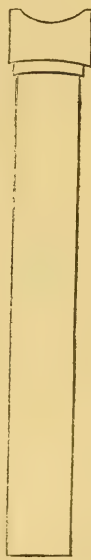


Fig. E.



Fig. L.



Fig. N.



Fig. O.

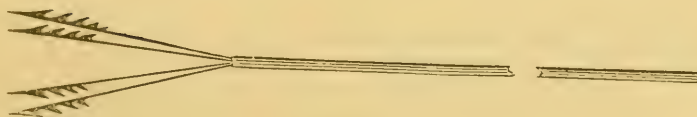


Fig. M.

very few, but used home-made stools and benches or sat on the ground. The women especially are very much accustomed to sit on the ground, or on their mats, or on the floor.

Matting, carpet, and floor-coverings.—They use nothing in the form of carpeting. They often lay their mats on the floor or ground, on which they store their things, eat, or sit, but do not use them as carpeting.

Racks and other protections for food.—Most of them have a small cupboard five or six feet high and two or three feet wide, without any door. Their flour is generally kept in the sack, the salmon in bundles or baskets, and much of their other food in baskets or sacks, or small amounts in cupboards. Their dishes are generally kept in the cupboards.

Tables.—The Government carpenter has made plain, unpainted tables for most of the summer houses, on which they eat, seldom, if ever, using a table-cloth. In their winter houses they use very few tables, either placing the food on a mat or eating from the vessel in which it is cooked, sometimes eating singly and sometimes together.

E.—MISCELLANEOUS—FURNITURE.

Brooms, fly-brushes, urinals, others not mentioned.—A number of them have American brooms, and a few use them considerably, becoming somewhat neat, but with most of them there is very much room for improvement. They also sometimes make a temporary broom from fir and cedar boughs. There is nothing else under this head of any importance which is used.

§ 3.—VESSELS AND UTENSILS.

a.—Natural material.

Mineral material.—They make no pottery or wares from clay, nor am I aware that they make any utensils from stone or of metallic material.

Vegetable material.—Maple and laurel are used in making spoons, cedar roots in making water-tight baskets, cedar boughs in making common carrying-baskets; also, one kind of swamp-grass forms the chief material for one kind of carrying-basket. Small grasses of black, yellow, and slate colors are used for beauty in the water-tight baskets. Rushes or cattail are used in making mats.

Animal material.—Cattle-horns are used in making large spoons, and clam-shells are occasionally used as drinking-dishes or spoons without any manufacture.

A.—VESSELS FOR HOLDING AND CARRYING WATER, FOOD, ETC.

Gourds, dug-outs, bladders, and funnels.—None.

Bottles, jugs, jars, bowls.—All of these are used, and are of American manufacture.

Boxes.—Boxes of all shapes and sizes are in use, chiefly of American

manufacture, both of tin and wood. They like also those of Chinese make. They do not use them for carrying water, and but little for holding food, but usually for holding other things. Cheap trunks of American manufacture are very common, in which they keep their best clothes, and other things which they wish to save from the smoke and dirt.

Tight baskets.—Water-tight baskets which are inflexible are very common, holding from a quart to half a bushel. They make them of cedar roots split, sew them very firmly together, and ornament them with grasses of various colors, yellow, black, slate-color, &c.

Mats.—Their mats, which are often spread on the ground, and on which their food is placed, are made of the swamp-grass sometimes called cattail. The women gather the material in the summer, dry it, and make them in the winter. The grass is first cut as long as is to be the width of the mat, usually about three feet, but sometimes five feet. The ends are then fastened together in the shape of the mat, and strings made of the same grass torn to pieces and twisted are run through lengthwise of the mat and about four inches apart. In doing this, a needle is used, which is about three feet long, a half an inch wide, and three-cornered, with an eye in one end, in which the string is placed. After the string is run through, a small piece of wood with a crease is run over the mat where the string has been sewed to render it firm and of good shape. The edges of the mats are fastened by weaving the grass firmly together. These mats are also used for beds, several thicknesses of them being quite soft, for making temporary houses, and for lining wooden houses to make them warm.

Mat-baskets.—A basket is sometimes made of grass, which is quite strong, but their principal flexible basket is made of cedar limbs, split and dressed. These pieces, some with the bark on and some with it off, are arranged quite regularly and tastily. They are strong, and are used for carrying apples, potatoes, fish, clams, mussels, indeed are of almost universal use for carrying purposes. They hold from half a bushel to a bushel. A rope is fastened into the handles of the basket, which passes around the forehead of a woman, and thus they usually carry the load by the strength of the neck. I have seen one carry a basket full of apples, and two babies one and two years old. Where the rope presses against the forehead it is changed to a braid of cloth, about three inches wide, which is soft, and does not hurt the head. The colors in this braid are often woven in quite fancifully.

B.—VESSELS AND UTENSILS FOR PREPARING FOOD.

Troughs and baskets for stone boiling.—None are in use now. Formerly their water-tight baskets described in A of this section were used for this purpose.

Pots of clay, stone, &c.—None of clay or stone are used. Iron pots of

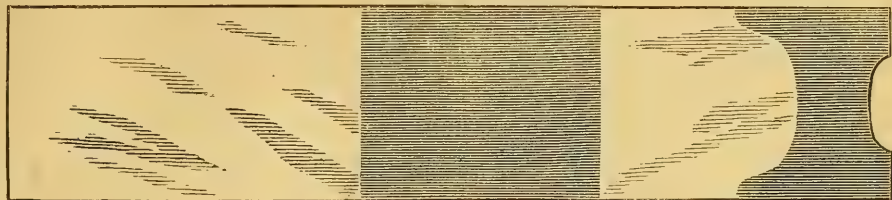


Fig. F.

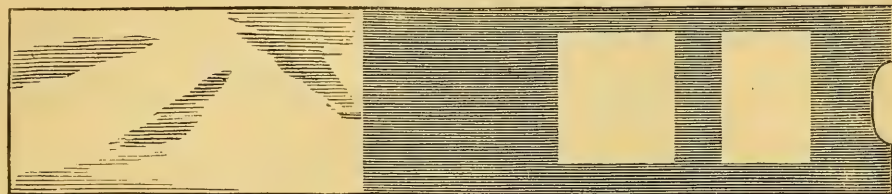


Fig. G.

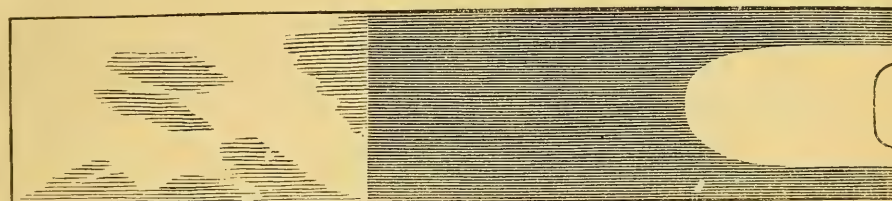


Fig. H.

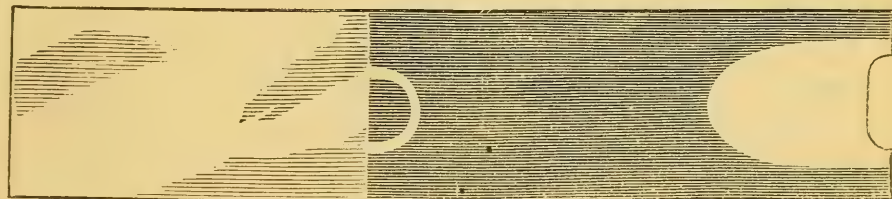


Fig. I.



Fig. K.

American manufacture are very common for boiling food, whether they cook by a stove, fireplace, or on the ground.

Pans.—Tin pans of American manufacture are very common for various cooking purposes.

Spits and other contrivances for roasting.—A very common spit for roasting fish is made by splitting a stick about three feet long and an inch in diameter two-thirds of its length, and then tying it with grass to prevent its splitting farther; all the ends are sharpened, the meat being stuck on the parts that are split, and the other end placed in the ground before the fire.

Bowls for mixing food.—They use American ones of earthenware quite generally.

Churns and dairy-vessels.—They have none, as they use but very little milk, and make no butter.

Coffee-mills.—American coffee-mills are used for grinding coffee.

C.—VESSELS AND UTENSILS FOR SERVING AND EATING FOOD.

Bread-trays, mush-bowls, meat-trays.—There is nothing made specially for these things.

Plates and dishes, pitchers.—Those of American manufacture, chiefly earthen, but some of tin, are almost universally used.

Drinking vessels.—Earthen tea-cups, bowls, tin cups, and dippers, are commonly used, and glasses are sometimes in use.

Knives and forks.—Common ones of American make are quite generally in use.

Spoons, ladles, and dippers.—Common American tea and table spoons and tin dippers are used quite often. They also make a spoon both of horn and hard wood, the handle of which is 4 inches long, the bowl of the spoon 6 inches long, 4 wide, and $1\frac{1}{4}$ deep, which is quite common, though sometimes they are much smaller and sometimes larger.

Pipes, pipe-stems, pouches.—Common American pipes and stems are generally used; sometimes they make stems of wood; generally they carry their tobacco in their pockets or in a common bag; a few of the older ones have pouches adorned with fancy work and beads and similar to a shot-pouch.

D.—ORNAMENTAL AND MISCELLANEOUS VESSELS, ETC.

Lamps and the like.—Quite often they use American coal-oil lamps. Candles were used a few years ago, and are to some extent now; but as lamps have become cheap they prefer them. Some also use American lanterns, and torches of pitch-wood are very common. However, they use neither candles nor lamps as much as Americans, as they cannot read or write during the evening.

Pails, basins.—For wash-basins they commonly use American tin wash basins, or tin pans, or sometimes earthen bowls; they use both tin and wooden water-pails.

§ 4.—CLOTHING.

A.—RAW MATERIAL.

Skins, sinews.—Formerly, clothes were made of dressed deer-skins sewed with sinews. I, however, have seen only one pair of pants here made of this material, and they were bought of the Chehalis Indians. A few moccasins are made of deer-skins. They dress a few deer and elk skins and catch a few beaver and seals, but sell most of the skins to the whites.

Wool and hair.—Formerly, a blanket was made of dogs' hair and feathers, but not now. They have no sheep, but buy a little wool, which they card, spin into yarn, and knit into socks and stockings.

B.—FABRICS IN DIFFERENT STAGES OF MANUFACTURE.

Dressed skins and furs.—Nothing except what is spoken of in the preceding section.

Woolen, cotton, and linen stuffs.—They buy a large amount of these kinds of American goods, which they make into dresses, women's underwear, shirts, children's clothes, and the like, and articles of household use.

C.—SUITS OF CLOTHING.

Of dignitaries.—There are none; neither the chiefs nor the medicine-men dressing differently from others.

Of male adults.—They generally dress with plain American clothing of all kinds during the week, though they do not keep it very clean. For Sunday, Fourth of July, and public days, most of the men have good pants, broadcloth or linen coats, according to the season, white bosom-shirts, collars, neckties, shoes and boots, socks, vests, hats, and caps.

Of females.—They dress very much as American women, with plain clothes. For more particulars, see the following paragraphs.

Of children.—At home, those just able to run around sometimes have little more than a long shirt, but generally they have more, especially as they grow older; very seldom, however, wearing shoes during the week-days. They have good clothes, like American children, for Sundays. Nearly all of school-going age are in the boarding-house, where they are provided with plain, strong American clothes as American children, Government furnishing the cloth, and the matron or her assistant making the clothes.

For special occasions.—Nothing except that both men, women, and children have better clothes for Sunday and prominent days than their common every-day wear.

Of special castes or crafts.—None.

D.—HEAD-CLOTHING.

Head-cloths, hoods, &c.—The women often tie handkerchiefs around

their heads, or wear their shawls over their heads; very often also they go bareheaded. Very few have hoods, hats, or bonnets. About a dozen have American ladies' hats, though but few wear them much. The school-girls all wear hats.

Caps, hats.—The men wear always American hats or caps, some wearing one and some the other; but hats are more generally worn. There are a very few hats which are made by the Makah Indians which are worn by the old Indians. They are strong and water-proof.

Head-dress of ceremony.—They wear none now.

E.—BODY-CLOTHING.

Clouts, cinctures, smocks.—They wear none now. Formerly they had a clout around the waist made of cedar bark, it being a band with a fringe extending nearly down to the knees. After the English came, they made them of blankets.

Aprons.—The women sometimes wear plain ones.

Breeches.—American ones are always worn by the men and older boys, except occasionally a very old man does not.

Shirts.—The men commonly undershirts and woolen overshirts; but on Sunday many appear with white ones.

Jackets, blouses, parkas, and tunics.—A few jackets and blouses are worn; almost all have coats of some kind; and, for rainy and cold weather, a few have cloaks, all of American make. Vests too are common.

Women's underwear.—They buy American material, and make their own clothes. First a chemise, and second a petticoat, and sometimes two or three.

Gowns.—A few of the very old ones are seen without dresses, stopping with the skirt; but almost all wear gowns made by themselves of American calico and woolen dress goods, according to the season.

Mantles, capes, and the like.—A very few have cloaks.

Shawls.—American woolen and "Dolly Varden" shawls are very common. Often they have several.

Blankets.—Occasionally blankets are worn in the winter, but not often, except by very old persons.

Robes of state and ceremony.—None are worn now.

F.—ARM-CLOTHING.

Gloves and mittens.—Occasionally, when well dressed, a few men and women wear cotton gloves, and in cold weather a few wear woolen mittens. All of American make.

G.—LEG AND FOOT CLOTHING.

Moccasins.—A very few are worn, but the climate is too wet to admit of their being used much.

Shoes, boots.—Both are very common, of American make. Thick heavy ones are generally worn; but sometimes they have lighter ones for Sunday. The men, except the old ones, wear them constantly; the women but little in the summer, except on Sundays, and the children are barefoot a great portion of the time. Even the Indian school-children are barefoot in the summer, but not in the winter.

Stockings.—Socks and stockings are very common, both of native and American manufacture.

Leggings.—Very seldom worn.

H.—PARTS OF DRESS.

Collars.—They are not usually worn, but sometimes the men wear American paper ones, and the women American paper and linen ones.

Pockets and reticules.—They have no reticules. Pockets are common in coats, vests, pants, overshirts, and gowns.

Needle-work and quill-work.—I have seen no quill-work. They do plain sewing very well, and a large amount of it, making their dresses and underclothes, and sometimes men's white shirts.

Bead-work.—There is not very much bead-work among them. Their gowns and shot-pouches are sometimes trimmed with them.

Fastenings.—A large brass pin, of native manufacture, about five inches long, is used for fastening the shawl together; and when this is lacking, one made of hard wood and in similar shape is used. American buttons, pins, a few buckles, hooks and eyes, are used.

Belts.—The men and women both wear belts, as American men and women do.

Others not mentioned.—Of late years, suspenders are slowly taking the place of belts among the men.

I.—RECEPTACLES FOR DRESS.

Nets, knapsacks, and skin-bags.—Very few, if any.

Trunks, chests, &c.—Trunks are very common for this purpose. See sec. 3, A, "Boxes." In their better houses, some of their clothes are often hung up on the walls. There are also a few American valises among them.

§ 5.—PERSONAL ADORNMENT.

A.—SKIN ORNAMENTATION.

Painting, patterns, and apparatus.—During their games, festivals, and at special times, a few of the men paint their faces, but it is more common among the women, not only on such days, but on other days. They use American red paint chiefly, but sometimes the juice of berries; formerly they obtained a red paint in the mountains. The women paint to prevent their being tanned by the sun; and also, if they have done anything which will make them blush when in company, they

paint to prevent their blushes being seen. They paint their faces very differently—sometimes in streaks on the cheeks, sometimes the whole cheek, or other parts of the face. There is no order about it. They use their fingers for brushes. Formerly there was much more of it than now, it being almost universal in time of war.

The native red paint was obtained from a tree in the mountains, and apparently has the grain of the bark; but from their description of it I think it is a parasite of the tree, and is prepared in some way, which certainly, from the specimen I have seen, does not destroy the grain of the plant, which is very coarse.

Tattoos and apparatus.—A little of this is done, but much less than formerly, and chiefly now among the children. In doing it, they use a needle and thread, blackening the thread with charcoal, and drawing it under the skin as deeply as they can bear it.

Scarring lancets and flint.—There are none now. Probably there were formerly, but I cannot learn definitely about them.

B.—HEAD ORNAMENTS.

Plumes and the like.—It is very seldom now that they wear native plumes in their hats. Formerly they were quite common, eagle's and hawks' feathers being preferred. Occasionally now in play the boys put a feather in their hats. Two or three of the men have their caps trimmed with a band of fur or red velvet. The few women who have hats have an ostrich feather in them, bought with them.

Hair-pins.—Some of the women braid the hair and put it up with pins; a few put it up in nets, but generally it is left to hang down unbraided.

Tucking-combs.—Very few are used.

Ear-rings and pendants.—They wear both native ear-rings and American cheap jewelry. One kind of native ear-ring is about an inch square, green, and made of a large oyster-shell. Another is their ancient money, obtained, as they say, far off in the ocean, probably north. They are white, about an inch and three-fourths in length, three-sixteenths in diameter at the larger end, and tapering toward the smaller end and slightly curved. Small bits of black or red cloth are thrust into the large end of them. About ten of them are worn in each ear. They also buy of other Indians, one made of silver, about two inches long, one-half an inch in diameter at the lower end, and tapering toward the upper end. I have also seen money used as a child's ear-ring. Except in the cases of a few old ones, the men wear none. The old women more commonly wear the shells, and the younger ones American cheap jewelry.

Head-bands were also made of the second kind of shell, used for ear-rings (see ear-rings of present section); also used for money, and called dentalia. Enough of these were strung to go around the head, but often ten or fifteen were placed side by side, making a wide head-band

Cheek-studs, mouth-pegs, labrets, nose-ornaments, teeth mutilations, and ornaments.—None are used now. Formerly they bored holes in the nose, into which they inserted quills or shells, the second described among the ear-rings in this paragraph.

C.—NECK-ORNAMENTS.

Necklaces.—Those of beads are often worn, the blue color being preferred, the second kind of shells spoken of under the previous paragraph. Ear-rings were formerly sometimes used for this purpose. American cheap jewelry is also sometimes worn now. All of these are worn chiefly by the women.

D.—BREAST AND BODY ORNAMENTS.

Gorgetts and ornamental chains; nipple-studs.—There are none in existence now, nor have they been used as far as I can learn.

Ornamental girdles, sashes, &c.—There are none now, but they formerly were used.

E.—ORNAMENTS OF THE LIMBS.

Armlets.—There are none now, and I do not know that they have been used.

Bracelets.—American ones are often worn by the women, of copper, brass, silver, and gutta-percha.

Finger-rings.—Those of American manufacture are often worn, chiefly by the women, made both of silver and gold.

Anklets.—There are none worn now, but those of copper and brass were formerly used.

F.—TOILET-ARTICLES.

Cosmetics.—None except paint.

Pomades for the hair.—Hair-oil is very often used, and formerly they used bear and other oils, but nothing for coloring the hair.

Soaps and substitutes therefor.—American soaps are very common. They also use a kind of sugar-colored clay, and the leaves of some trees.

Combs.—American ones are in common use. Formerly they made them of wood. I have one with teeth about two and a half inches long, and five of them to the inch, but they vary in size.

Brushes.—American hair and clothes brushes are often used.

Tweezers for removing hair and beard.—They make them of steel and tin, and sometimes pull out the beard between the finger and a knife.

Mirrors.—Small American ones are very common.

Perfumes.—All kinds of American perfumes which they can obtain they use. They also use sweet-scented roots.

G.—OTHER PERSONAL ORNAMENTS.

Fans.—Boughs of trees are used for fans, also birds' wings and tails, especially those of eagles and hawks.

Parasols, shades.—None are used to protect them from the sun. A few have American umbrellas for rainy weather.

Artificial flowers.—The few women who have American hats have artificial flowers in them. They use no others.

Beads.—They are common for necklaces; a few also use them for trimming dresses. A few children have their dresses trimmed with dimes, on the shoulders.

§ 6.—IMPLEMENTS.

I.—Of general use.

Knives.—American eating, butcher, and pocket knives are in common use. They also make one of steel, with a wooden handle. It is about six or eight inches long, and curves at the end, as shown at Fig. L, Plate 23.

Chopper-knives.—They use none. Formerly they made one similar in shape to a chopping-knife, of tin, for opening salmon.

Axes and hatchets.—All use American ones, as they do a large amount of logging.

Adzes and wood-scrapers.—They make a small hand-adze of a large file, sharpening it at one end and fastening the other to one branch of a forked stick with rawhide, while the other branch is used as the handle. Each branch is about six or eight inches long.

Wedges and mauls.—Both are in use. The mauls are made by themselves, as Americans make them, or with the help of the Government carpenter. Old ax-heads are also often used for wedges. They were formerly made of elk-horns, pieces a foot in length being cut off from the base where they are two and a half or three inches in diameter. Wooden ones are also used.

Chisels, gouges, and the like.—They have American chisels.

Sawing-tools.—American hand and cross-cut saws are in common use, the latter chiefly in logging.

Hammers.—They use American ones chiefly. A few have the old stone ones, made in the shape of a pestle.

Drills and perforators, embracing awls, reamers, hand and bow drills.—American awls and augers are in common use.

Clamps and nippers.—They have American nippers.

Rasps and other smoothing-tools.—They have American drawing-knives for smoothing boards, and some of them are able to use a plane, but they own none.

Whetstones and other sharpening tools.—They have American whetstones, and some own grindstones. They use American files, large and small, for filing saws.

Levers, &c.—They use wooden levers and cant-hooks for rolling logs. They also have some American blocks and tackle.

Tool-boards and boxes.—They have no tool-boards. Any common box answers for holding the smaller tools, and the large ones are kept anywhere about the house.

II.—*Implements of war and the chase.*

A.—STRIKING.

Clubs of various forms and material.—Formerly they made such of wood and stones large enough to be handled easily.

B.—THROWING-WEAPONS.

Slings and shots or stones.—Slings and stones are used as playthings by the boys, and formerly by the young men in killing ducks.

Fire-pots.—Those filled with pitch-wood were formerly used to set on fire houses into which an enemy had fled. A part of the besieging force would attack one side of the house in order to draw the attention of the besieged away from the opposite side, when the party with these fire-pots would approach, set on fire the pitch-wood, throw it on the roof, and as the besieged attempted to escape they were killed with spears, clubs, knives, or were shot.

C.—WEAPONS FOR CUTTING AND STRIKING.

Battle-axes, tomahawks, and the like.—None are in use now. Formerly they had them made of stone, and, after they were able to obtain them, hatchets were used, though not to throw.

D.—THRUSTING-WEAPONS.

Lances and lance-heads.—These, about eight feet long, were formerly used in both war and the chase. The points were stone, iron, bone, yew, or ironwood.

Harpoons and points.—These were formerly used in fishing. See beyond, under "Fishing-implements."

Daggers.—They formerly made them of files or other suitable iron which they could obtain, and they are used some now.

Spears and points.—A duck-spear, which is fifteen or twenty feet long, with four or five prongs at the end, so far apart that a duck may be caught between them. At the end of each prong is a piece of steel about six inches long, made from an old file, with a few very coarse teeth, which are on the outside so that they will not injure the body of the bird, and yet will catch among the feathers. They use these spears by night, going in their canoes, making a kind of dark lantern, so that the duck will not see the men. (See Fig. M, Plate 23.)

E.—PROJECTILE WEAPONS.

Bows and arrows, arrow-heads, and quivers.—At present, they are used only as playthings for children, and are very poor; but formerly they were very common. The bows were about three feet long, and were made of yew-wood; the strings of sinew, or the intestines of raccoons. The arrows were about two and one-half feet long, were made of cedar, with feathered shafts, and points of stone, and of nails after they obtained them; and the quiver of wolf-skin. Arrow-heads are sometimes made of brass or iron, two or three inches long, half an inch wide, and very thin, and of very hard wood, five inches long, and round. Sometimes, for birds, they are made of ironwood, about five inches long, with two prongs, one of them being half an inch shorter than the other.

Fire-arms and outfit.—Rifles and muskets are very common, the men often owning several. Their shot-pouch is made either of cloth or leather, and their powder carried either in the flask or horn. A very common sheath for the gun is made of a piece of a blanket, sewed so that the gun will fit into it.

Poison for missiles.—None, as far as I can learn, has been used. Formerly, they sometimes burned their spear-points a little, both before and after wounding an enemy, superstitiously thinking it would hurt worse, or poison that into which it had been or would be thrust.

F.—DEFENSIVE WEAPONS.

Parrying-sticks, shields, helmets, visors, mail, greaves, fetters, snares, pit-falls, stockades, earthworks, and other fortifications.—None are in use now, nor do I learn that they ever were, in war. In hunting, they formerly sometimes used pitfalls, and also made stockades of sticks in the form of a V, at the small end of which was a net made of string. The deer being driven into the V would attempt to escape, but not seeing the net, would catch his horns in it, and then was killed. The string for the net was made of nettlestalk fiber twisted.

G.—BESIEGING AND ASSAULTING CONTRIVANCES.

The only one of which I learn has been described in B of the present section, "Fire-pots."

H.—ARMORIES.

They had none.

I.—TROPHIES AND STANDARDS.

Scalps and the like; tomahawks of ceremony and other standards-trophies erected to commemorate victories.—As far as I can learn, none of these have ever been in use.

Skulls.—The heads of the enemy were formerly brought home as emblems of triumph.

K.—OTHER WEAPONS.

Deadfalls were formerly used in hunting, some of them very large, with weights so heavy that they would kill large animals. As they have had no war either with the whites or other Indians for eighteen or twenty years, it is almost impossible to describe minutely their weapons or mode of war. They are now a very peaceful tribe. If by any chance a war should occur, it is probable that an observer would learn many things of which we now have no report.

III.—*Implements of special use.*

A.—FLINT AND STONE WORK, EMBRACING ALSO WORKING IN IVORY AND OTHER HARD MATERIALS.

Quarrying, flaking by fire and otherwise, chipping, pecking, grinding, sharpening, polishing, perforating, carving.—They do no such work now, and hence have no such implements. I have been told that they never did much such work, but bought their stone implements of other Indians; but I am inclined to think they did make some stone hammers, pipes, and arrow-heads, but if they did it was so long ago that it is impossible to describe the process or the implements.

B.—IMPLEMENTES FOR FIRE-MAKING AND UTILIZING.

Hand-drills and fire-sticks, bow-drills, flint and steel or other pyrites, moss, punk, and tinder-tongs, bellows, other fire-tools, and special fuels.—I do not learn that they ever used tongs or bellows. Formerly a fire was made with two sticks, holding one perpendicular to the other, letting one end of it press on the side of the other, and rubbing it briskly between the hands. Fire was then very valuable, and was often carried very carefully long distances from one camp to another by inclosing it closely between two sticks, so that very little air should strike it. This process was used twenty or twenty-five years ago. Afterward, when they obtained flint-lock muskets, they struck fire with them. Of late years, they use matches almost entirely. Fir pitch-wood is also very common in helping to start the fire, and also for a light out-doors, especially when fishing in the night. They frequently bring small bundles of it to the whites for sale.

C.—IMPLEMENTES FOR BOW AND ARROW MAKING.

Bow-dressing, bowstring-making, arrow straightening and polishing; cement and sticks.—As at present, bows and arrows are only used as playthings by the children; the making of them is of no special importance. They are made with a knife, and any common strong string is used. A straight cedar stick is split for arrows, a few common feathers tied on, the point split, and a nail tied into it. For further particulars see sec. 6, II, E.

D.—FISHING-IMPLEMENTS OTHER THAN WEAPONS.

Hooks and lines.—They buy American lines, also some American hooks. They make a large number from steel and bone, which they prefer, as they say they are stronger than American ones. By heating and filing the steel, they bring it into the proper shape. One kind of salmon-hook is made of a straight piece of steel, about six inches long, and sharp. On each side of it pieces of bone are tied. A line is attached to it, and also a pole fifteen or twenty feet long, in such a way that by means of the pole it may be driven into the fish, the pole drawn out, and the hook remain, held by the string, when it is drawn in.

Gigs, harpoons.—Harpoons are sometimes used for seal-fishing. The point is of iron, and the spear and line used as with the salmon-hook just described.

Spears.—For one kind, see sec. A, of the present chapter. A herring-spear or rake is made about fifteen feet long, and on the lower end for three feet sharp iron points, often made of nails, are driven in about an inch apart.

Nets.—They generally buy American twine and make them. For one kind, see the following description of weirs. There is one net on the reservation about four or five hundred feet long and forty feet wide, made of twine, buoyed with blocks made of cedar, and used for catching salmon in salt-water.

Probes, ice-breakers, stools, skewers, &c., for seal-fishing.—They have none. In catching them, they shoot them or spear them at night. For spear, see harpoons.

Weirs and traps of every kind.—Weirs are made across the river. They are of small sticks, about an inch in diameter and six feet long, fastened closely together, so that a fish cannot run up between them. A number of nets are made of twine, about eight feet across, and in the shape of a shallow bowl, the rim being of wood bent around. These are let into the water at night below the weir, and closely watched. A few strings, one end of which is tied to them and the other end above, indicate when a salmon is in it, when it is hauled up, and the fish killed.

E.—HUNTING-IMPLEMENTS OTHER THAN WEAPONS.

Traps and snares.—American steel-traps are often used in catching mink and beaver.

F.—LEATHER-WORKING TOOLS.

Butchering and flaying.—For this an American knife, commonly a butcher-knife or large pocket-knife, is used.

Scrapers, tanning.—The deer or elk hide is soaked for two days, and the hair removed by scraping it with a rough iron. It is then soaked a half a day with the deer-brains, in hot water, over a fire; the deer-

brains being rubbed over, something like soap. It is then stretched, and rubbed with rocks until it becomes soft and pliable, when they dig a hole in the ground, build a fire of rotten wood or cedar bark, stretch the skin over it, and cover it with blankets, thus smoking it, after which it is fit for use.

Leather-working, crimping, sewing, shoemaking, fringing, braiding, making babiche, &c.—There is very little of this now, as has already been stated. They sell most of their tanned deer and elk skins to Americans. In sewing into moccasins, they use a needle and awl, thread and sinew. I have not seen any of the other kinds of work mentioned.

G.—BUILDERS' TOOLS.

Tent-making.—They have no real tents, only mat houses, in the making of which they use an ax, hatchet, hammer, and a few nails.

Felling trees.—American axes are always used.

Making planks.—They are bought at the American saw-mills. Formerly they were split from cedar-trees with wedges.

Smoothing wood.—The knife, ax, hand-adze, and drawing-knife, and a few use Government planes, though they own none.

Hollowing and carving wood.—The knife, ax, hatchet, and hand-adze are commonly used.

Painting.—Generally this is done with the fingers or a cloth; seldom, if ever, using a brush.

Boat-building.—They make no boats except canoes, in the making of which an ax and the hands are the principal implements used.

I.—POTTERS' TOOLS.

As has been already stated (sec. 3, A), they do no work of this kind, and hence have no tools.

J.—TOOLS FOR MINING AND METALLURGY.

Sledges for breaking ore, hammers and anvil-stones for cold metal, smelting and molding apparatus, smithing-tools, implements for gold and silver working.—They do no stone, gold, and silver working, and hence have no tools. In working iron for making spear-points and fish-hooks, they use an ax and hammer and file and fire.

K.—TOOLS FOR PROCURING AND MANUFACTURING FOOD.

Root-diggers.—Sharp-pointed sticks and iron tools are used.

Gathering-baskets and fans.—Their common baskets, of all kinds and sizes, are used; the water-tight ones more especially for berries and the larger ones for roots. (See sec. 3, A.)

Pounding-baskets and pestles.—Their water-tight baskets are used in which to pound the food, and any rough rock or the hand for pounding.

L.—AGRICULTURAL IMPLEMENTS.

Spades, shovels, hoes, rakes.—All of these of American manufacture are in constant use, a large share of which they have received among their Government annuities.

Plows.—Generally they dig their gardens with the hoe or spade. When they wish to plow, which is seldom, they borrow a Government plow, as they own none.

Harvesting-tools, granaries.—As they raise no grain, they have none. For cutting hay, they use American scythes; forked sticks in the shape of forks, and American forks for putting it up, and haul it in with oxen on a sled.

M.—BASKET-WORKING TOOLS.

Tools, ornamentation patterns.—They use but few tools in doing this; a knife in cutting and splitting the material, and an awl in sewing the water-tight baskets. The rest of the work is done with the fingers. For ornamentation, see sec. A of the present chapter. There is no particular figure in this ornamentation, nor does it mean anything, but is done simply for beauty.

N.—TOOLS FOR MAKING AND WORKING FIBER.

Carding and hackling.—They have none for hackling now. Formerly when they made string out of nettle-stalks, they scraped them with a shell or knife. Some of them use American cards for carding wool very well.

Spinning, twisting.—Some of them roll the wool on their laps with their hands, and make a coarse yarn. A more common way is to use a native hand-wheel, eight or ten inches in diameter, through the center of which a spindle twelve or fifteen inches long is inserted at right angles. This is rolled by one hand on the lap and the wool held by the other. This year a few American spinning-wheels have been introduced among their annuities, and are well liked.

Knitting.—This they do with American knitting-needles.

Weaving, matting.—These have been described under section A of the present chapter.

Ornamenting.—The needle is chiefly used in ornamenting common work.

Sewing embroidery with beads.—American needles are used.

For braiding.—The hands are used.

For dyeing.—Dark mud is used in dyeing black; the grass which they use in ornamenting their baskets and the root of the wild Oregon grape in coloring orange.

O.—IMPLEMENTS OF NOMADIC AND PASTORAL LIFE.

Tools for marking cattle.—They have but few cattle, which they readily know, and do not mark them.

Whips.—Generally any common stick is used. A few have whips, with wooden handles, about a foot and a half long, and a lash of rawhide inserted into the end.

Tethers, halters, lassos, lariats.—For these they use chiefly American hemp ropes. Formerly they used those made of rawhide.

P.—IMPLEMENTS OF SPECIAL CRAFTS NOT ENUMERATED.

Logging is a very prominent business among them, as they sell the logs to the different saw-mills on the sound. After the road is built, they cut the timber. As they wish to cut the trees much higher than they can when they stand on the ground, they cut notches in the tree, and insert therein a plank, about 4 or 5 feet long, and 6 or 8 inches wide, with the end ironed, on which they stand and cut with an ax. When the tree has fallen, they measure it with a pole, saw it with a cross-cut saw, and take off a part of the bark, so that it will slide easily. This is done with an ax, or a heavy iron made for the purpose, about 3 feet long, widened and sharpened at the end. They then haul the logs to the water with three yoke of oxen. For a whip they use a small stick about 5 or 6 feet long, with a small brad in the end, with which they punch the cattle. They use American yokes and chains. When the saws are dull, they file and set them with American files and saw-sets. When the boom is full, a steamer from the mill comes for it and tows it to the mill. The money being received, they first pay the necessary expenses of running the camp, including the provisions, and divide the rest among themselves according to the amount of work done by each. They mess together, some of their wives generally cooking for the camp.

§ 7.—MEANS OF LOCOMOTION AND TRANSPORTATION.

A.—TRAVELING BY WATER.

Dug outs, canoes.—They do a large amount of traveling by water, chiefly in canoes. These are dug out of a single cedar-tree and vary in size. The largest are about 30 feet long and $5\frac{1}{2}$ wide and 2 deep, and the smallest about 10 feet long, $2\frac{1}{4}$ wide, and 8 inches deep. They make but few here larger than those 22 feet long, 4 wide, and $1\frac{1}{2}$ deep. The larger ones are bought of the Clallam Indians, who in turn buy them of the Indians of British Columbia.

Boats built from logs or of planks.—There is one small sloop owned by one of the Indians, which was bought from an American.

Sailing-crafts.—The larger canoes and sloop carry sails.

Bridges, ferries, &c.—Bridges are made with log stringers, and covered with logs, or split cedar. In crossing a large river where there is no bridge, they swim their horses, and take their things over in canoes.

B.—APPURTENANCES TO THE FOREGOING.

Poles for propelling, pushing-sticks.—None.

Paddles.—There are two kinds, each about four or five feet long, the blade two and a half to three feet long, and five or six inches wide, and a second handle three or four inches long at the end of the main handle, and at right angles to it. The blade of one kind is straight; that of the other kind curves (see Plate 23, Figs. N and O). The first is most generally used, but the latter is used in the river for pushing off from logs, the point being made for that purpose, and there being many in the river. They are generally made of maple or yew.

Oars.—A very few are used, generally six or seven feet long, and made of cedar.

Sails.—All the larger canoes are made to carry sail, and the largest two or three, which are of cloth. Formerly they were of cedar-bark mats, made by the Makah Indians.

Rudders.—Very few are used, as they generally steer with a paddle.

Anchors.—Generally a large stone, or piece of iron of any shape, answers for these.

Cables and tackle, cleats for various uses, dead-eyes.—None, except in the American-made ones in the sloop.

Outriggers.—Booms and sprits are used for spreading sail.

C.—TRAVELING ON FOOT.

Carrying-straps, baskets.—The common water-tight and mat baskets are used for this purpose. For a description of them and straps see sec. 3, A, of the present chapter. In addition to these, others of the same shape are made, but the material is bark, and they are also used in carrying loads of wood and bark. They are used almost entirely by the women and very old men.

Staff for mountain-travel, srip or haversack, canteens, carrying-nets and yokes, sedan for carrying travelers, skates, ice-creepers, and the like, and snow-shoes.—I do not know that any of these things are used. There is but little snow and ice here during the winter, therefore they have no special means of traveling in that way.

D.—LAND CONVEYANCES AND OTHER MEANS OF TRANSPORTATION.

Saddles and their parts.—American saddles and their rigging are used. No womens' saddles are used, the women riding like the men on men's saddles.

Bridles and halters of all kinds.—American bridles are used, but often a rope is put in the animal's mouth for a bridle. American leather halters and hemp ropes are used for tying.

Packs, panniers.—Sometimes they pack on American pack-saddles, and sometimes on riding-saddles, often carrying large loads on the horses which they ride.

Harness for horses.—This year a number of American harnesses have been furnished them among their annuities. Previously to that, a few ropes and bands roughly put together generally answered the little use they had for them. American ox-yokes are used always with the oxen.

Trappings, tassels, saddle-cloths, fringes.—Hardly anything of this kind is used.

Sledges, embracing sliding vehicles of all kinds.—Sleds are in common use for hauling hay, lumber, &c. Some are very roughly made and slender; others are quite strong. As the reservation is not three miles square, with water on two sides of it, and the greater portion of their houses not far from the water, they do most of their transportation in canoes.

Road-making and tools.—Roads for common traveling are simple, a trail sufficiently wide for walking and traveling on horseback being cut through the timber with an ax. A few roads are wide enough for a sled, drawn generally by oxen. Their logging roads are more expensive. Of necessity in hauling long logs there cannot be short turns in them, they must be tolerably level, and also must go through heavy timber. Large trees must be cut down, large logs cut out of the way, roots dug out, holes filled up, and small banks dug down. This is done with axes, saws, spades, and shovels. Then skids, about a foot in diameter and eight feet long, are placed across the road, at intervals of about ten feet, on which the logs are hauled. Where it is very muddy, especially over the salt-water marsh, corduroy road and bridge are made. On one road there is more than a thousand feet of this work. The skids are kept constantly oiled with dog-fish oil, so that the logs may slide easily.

Postal apparatus for sending messages, means of signaling, public conveyances.—None. When they wish to send a message, some one goes in person, or occasionally they get some one who can write to write for them and send by mail.

§ 8.—MEASURING AND VALUING.

A.—COUNTING.

The extent and character of their numeral system :—

- | | |
|---|--|
| 1. Da'-kus. | 10. Ō'-pah-dich. |
| 2. Es-sa'-le. | 11. O'-pah-dich-klo-de dakus. |
| 3. Cho'-us. | 20. Tsub-klak'. |
| 4. Boo'-sus. | 30. Chah-dahk'-klak. |
| 5. Tsa-whess' (whisper first syllable). | 40. Shtib-oo'-sus. |
| 6. E ^a pah'-chy. | 50. Tsitss-a-whus' (whisper first syllable). |
| 7. Tu-khos'. | 60. Stee-a-pah'-chy. |
| 8. T-kah'-chy. | 70. Stich-tu-kōs. |
| 9. Hwi'-lea. | 80. St-tu-kah'-chy. |

90. St-tu-hwile.	600. Ee-a-pah-chist-tu-pahl-owsle.
100. St-tu-pahl-owlse'.	700. Tu-kōs-h-tu-pahl-owlse.
200. Esah-li-tu-pahl-owlse.	800. Tu-kah-chish-tu-pahl-owlse.
300. Cho-us-tu-pahl-owlse.	900. Hwilish-tu-pahl-owlse.
400. Boo-sus-tu-pahl-owlse.	1,000. O-pah-dich-tu-pahl-owlse.
500. Tsa-whess-tu-pahl-owlse (whisper first syllable).	

Having no written language, all their counting is verbal.

Methods of calculating.—None, except mentally.

System of notation, if any exists.—None, except sometimes by cutting notches on a stick, or the like.

B.—MEASURING.

Linear and other standards.—They use the American foot, yard, mile, &c.; formerly the two arms' lengths. For cubic measure, they use pint, quart, gallon, bushel; formerly a basket-full.

Divisions of the month and year.—Now they use the American hour, day, week, and month. Formerly they divided the year into moons, or lunar months, and months into days. Many of them have clocks, and a few have watches.

Names of days, months, year, heavenly bodies, and points of the compass.

<i>Moon,</i>	Slo-khwill'-um.	<i>June,</i>	Tāh-kā-chid.
<i>Star,</i>	Kla-kla-chīs'.	<i>July,</i>	Kwī-o-wāt-id.
<i>Sun,</i>	Klo-kwāt'.	<i>August,</i>	Klā-lāch'-rid.
<i>January,</i>	Hā-hāt.	<i>September,</i>	Kā-ka-bat.
<i>February,</i>	Stāh-kwāl'-deb.	<i>October,</i>	Kwā-lā-kwobe.
<i>March,</i>	Sī-ai-kwúdst.	<i>November,</i>	Kwā-kwa'-chid.
<i>April,</i>	Stā-ko'-lit.	<i>December,</i>	Yā-shūtl.
<i>May,</i>	Stā-klā'-chid.		

These are the names as well as I can find out. They are nearly out of use, and the young men who understand English do not know them. The older ones can only begin at the present month, November, and count backward and forward, and hence they may be a little inaccurate as to the order. The beginning and end do not exactly agree with ours, but are nearly as indicated.

There are no names for the points of the compass; but the following are the names for the winds:—

<i>North wind,</i>	Tō-lō'-tsād.
<i>South wind,</i>	Tō'-lā-chūl'-lā.
<i>East wind,</i>	(No word.)
<i>West wind,</i>	Tōz-bā'-dit.

Before the Americans came, they had no weeks, but simply num-

bered the days in each moon. Since that time they have used the following:—

<i>Sunday,</i>	Hā-ha-āt'-lis.
<i>Monday,</i>	Tslā-pāt'-lis.
<i>Tuesday,</i>	Tsib-bī-ās'-sab.
<i>Wednesday,</i>	Chā-dā-kwi-sub.
<i>Thursday,</i>	Būs-sā-tli'-sub.
<i>Friday,</i>	Su-kus-tli'-sub.
<i>Saturday,</i>	Sā-chub-its.

The first means literally holy day; the second, past, *i. e.*, one day past; the third, second day; the fourth name, third day; the fifth, fourth day; the sixth, fifth day; and the last, alongside, *i. e.*, of, Sunday.

Number of generations, moons, hunting-seasons, &c., to which memory runs back.—How far tradition runs back they do not know.

C.—VALUING.

Means of establishing value, valuing, obligations, liens, transfers, money, &c.—Formerly they had a kind of shell-money, the second described under ear-rings, sec. 5, B. At present, they use the American standard coin, both gold and silver, not having much to do with currency, as they cannot read, and cannot tell the difference in the value of currency. Their obligations, liens, transfers, &c., were, and are, all verbal, and are sometimes broken.

§ 9.—WRITING.

None of the older Indians write, and none of the others, except those who have been in our schools. I send, in connection with Part I, some specimens from the school. They are generally as good as that of the children of the white employés, who attend the same school and have written for the same length of time. During the last four years, the school has increased from an average attendance of five to thirty-five, which is all that the Government funds will support; for, in order to secure anything like regular attendance and cleanliness, it is necessary to keep most of them at the boarding-house, where Government supports, feeds, and clothes them; also paying the teacher \$1,000 in currency and the matron \$500 per annum. Thus far, the children have studied only reading, spelling, writing, geography, arithmetic, and grammar, all being taught in the English language, their own language never having been reduced to writing. In the winter, they attend school six hours a day, and in the summer three hours, working half of the day, under the teacher, getting wood, in the garden, and the like.

§ 10.—SPORTS AND PASTIMES.

A.—GAMBLING.

Number of games and mode of playing and effect.—There are three

methods: with round blocks or disks, with bones, and the women's game.

(1) *With round blocks.*—The men's game more generally, though sometimes all engage in it. There are ten blocks in a set. All but one have a white or black and white rim. Five of them are kept under one hand on a mat, and five under the other, covered with cedar bark, ground up fine. After being shuffled round and round for a short time, the opposite party guesses under which hand the one with the black rim is. If he guesses aright, he wins and plays next; but, if wrong, he loses, and the other continues to play. The players are ten or twelve feet apart. Generally they have six or more sets of these blocks, so that if, as they suppose, luck does not attend one set, they try another. They generally have from twelve to twenty-four sticks, a few inches long, lying on a board or frame, with which they keep tally. When one party wins, a stick of the opposite party is moved to his side, and when he loses, it is moved back again. If fortune attends each party evenly, or nearly so, it naturally takes a long time to finish a game, sometimes three or four days. Sometimes two persons merely are interested, one on each side; but on special occasions nearly the whole tribe engage in it, being attached to one side or the other. When one player is tired, or bad luck attends him, another takes his place. When many are engaged, they are accompanied by a kind of drum, and those belonging to the party playing halloo and sing in regular time to keep up the spirits of the player. Sometimes they play for fun, but in large games sometimes for \$300 or \$400; generally, however, for only a small amount, as a dollar or a dinner. There is a tradition in regard to the disks, that when the Son of God came, a long time ago, he told them to give up all bad habits and things, these among others; that he took the disks and threw them into the water, but that they came back; he then threw them into the fire, but they came out; he threw them away as far as he could, but they returned; and so he threw them away five times, and every time they came back; after which he told the people that they might use them for fun and sport.

(2) *Game with one or two small bones.*—The young men and older boys play this most. The players sit opposite each other, about six feet apart, from one to six or more on a side, each party in front of a long pole. Then one person takes one or both of the bones in his hands, and rapidly changes them from one hand to the other. One person on the opposite side guesses in which hand one is. If only one bone is used, he guesses which hand it is in, and if both are used he guesses in which hand a certain one is. If he guesses aright, he wins and plays next; but if not, he loses, and the other continues to play. While each one is playing, the rest of his party beat with a small stick upon the larger one in front of them, and keep up a regular sing-song noise in regular time. Small sums are generally bet in this game, from 50 cents to \$1.50. Different ones play according as they are more or less successful. Sometimes

they grow so expert, even if the guess is right, that the one playing can change the bone to the other hand without its being seen.

(3) *Women's game.*—The dice are made of beavers' teeth generally, but sometimes from muskrats' teeth. There are two pairs of them, and generally two persons play, one on each side; but sometimes there are two or three on each side. The teeth are all taken in one hand, and thrown after the manner of dice. One has a string around the middle. If this one is down and all the rest up, or up and the rest down, it counts four; if all are up or down, it counts two; if one pair is up and the other down, it counts one; and if one pair is up or down and the other divided, unless it be as above when it counts four, then it counts nothing; 30 is a game; but they generally play three games, and bet more or less, money, dresses, or other things. They sometimes learn very expertly to throw the one with the string on differently from the others, by arranging them in the hand so that they can hold this one, which they know by feeling, a trifle longer than the others.

The general effect of gambling is bad, because it teaches them to lie and cheat, and many other evils attend it besides the common ones of loss of money, and the excitement. It is very common among them, though less so than formerly. Regular dice, chess, and checkers are not used, and cards but very little.

B.—FIELD SPORTS AND PASTIMES.

Horse-racing and sometimes foot-racing are common. Bets are made on them, generally small, but occasionally amounting to \$300, and are said to have amounted occasionally in former times to \$1,000.

Dancing is another amusement, which was formerly very much practised, but now very little. There are no partners chosen, but men and women both dance; the men generally being together, and the women by themselves, holding on to each other's hands, in the same room. Their dancing is chiefly a jumping up and down, keeping time to the music, which consists of singing, hallooing, pounding on a drum, on sticks, or on the wall, &c., while rattles, either in their hands or hung around their waists, are being continually shaken. These rattles are simply deer-hoofs dried and hung on a string.

C.—SPORTS AND TOYS OF CHILDREN.

The extent to which they are taught to mimic the occupations of their seniors.—They are continually taught to do so from youth until grown.

Their toys and games as above.—Formerly the boys played at shooting with bows and arrows at a mark, and with spears throwing at a mark, with an equal number of children on each side, and sometimes the older ones joined in; but of late years there has been but little of this. They now mimic their seniors in the noise and singing of gambling, but with-

out the gambling; also play ball, jump, and run races. The girls play with dolls. The girls and boys both play in canoes, and stand on half of a small log six feet long and a foot wide and paddle around in the water with a small stick an inch in thickness, and in fact play at most things which they see their seniors do, both whites and Indians.

§ 11.—MUSIC.

The character and frequency of their music, both vocal and instrumental.—Vocal: Love songs, tamanamus or medicine-men songs, war and gambling songs, and baby songs. All but the war songs frequent, but with no regularity. Instrumental: A kind of rough drum to accompany tamanamus and gambling songs.

The classes who practice it.—All classes practice all kinds.

The existence of minstrels or special musicians.—None.

The occasions, with copies of the melodies and score, if possible.—War songs in war time; tamanamus songs at the medicine-men's work; gambling songs at gambling, and love songs very irregular, but often, especially when in company, traveling, or at work, and more especially by the women and younger persons; baby songs when taking care of their children. Their own native songs as yet I have been unable to obtain.

The following are songs in Chinook, which they have been taught during the past two years at church and Sabbath-school. The Chinook is the language which they use in their intercourse with the whites, except when an interpreter is used, although the Twana is their own language, and used in the intercourse between themselves.

TUNE.

1. Abukuttie nika tikegh whiskey, (Repeat twice.)
Pe alta nika mash.
Alta nika mash (Repeat twice.)
Abukuttie nika tikegh whiskey, (Repeat twice.)
Pe alta nika mash.

2. Whiskey has cultus,
Pe alta nika mash.
3. Whiskey mimoluse tillicums,
Pe alta nika mash.
4. Cultus klaska muckamuck,
Pe alta nika mash.

} These all repeat as the first verse.

(Translation.)

1. Formerly I liked whiskey,
But now I throw it away.
2. Whiskey is very bad,
And now I throw it away.
3. Whiskey kills the people,
And now I throw it away.
4. They drink that which is bad,
And now I throw it away.

SONG 2.—Tune: *Come to Jesus.*

(Translation.)

- | | | |
|--|---------------------------|--|
| 1. Chaco yakwa, (Repeat twice.)
Okoke sun (Repeat once.)
Chaco yakwa, (Repeat once.)
Okoke sun. | | Come here (<i>i. e.</i> , to church).
To-day (<i>i. e.</i> , Sunday). |
| 2. Halo mamook
Okoke sun. | } (Repeat as in verse 1.) | Do not work
To-day. |
| 3. Halo cooley
Okoke sun. | | Do not play
To-day. |
| 4. Iskum wawa
Okoke sun. | | Get the talk
To-day, <i>i. e.</i> Sunday. |
| 5. Saghalie tyee
Yaka sun. | | God,
It is his day. |

SONG 3.—Tune: *John Brown.*

(Translation.)

- | | | |
|---|-------------------------|---|
| 1. Jesus chaco copa Saghalie. (Repeat
Jesus hias kloshe. [twice.]
Jesus wawa copa tillicums. (Repeat
Jesus hias kloshe. [twice.] | | 1. Jesus came from Heaven.
Jesus is very good.
Jesus preached to the people.
Jesus is very good. |
| 2. Jesus wawa wake kliminhoot. }
Jesus hias kloshe. }
Jesus wawa wake kapswalla. }
Jesus hias kloshe. } | } Repeat as in verse 1. | 2. Jesus said, Do not lie.
Jesus is very good.
Jesus said, Do not steal.
Jesus is very good. |
| 3. Copa nika Jesus mimaloose.
Jesus hias kloshe.
Jesus klatawa copa Saghalie.
Jesus hias kloshe. | | 3. For me Jesus died.
Jesus is very good.
Jesus has gone to Heaven.
Jesus is very good. |
| 4. Alta Jesus mitlite copa Saghalie.
Jesus hias kloche.
Yahwa Jesus tikegh nika klatawa.
Jesus hias kloche. | | 4. Now Jesus lives in Heaven,
Jesus is very good.
There Jesus wishes me to go.
Jesus is very good. |

SONG 4.—Tune: *Greenville.*

(Translation.)

- | | | |
|--|--|---|
| 1. Copa Saghalie conoway tillicums,
Halo olo, halo sick,
Wake kliminhoot, halo solleks,
Halo pahltum, halo cly.
Chorus:
Jesus mitlite copa Saghalie
Kunamoxt conoway tillicums kloshe. | | 1. In Heaven all the people
Are not hungry, are not sick,
Do not lie, are not angry,
Are not drunk, do not cry.
Chorus:
Jesus lives in Heaven
With all good people. |
| 2. Yahwa tillicums wake klahowya,
Wake sick tumtum, halo till,
Halo mimoluse, wake mesachie,
Wake polaklie, halo cole.
Chorus:
Jesus mitlite, &c. | | 2. There the people are not poor,
Have no sorrow, are not tired,
Do not die, are not wicked,
There is no darkness and no cold.
Chorus:
Jesus lives, &c. |
| 3. Yahwa tillicums mitlite kwanesum.
Hiyu houses, hiyu sing.
Papa, mama, pee kloshe tenas;
Oacut yakachikamin pil.
Chorus:
Jesus mitlite, &c. | | 3. There the people live always.
Many houses, much singing. [dren;
There are father, mother, and good chil-
The road is of gold.
Chorus:
Jesus lives, &c. |
| 4. Jesus potlatch copa Siwash,
Spouse mesika hias kloshe,
Conoway iktas mika tikegh,
Copa Saghalie kwanesum.
Chorus:
Jesus mitlite, &c. | | 4. Jesus will give to the Indians,
If you are very good,
Everything you wish,
In Heaven forever.
Chorus:
Jesus lives, &c. |

Instruments for beating.—A rough drum is made about a foot and a half square and four or five inches deep. This is covered with rawhide on one side, and used in their gambling and tamanamus songs. One of the school-boys has a small American snare-drum, which he beats tolerably well. No clappers, bells, sounding bars, tambourines are used.

Blowing instruments.—One of the school-boys owns and plays on a flageolet. There are no pau-pipes, flutes, nose-flutes, clarionets, reed instruments, or whistles. American tin horns are used for calling the people together, especially the people of a logging camp, to their meals, but not as a musical instrument.

§ 12.—ART.

The classes of men called artists, if there are any, and are they separated from the artisans?—There are no special artists.

The first efforts of rude tribes to carry out art ideas.—I know of none except as under the next head.

The sources from which they draw their models, mythical, imaginary, and natural.—A figure similar to an alligator is painted on some of their canoe-heads, said to represent lightning. There are no alligators near here which they have ever seen. These figures are chiefly on those which have come from British Columbia. The face of a man is painted on one door. The figure of a man's head roughly carved from wood, and painted, with the body dressed with clothes, is placed inside of a few of their grave-inclosures. I have also seen two figures roughly carved, representing an English man and woman, about eight and eleven inches tall. There are no specimens of art-work in pottery or on stone, ivory, bone, shells, or gourds, no feather-work purely artistic, no mosaics or stucco-work, nor do I know of any cloth or leather embroidery or bead-work for art purposes, except that spoken of under sections 4, H, and 5. Their powder-horns are sometimes ornamented with figures marked in the horn and with brass tacks driven in.

§ 13.—LANGUAGE AND LITERATURE.

Vocabulary.

Man.	Stē'-bāt.
Woman.	S'khlāl'-dai.
Boy.	Ts'-chai'-āts.
Girl.	Sl'-hāl-do.
Infant.	Ts'-chai'-āts (same as boy).
My father (said by son).	Dō-bād.
My father (said by daughter).	Dō-bād.
My mother (said by son).	Dis-kō'-yā.
My mother (said by daughter).	Dis-kō'-yā.
My husband.	D-kwit-tā-bāts.
My wife.	Dī-cho'-wash.

My son (said by father).	Dis-būd'-dā.
My son (said by mother).	Dis-būd'-dā.
My daughter (said by father).	Dis-klā'-dā-ale.
My daughter (said by mother).	Dis-klā'-da-ale.
My elder brother.	Dis-sīl'-klā-du-chat.
My younger brother.	So-so'-kwi, (or) Tī-ū-hwa-tāl-lā-bdis-so-kwi.
My elder sister.	Tsī-tsi-klā-dū-chush.
My younger sister.	Tsī-u-hwa-tal-lab dū-chush.
An Indian.	Klā-wāl'-pīsh.
People.	Klō-klā-wāl'-pīsh.
Head.	Sō-hōtes-hīs.
Hair.	Tā-bate'-kwob.
Face.	Būs.
Forehead.	Skū-pōs'.
Ear.	Kwül-lād-dī.
Ear.	Kwül-lād'-y.
Eye.	Dō-klais'-ā-būt.
Nose.	Büks'-sūd.
Mouth.	Tsūts-tsid'.
Tongue.	Dukt'-säch.
Teeth.	I'-ē-dis.
Beard.	Kwī-düts'-ā.
Neck.	St'stsa-hāps'-ūd.
Arm.	Chāl-lāsh'.
Hand.	S'khā-sük'-kāh-gy.
Fingers.	S'khā-suk'-kāh-gy (same as hand).
Thumb.	Sī-dā-kuls-chy.
Nails.	Kwow-hū-chy.
Body.	Dow'-ūt-sy.
Chest.	Sküp-pō-bade.
Belly.	Khl-ach'.
Leg.	Shī-ā shud.
Foot.	Ī-ā-shud.
Toes.	Skā-shük-ā-sīd.
Bone.	Skā'-wā.
Heart.	I'-ā-dū-wūs.
Blood.	Sīd-dük'-kōle.
Town, village.	No word; they use town.
Chief.	Sō'-wīl-lūs.
Warrior (literally brave).	Schā-lah-kāh.
Friend.	S'to-bā'-ted.
House.	Sī'-ā.
Kettle.	Tsük-sta'-kīd.
Bow.	Stāt'-pt-sēd.
Arrow.	Tā-āt-sēd.

Ax, hatchet.	Küb'-bād, küb-bād-dötl.
Knife.	Dā-whūk'-bīd.
Canoe.	Klā-ī-ō-latl.
Moccasins.	Ī-ō-shīd.
Pipe.	Pāh-āk'-u.
Tobacco.	Sī-isp'-whū-ub.
Sky.	Sklā'-tl.
Sun.	Klo-kwāt'l'.
Moon.	Slo-kwill'-um.
Star.	Klā-klā-chī'-us.
Day.	Slū-khēt'.
Night.	Chā-āl'.
Morning.	Chā'-lū.
Evening.	Hū-āt'-kd.
Spring.	Sī-ai-kwatst, or petl'-ko-sāb, or sāl'- lāl-āb (the first a name, the last two literally getting warm).
Summer.	Spīt'-kāp.
Autumn.	Pet-tō ūl las (literally getting cold).
Winter.	Spāt-chī'-ā (literally cold weather).
Wind.	Spō-hōbe'.
Thunder.	Kwā-ā-hwōd.
Lightning.	Chūl'-lā-kwob.
Rain.	Stūts.
Snow.	Sā-ūk'-kwā-kwā.
Fire.	As-kwot'-tā.
Water.	Kā'-ā.
Ice.	Skab'-ū.
Earth, land.	Tā-bī-hū.
Sea.	Sī-dā'-kwā.
River.	Kā'-ā (same as water).
Lake.	Kwā-lā'-ât.
Valley.	Bā-kwāb.
Prairie.	Bā-kwāb.
Hill, mountain.	S'bā-tay-chāb, s'bāh-date.
Island.	S'tē-chā.
Stone, rock.	S'chāl-tās'.
Salt.	Salt (having no word).
Iron.	Pay-tā-dī'-up.
Forest.	Chē-sāb.
Tree.	Tsā'-ko-pay.
Wood.	Sī-ā-wis'.
Leaf.	Kwā'-lā-oy.
Bark.	Pā-lād' (whisper first syllable).
Grass.	Skwil'-la-ai.
Pine.	Tuk-tuk'-la-hoi.
Maize.	Have no word; use <i>corn</i> .

Squash.	Have no word; use <i>squash</i> .
Flesh, meat.	Bai'-yăts.
Dog.	Skwâ-bai-yā.
Buffalo.	Have no word.
Bear.	Stsa-ū'-ŭl.
Wolf.	Dū-eh-shū'-eh-yai.
Fox.	Have no word.
Deer.	Swhē-shīd.
Elk.	Kwāh-kwa'-chid.
Beaver.	Stō-pō-hwob.
Rabbit, hare.	Kwīch-i-dy.
Tortoise.	Have no word.
Horse.	Stī-ā-kē'-ō.
Fly.	Ūh-hwai'-ŭh-hwai'-ŭh.
Mosquito.	Chī-chī'-ats.
Snake.	Bŭts'-ai.
Rattlesnake.	Wāt-push.
Bird.	Spāpts'-ho.
Egg.	Kaw'-kū-ba-lich.
Feathers.	St'klūk ^b '-el.
Wings.	Same as feathers.
Goose.	Pi-sak.
Duck, mallard.	Hāh-hob-shud, or bâk.
Turkey.	Have no word.
Pigeon.	Hŭ-bīp.
Fish.	Sbe-lăch'-sŭd.
Salmon.	Slaw-awb.
Sturgeon.	Have no word.
Name.	Tsō-băt'.
White.	Pāk.
Black.	Ais-klāl'.
Red.	Āst-sa-uk.
Light blue.	Ās-kwa-ŭh.
Yellow.	Ās-kwa-kā.
Light green.	Āhs-pap-kwak-do-kureb (whisper- last syllable).
Great, large.	Sī-sīd'.
Small, little.	Kā-kāp, or kā-kām-el.
Strong.	Sto-bish.
Old.	Has-pōt'-ŭl.
Young.	T'chay-shul, tchai-ăts.
Good.	Ai'-y.
Bad.	Ki-lŭb.
Dead.	Ais-klai'-lul, ās-at'-to-bit.
Alive.	Hāh-lay'.
Cold.	S'chay'-ŭh.

Warm, hot.	Us'-say-lāb, us-kwil-lok-kho.
I.	Dits-ū.
Thou.	Dū'-ī.
He.	Tsud-dī-ūl.
We.	Dī-ā-bātl.
Ye.	Wil-la-wōl lup.
They.	Tsood-tsud-dāl.
This.	Tee-tli-ā.
That.	Klā-tsāh-ī-ā, taw-o-y.
All.	Pī-ase'.
Many, much.	Haw-haw'.
Who.	Wū-āt.
Far.	Kwā.
Near.	Chate.
Here.	Ech-tel-ya'.
There.	Klay-tsā-ī-a, taw-o-y.
To-day.	Tel-es-lū-kha' it.
Yesterday.	Ūt-sūs-wūd-it.
To-morrow.	Tsō-ūt-chā'-ūl.
Yes.	A.
No.	Hwā'-kā.
One.	Dā'-kus.
Two.	Es-sā'-ly.
Three.	Cho'-ūs.
Four.	Bu'-sūs.
Five.	Ts-whess'.
Six.	Ī-ā-pa'-chy.
Seven.	Tū-khōs.
Eight.	T-khā'-chy.
Nine.	Hwail-e-a.
Ten.	Ō'-pā-dich.
Eleven.	O'-pā-dich-klō-dy-dā-kūs.
Twelve.	O-pā dich-klō dy-es-sā'-by.
Twenty.	Tsub-kh-lāk'.
Thirty.	Chā-dāk-klōk.
Forty.	Sh'tib-bū-sus.
Fifty.	Tsitss-a-whüss' (whisper first syllable.)
Sixty.	Stē'-ā-pāh'-chy.
Seventy.	Stich-tū-khōs.
Eighty.	St'-tū-kā'-chy.
Ninety.	St'-tū-hwal'-ē-a.
One hundred.	St'-tū-pāl-owlse.
One thousand.	Ō-pā-dich-tū-pāl-owlse.
To eat.	Sū-ī-klād.
To drink.	Skōh.

To run.	Wě-chŭ'-chun.
To dance (Indian dance).	Skwates.
ing.	S'il-lāl.
To sleep.	S'tō-pād'.
To speak.	S-lay-äl-kwob.
To see.	Sil-lā-lap.
To love.	S-hāt'-l.
To kill.	Āt'-to-bid.
To sit.	Āb'-būt.
To stand.	Us-sāh-tād'-u-bit.
To go.	S'ōl.
To come.	Tsī-ŭ', hai-ŭ.
To walk.	Wōh'-chab'.
To work.	Sū-ā-chib.
To steal.	S'chā-lo-äl.
To lie.	Skwai-yup'.
To give.	Sbī-hwā.
To laugh.	Sbī-hwā-wa (whisper last syllable).
To cry.	Il-lal.

I have obtained these words by asking three or four individuals, and where they differed, continually asking until I found which was right. They are the native Twana. Quite a number talk the Nisqually language entirely; a large number understand, and it is said that during the last few years more and more individuals are learning to speak it. The great majority, however, talk the Twana language in their conversation among themselves. All except the old persons talk also the Chinook in their intercourse with the whites and some other tribes of Indians, and quite a number understand English.

Their knowledge of their own affairs.—Of their history they know very little except what the oldest remember.

Their theories of natural phenomena, as sunrise and sunset, the origin and motion of the heavenly bodies, thunder and lightning, wind, rain, &c.—They supposed that the sun really rose and set, and not that the world turned over as they have been told.

Wind they supposed was caused by the breath of a great being, who blew with his mouth. In this they reasoned from analogy, as a man can with his breath cause a small wind.

Cold they supposed to be caused by our getting farther away from the sun in the winter, for they suppose that the sun is much farther off when it is low than when it is high, and that the cold regions are away from the sun, hence that we are near these cold regions in the winter.

Thunder and lightning some supposed were caused by a great thunder-bird flapping its wings, an idea which is prevalent among nearly all of the Indians on the sound. Others suppose that a wicked tamanamus, or medicine-man, very strong, caused it by his tamanamus when angry with some one.

I have heard of two legends of the origin of the sun; both, however, being legends, more than a matter of real belief.

First. A woman had a son who ran away from home. After a little she went after him, but could not find him. Her people went after her, found her, and brought her back. They did not know what became of her son until a short time afterward they beheld him, having been changed into the real sun, coming up from the east. This is the origin of the sun.

Second. A woman having no husband had a son, who, being left in charge of its grandmother, who was blind, was stolen away by two women who carried him very far away, where they brought him up, and he grew very fast and became their husband. His children were the trees, the cedar-tree being the favorite one. His mother in the mean time sent messengers, the cougar, panther, and some birds, who went everywhere on the land searching for him except to this place, where they could not go on account of a very difficult place in the road, which was liable to come together and crush whatever passed through. At last, the blue-jay made the attempt, and was almost killed, being caught by the head, nearly crushing it, and thus causing the top-knot on it. It however found the son, a man grown, and induced him to leave his present home and return to his mother. When they came to this difficult place in the road, he fixed it, and did good wherever he went. When his mother found that he was lost at first, she was very sorry, and gathered his clothes together, pressed from them some water, wished it to become another boy, and, being very good, her wish was granted. He was a little boy when his older brother returned. They were both somewhat like God, in that they could do what they wished. The older brother said to the younger one, "I will make you into the moon to rule the night, and I will be the sun to rule the day." The next day he arose in the heavens, but was so hot that he killed the fish in the sea, causing the water to boil, and also the men on the land. Finding that this would not do, he retired, and his brother tried to be the sun and succeeded, as the sun is at present, while the older brother became the moon, to rule the night.

Orations.—The following are taken from the minutes of a council held with them by Commissioner F. R. Brunot, September 4, 1871:

By BIG FRANK, the present head chief:

I am the only one who was at the treaty at Point-no-Point. I heard what Governor Stevens said, and thought it was good. I am like a white man, and think as the white man does. Governor Stevens said all the Indians would grow up and the President would make them good. He told them all the Indians would become as white men; that all their children would learn to read and write. I was glad to hear it. Governor Stevens told them, "I will go out and have the land surveyed, and it will be yours and your children's forever." I thought that very good. He said a doctor and carpenter and farmer would come. The

chiefs thought that was all good; they thought the President was doing a kindness. I never spoke my mind to any one. I talk to you because you come from Washington. All the agents talk differently. You talk as Governor Stevens did. I hear what you say. Every agent who comes here, I don't know them. I thought all Governor Stevens said was very good. Perhaps the President thinks all the Indians are good, as they were to be under the treaty; but they are not, they are Indians still. I think there was plenty of money sent by the President, but I think much did not come here. Perhaps it gets scattered, I really think it does not come. When it comes, it is in calico. But I know more is sent than gets here.

By SPAR, the chief at that time, since dead:

When I came here I was young, and did not know much. I was here when the reservation was opened, and know what was done. When the agents came, they never taught us anything; never said, "Go and fix your places." All they think of is to steal, to sell the reservation cattle and reservation hay; to sell the fruit and get all they can; to go and log and sell them. That is all every agent has done. They never advised us what to do, never helped us. After I had seen all this, I was sorry. Did the President send men for this, to come and get what money they could out of the reservation and their pay? I know the Indians lose all their cattle. When they get the money, where does it go? When I ask about it, they say they will punish me. I thought the President did not send them for that. I got very poor, and wanted to borrow the reservation team. You know what I have done. They refused me the use of the cattle.

By DUKE WILLIAMS:

I am glad to see you. All our folks are very poor. Our planting grounds and logs and apples and hay are taken from us, and I felt sad, and wanted to go and see the President. I know I will not live long. I asked the Indians to give me the money, and I would go and see the President. I would have gone if you had not come here. Did the President send men here as agents to log and get all the benefits? That is what I wanted to go and ask the President.

By BIG JOHN, a subchief:

You come to get the Indians' hearts. You ought to take time. You are the great chief, and we want you to hear us. When we talked before, it was put down, and they said it would go to Washington. We do not know what became of it. We don't think the President saw it. We think it don't go far from here. I am a poor man. You are making all of these young men and women happy. I thought, when a boy, that we would get all of the money that was promised. White men don't give things away. They don't take a shirt or a blanket for lands. They get gold and silver. The Indians don't get money for their country.

These are samples of their orations on this subject, and enough to

show their style. I have heard them speak on other subjects; on temperance and religion; but those orations have not been preserved. We do not get their real style, however, when they talk through an interpreter. They are natural orators, and their looks and gestures, which are numerous, speak eloquently.

§ 14.—DOMESTIC LIFE.

A.—MARRIAGE.

Including courtship, betrothal, and wedding ceremonies.—Formerly courtship extended for a long time, and the couple were engaged for some time before marriage, though secretly. The husband purchased the wife of her parents, the price generally being a hundred or several hundred dollars, a large part of which was returned at the wedding. At the wedding there was a large feast at the house of the wife's parents, to which all the friends were invited, and after this there was often more feasting for a long time, alternating between the families of the husband and wife. There is but little of this now. At present when they are married in Indian fashion they generally simply take each other without any ceremony, though a few marriages in ancient form have taken place lately among the more uncivilized.

Within two and a half years, a dozen marriages in American Christian form have taken place, and when this is done they consider the relations far more binding, so much so, that they are generally unwilling to have it done unless they have been married six months or more in Indian fashion, to learn whether they will like each other sufficiently.

Conditions of both parties as to relationship.—The wife is not so elevated as white women, doing much more rough work, but is by no means a slave, and is highly prized.

Dowry.—The wife receives at marriage a large share of the property which the husband gave her father for her before marriage, and also some other things, but there is no regular rule.

Polygamy, rank of wives, &c.—Polygamy has been practiced quite commonly among them, the number of wives depending on their ability to purchase, and their wishes. But this custom is going out of existence, only four of them having more than one wife and only one having three now.

Laws about marrying in and out of the tribe.—They may do either, with the consent of the parents. The children of those who marry out of the tribe belong to the tribe of the father; and a number of persons have married out of the tribe.

Sacredness and permanency of marriage.—Quite sacred, there being trouble when the marriage-vow is violated by either party; but not permanent, divorces occasionally taking place, though much less often now than formerly.

B.—CHILDREN.

Accouching.—The woman attends to herself.

Seclusion of mother.—They are secluded as unclean about one week.

For a long time, the mother is not allowed to touch fish, fowl, or game, the gun, fishing-apparatus, or anything by which any of these are taken, as they think it will bring ill luck.

Naming.—They are named after deceased friends often, and when this is done, a little potlatch is made.

Cradling.—The cradle is described in chap. III, sec. 2, C. The cradle often lies down, but sometimes is hung on a small stick, a few feet high, which is fastened in the ground or floor, in a slanting direction, and acts as a spring. A string is fastened to it, and the mother pulls the string, which keeps the stick constantly moving, and the cradle and child constantly swinging. This is done with the foot when the hands are busy at work.

Deformations.—The only one is the flattening of the head, which is done in infancy.

Nursing.—This is done longer than among the whites.

Child-murder.—This is unknown.

Adoption.—This prevails a little, but is not common.

Education or treatment while growing up.—The Indians educate them only in Indian customs. For school, see sec. 9.

C.—WOMEN.

Standing in family and society.—Inferior to whites.

Peculiar duties.—Waiting on her husband, preparing meals, getting wood and water, preparing fish, the large game being dressed by the men, spinning, sewing, knitting, making of clothing, and washing are her chief duties.

General appearance.—Unattractive, with coarse features.

Growing old.—Early in life, they begin to have a wrinkled and aged appearance.

D.—RIGHTS AND WRONGS.

Chastity.—Very many are unchaste.

Immoralities.—Almost universal.

Prostitution.—It is rather common by both sexes.

Schoopanism and Sodomy.—Unknown.

Divorce.—They are easily obtained, but growing less.

Conditions of.—If a man puts away his wife, he gives her a present; but if she leaves him, he does not.

Results of.—Morally they are evil, but socially, among others, neither party is lowered.

Celibacy.—Not known.

Inheritance.—See sec. 16, B, of present chapter.

Rights of parents and guardians.—Parents exercise authority over their children fully equal to that of white parents over theirs, but over adopted children they have less.

§ 15.—SOCIAL LIFE AND CUSTOMS.

A.—ORGANIZATION OF SOCIETY.

Classes of men and professions.—Chiefs, sub-chiefs, headmen, medicine-men, common people, slaves.

Military, political, and religious castes.—None in the proper sense of the term.

Secret orders.—Black Tamanamus. I cannot learn that there has been any of it for eight years. If it is practiced at all now, it is done very quietly, and in a very different manner from formerly; but as near as I can learn, the society is entirely broken up. I have not been able to learn the entire ceremony, but am told that it was similar to the Makah ceremony, which has been given by Mr. J. G. Swan in his description of that tribe, though the ceremonies varied somewhat in the different tribes on the sound. I, however, learn that the candidate was starved for a long time (one man saying that he did not eat anything for eight days), but he or she (for both men and women were initiated) was closely watched inside a large tent, and what else was done in it I cannot learn; but occasionally the candidate was let out and pursued by two or three others with all their might, and sometimes he himself pursued others, and if he gave out in the race or other exercises he was not considered worthy to become a member. If he did not, he was taken back to the tent and watched and starved, and the same scene repeated every day or two. At last he was brought out perfectly rigid, and taken by several men and thrown up as high as they could into the air, sometimes eight feet, and caught, and this was continued until he apparently came to consciousness and screamed. There was also very much cutting of the body and limbs quite deep, so that the candidate became quite bloody, but he did not seem to take any notice of it. After these ceremonies, he would sometimes sit, in his house or lodge, looking like an idiot, for two or three months, and speak to no one, even to a husband or wife, but simply wind something on a stick and unwind it again day after day.

Slaves.—Those taken in war or bought, always originally captives, however, were slaves. Formerly they were very much oppressed, but now they have considerable liberty, and there are only two in the tribe, as there has been no war for a long time, and the treaty by the Government provides that there shall be no slavery.

B.—CUSTOMS.

Personal habits.—Not neat in their houses, and not very neat in their clothes, though growing much more so. Very much accustomed to bathe. In dress, quite showy and clean on public days.

Salutation, etiquette, hospitality.—Not much form in salutation, only a word or two, and sometimes shaking of hands, which they have learned from Americans. Not much etiquette. Very hospitable to friends.

Feasting and festivals, manner of observing, and meaning.—When friends come on the 4th of July and Christmas, or because of a potlatch, *i. e.*, distribution of gifts. On the 4th of July, Christmas, or when friends come, they simply cook a large amount of food, spread it on mats, which are on the ground, and they gather around the different mats in companies. Sometimes when friends come, they bring a large amount of food with them, both for themselves to eat and those whom they come to see, expecting that there will be much over, which will be given to the friends whom they visit. At a potlatch, one man, or a few persons, give notice that they will give away a large amount of money and provisions, and they invite not only their own tribe, but also the neighboring tribes. Food, clothes, and money, and other things, are then given away, sometimes to the amount of \$5,000, the persons doing so immortalizing themselves for life by this means. The potlatch lasts from three days to three weeks, and is accompanied by feasting, gambling, visiting, &c.

Sleeping customs.—The more civilized class have a bed-room partitioned off, and very many have bedsteads. Often men, women, and children sleep in the same room, and sometimes on the floor with mats, feather-beds, straw-beds, skins, blankets, and quilts, more or less as they are able to procure them. A few use sheets. Formerly they all slept in the same room and on the ground, but are now slowly adopting American customs.

Charities, &c.—There is nothing organized, and formerly there was much suffering among the sick and old; but of late years, as they have earned money, the friends of the sick and poor care for them, so that there is but little real suffering because of poverty. The agent also provides extra food for the sick and poor from Government supplies.

Initiation into manhood or into the tribe.—There is no ceremony now, and has not been, as far as I can learn.

Social vices.—Intemperance, gambling, and filthiness.

Healing.—See sec. 1, E, of present chapter.

Bleeding, extracting teeth, amputation, trepanning.—These were unknown among them before a white physician came.

Customs when about to build a house, to go on a hunting or fishing expedition, to make a journey, or to engage in any new pursuit.—Formerly, as now, when about to build a house, they did nothing special, as their houses were so small and often removed, that it was an event of no great importance; but when about to go on a hunting or fishing expedition, to make a journey, or engage in anything special, they would *tamanamus*, their way of invoking the presence of the Great Spirit, so that they might be successful. They do very little of this now.

Customs when about to engage in war.—They would consult together in an assembly where those who wished would speak, and then do as the chiefs said. After this they would *tamanamus* in order to be successful, and paint themselves with black and red, making themselves as hideous as possible. They have had no war for many years.

Treatment of the captives and wounded.—Wounded enemies were generally killed. Captives were made slaves or sold; but sometimes prominent men were ransomed.

Customs around the dying and dead.—They will tamanamus (see III, 17, D, Exorcism) for the removal of the evil spirit. When a person is about to die, they remove the person from the house, supposing that if a death takes place in a house the evil spirit who killed the deceased will kill every one who shall afterward live in the house. If it is unpleasant weather, a mat house is built in which they may die, and being immediately torn down, it allows the evil spirit to escape. If a person dies in a house, they will not live in it afterward, and generally tear it down. After death, there is a great deal of crying and mourning and noise.

Funeral and burial customs.—The dead are placed in coffins, and many things are also placed with them in the coffins, as good clothes and other things, which they will be supposed to need in the next world. Occasionally, Christian services are held over them, after which they are taken to the graveyard. The number of these Christian services has increased considerably during the last two years. If no Christian service is held at the convenience of the friends, they are taken to the grave, but generally much sooner after death than with the whites, often as soon as the coffin can be made. They are quite superstitious about going near the dead, fearing that the wicked spirit who killed the dead will enter the living who go near. They are most fearful of having children go near, they being more liable to be attacked than older persons. They are very slowly overcoming these prejudices as they see the customs of the whites, but are more slow in regard to this than to adopt most other American customs.

Manner of disposing of the dead, by cremation, in coffins, embalming, in graves, in lodges, on scaffolds.—No cremation, no embalming, not in lodges. They are placed in coffins, which are made by the Government carpenter, or in a rough box, if the former cannot be easily procured, and then in a grave. Formerly they were placed on scaffolds, but there is very little of this now. Over the grave is an inclosure generally in the shape of a small house, shed, lodge, or fence, and with some the sides are quite open, and with others entirely closed, or with a window. Both outside and within the inclosure are various articles, as guns, canoes in miniature, dishes, clothes, blankets, sheets, and cloth mats, and occasionally a wooden man, carved and painted in the face, and dressed. On some graves, these things are replenished every year or two, as they are destroyed by the effects of time. Some graves have nothing of this kind. In this respect, they are adopting American customs more and more.

Ossuaries and public cemeteries.—There are no ossuaries. They have two cemeteries, both on Hood's Canal, one on the reservation and the other a little ways from it. They are not regularly laid out, but face the water, generally extending back only one or two rows of graves.

§ 16.—GOVERNMENT AND POLITICAL ECONOMY.

A.—ORGANIZATION.

Authorities in time of peace, claims, and treatment of.—The United States Indian agent is almost supreme with them, and hence the chiefs have but little real authority. The officers are a head chief, four sub-chiefs, headmen, and a policeman. The honor of chieftainship is, however, considerable, so much so that the place is sought after. The chiefs, sub-chiefs, and headmen have, however, considerable influence, and on court-days, while the agent acts as judge, they act as jury, and they also are supposed to have more influence with the agent than others. They also settle some of the minor cases.

Assemblies and public deliberations.—They generally assemble on the sabbath for religious worship and sabbath-school, on court days for court, at feasts and tamanamus, and when Government annuities are distributed; also when any event of importance takes place. The chiefs and headmen do most of the talking, but any one who wishes has the privilege of speaking.

Military organizations, war chiefs.—The same persons who are chiefs in time of peace are also chiefs in time of war. They are the commanding officers of the army, which, in battle, is a very irregular one, each man fighting as seems best to him.

Authority of privileged classes.—The chiefs are honored, and have some authority, but not much, especially when they disagree with the Indian agent. The medicine-men are feared.

The common people, what part of them have a voice in the assembly.—Any one speaks who wishes to do so.

B.—REGULATIONS, LAWS, ETC.

Concerning labor, trades, and castes.—There is no law about labor or the trades. There is no caste. When one wishes to labor, he does so in the way which suits him best. Logging has been their principal business. A number work together, from six to fifteen, and when the boom is sold and the amount deducted which their food cost, the rest is divided among them according to their labor. They have farms and work on them, also work for white persons as they find employment. None have learned the trades to any extent. It has been difficult to teach the older ones the trades, as, while they are able to earn but little, they wish full pay. A few, however, have learned to handle tools quite well. Many of the women wash and iron for the whites.

Personal and communal possessions, debtors.—Their possessions are personal wholly; hardly anything is held in common. Common custom says debtors must pay, though seldom is property taken by force for debt.

Oaths and trials.—The United States Indian agent acts as judge some-

times; in regard to small cases, the chief and subchiefs decide; but generally the cases are brought to the agent, who, after hearing all the evidence, decides the case, or else refers it to five or six of the principal men as a jury for decision. Witnesses and jury are not put on oath; but when persons join the temperance society, they are sworn in the presence of God and all present.

Slavery.—There are a very few slaves; but as there has been no war for a long time, slavery is dying out, and the few which there are are not treated as harshly as they formerly were.

Inheritance.—Property of deceased parents goes to their children, or, if there are no children, to their friends; sometimes, with the consent of the friends, it being given to everybody, strangers even. The oldest child generally receives most.

Torture and punishment.—There is no torture among them now, nor has been, except when captives tried to run away or were contrary, when they cut the soles of their feet. The punishment is generally by fines or imprisonment for a few days, seldom more than two weeks. Generally murder is settled by the payment of from \$300 to \$600, though occasionally blood revenge is practiced.

Revenue.—The only revenue is that the convicted persons pay the sheriff or policeman; the chiefs and jury give their time.

Census.—They take no census. All that is done is taken by the agent, as given under I, D.

Declaring and conducting war, truces, treaties, &c.—For declaring war, see III, 15, B. When a truce takes place, one man, who is favorably known, is sent to the opposite party to arrange the terms of peace; and if a treaty is made, then, sometimes, they prepare a feast, to which the principal men on both sides are invited, and of which they partake together. In their later truces, they used the white flag, or something white as a sign of the truce.

Commerce, foreign and domestic.—There is nothing deserving the name of commerce among themselves; they simply trade for different articles as they wish. To the Americans they sell boom-logs chiefly, and buy provisions, clothes, ornaments, &c. They have very little trade with other tribes, sometimes trading horses with the Nisqually Indians, and buying canoes of the Clallams.

Succession to rank.—Formerly the chieftainship descended from father to son; now the head chief is elected, generally annually, on the Fourth of July, the custom having changed within ten years. The subchiefs are chosen by the people to serve during good behavior, subject to the will of the people and agent. The sheriff or policeman is appointed by the agent to serve during good behavior.

Public property, provisions, and stock.—There is none.

§ 17.—RELIGION.

A.—OBJECTS OF REVERENCE AND WORSHIP.

Angelic spirits and demons.—Many angelic spirits. (See Tamanamus.) Sometimes it is believed that they do fear the devil and demons so much that their medicine-men try to gain their favor so that they shall not be injured by them.

Shamans.—As above, under head of demons.

Gods.—They worship a Great Spirit, who they believe made the world and all in it, and who preserves and governs it. See nothing of a Trinity in their ideas.

Totems.—Each person has his own guardian spirit, called his tamanamus. On the door of one house is an image painted with white paint (see Fig. P, Plate 25),—the tamanamus of the owner of the house.

On the door of another is one of the shape shown at Fig. R, Plate 25, the heavy shading immediately around the human figure indicating red paint. At the head of the bed of one woman is a board about 6 feet high, 2½ broad, and figured as shown at Fig. R, Plate 25. There the heavy shading indicates red paint. I am told that some others have theirs at the head of their beds, but have not seen them. They generally have some animal as their tamanamus, although these look very little like any. Most of the Indians, however, have no figure to represent their tamanamus. How it is chosen or when, I have not learned from them, but suppose it to be done as other Indians on this coast do. There is very much about the whole subject which I do not fully understand, though I am trying constantly to learn more.

B.—HOLY PLACES AND OBJECTS.

Sacred legends, litanies, or laws.—That God made the world; that He made man, but that there were different centers of creation for man, the ancestors of each tribe being created where that tribe now lives; that there was a flood, but that it was not very long ago, and that it did not overflow all their land, but that the summit of Mount Olympus, the highest mountain near here, was not submerged, and that a number of people remained there until the flood subsided; that before it subsided a number of the canoes broke from their fastenings, and carried the people who were in them far away, so that they never returned, which accounts for there being so few left here, and the mountain is called Fastener in their language, from the fact that they broke from their fastening; that none but good Indians were saved at all; that the pigeon or dove did not die, but went abroad to see who were dead; that there has been a great fire, which burned up everybody and everything except good Indians; that one person, very wicked, was turned into a rock, and hence that all wicked Indians will be turned into a rock or else into some beast; and that God at some time formerly came down to this world. (See III, 17, F, Incarnation.)

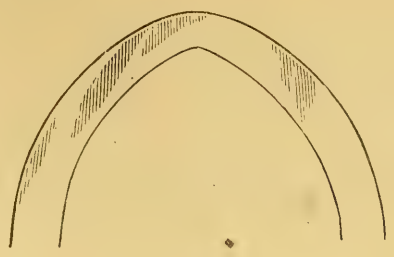


Fig. P.

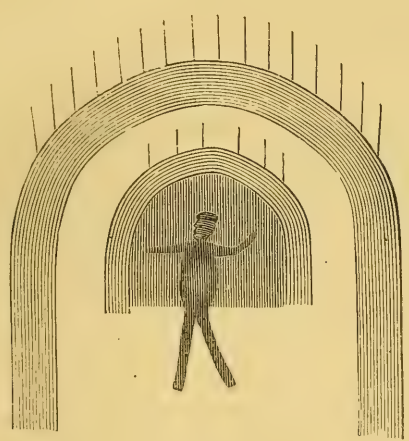


Fig. Q.

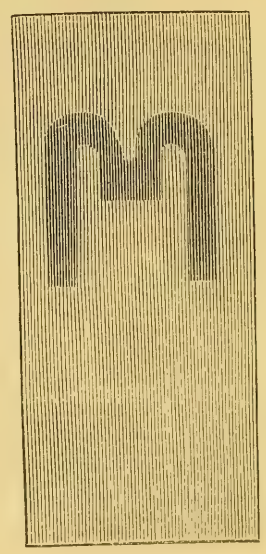


Fig. R.

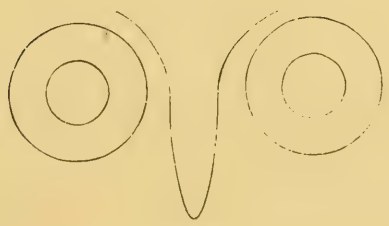


Fig. S.



C.—ECCLESIASTICAL ORGANIZATION.

Medicine-men, rain-makers, sorcerers, devotees.—No sorcerers or devotees. There are medicine-men. No special class of rain-makers; but there is a certain rock in Hood's Canal, near the reservation, which they have thought if any one should strike in a certain way it would bring rain. But they have about lost faith in it now.

Part taken by the laity in religious ceremonies.—At tamanamus they are present and help make the noise, while the medicine-man draws forth the evil spirit. (See III, 17, D, Exorcism.) In their old mode of worship, by dancing, they danced.

D.—SACRED RITES.

Installation of dignitaries.—At present, when a chief is chosen, he makes a short speech, and a few others congratulate him.

Exorcism, generally called tamanamus.—A wicked medicine-man is supposed to be able to send a woodpecker, squirrel, bear, or any treacherous animal, to the heart of his enemy, to eat his heart, plague him, make him sick, or kill him. The good medicine-man finds out, from his sickness, what kind of an animal it is, and then tries to draw it forth; and while the common people make a noise, pounding on a rough drum, on sticks, hallooing, singing, &c., the medicine-man places his hands on some part of the body, where to him seems best, and draws forth with his hands, or says he does, the evil spirit; and when he says he has it, he holds it between his hands, invisible, and blows it up, or takes it to another man, who throws a stone at it and kills it. When the sick person is not cured, they say there are several evil spirits, but sometimes the person dies before they are all drawn out, or else the opposing medicine-man is stronger than he, and so he cannot draw them all out. Sometimes the good spirit of the person is gone, and he is sick. Then the medicine-man tries, with his hands, to draw it back, and so cure him.

Choosing a totem.—See A of present section.

Sacrifice.—Formerly, when they went to a new land to live for any length of time, they would build a fire, and then burn some fish, good mats, or something valuable made with the hand, except clothes, which they said they gave to the land in order to gain its favor. Even now in some of their tamanamus ceremonies they do something similar.

Purification.—None as a religious rite. Formerly the women were considered unclean when changing to womanhood, and also at the birth of a child; on account of which they were kept out of the house, and purified by washing with certain leaves. These customs are almost extinct.

Exorcism.—A wicked medicine-man can also, in an invisible manner, shoot a stone, ball, or poison into the heart of the sick person, and the animal spoken of, to eat the heart of the person, is also sent in an in

visible manner. They believe in it so firmly, that they say when the heart of one who has died has been opened that often this stone, or bone, or the like, has been found. When the good medicine-man tamanamuses over the sick person, sometimes he gets well and sometimes he does not. When he does, often I think he would have recovered had there been no tamanamus, and sometimes I am inclined to think it might, perhaps, be attributed to mesmeric power on the part of the doctor, or to the powers of the imagination, as often spoken of in mental philosophy, on the part of the sick person. There are enough cures to make them firm believers in it, and enough deaths to make them believe that there is some other doctor stronger than the one who is trying to cure. They pay the doctor who is trying to cure whatever they wish, but generally considerable, so as to secure his services again if they need him, and if they can discover to their satisfaction the bad doctor who sends the sickness, they will extort considerable from him.

In addition to this, which might be called tamanamus for the sick, there are at least three other kinds which are called by the name of tamanamus—the black tamanamus—which is the most savage (see III, 15, A, Secret orders), that for the living and that for the dead.

I do not know all the order of ceremonies, but there is, in connection with the last two of them, very much feasting, pounding, singing, hallooing, dancing, &c., and some fasting.

In the tamanamus for the living, the candidate starves himself until he is about sick, when all his friends gather and make the noise, he singing a kind of solo at times and they responding; and this is kept up more or less for several days and nights, with intervals of rest more or less long. The object of it is to gain the favor of his tamanamus or guardian spirit.

Tamanamus for the dead:—Some time before a person dies, it may be months, it is supposed that a spirit comes from the spirit-world and carries away the spirit of the person, after which the person gradually wastes away or suddenly dies. If by any means it can be discovered that this has been done, and there are those who profess to do it, then they attempt to get the spirit back by a tamanamus, and, if it is done, the person will live.

There are three traditions about tamanamus which I have learned.

One is of a man, a long time ago, who formed an image of a man, into which he put his tamanamus, and over which he had considerable power, even to making it dance. Two young men did not believe it, and at one time, when many were gathered in the house where it was, were told that, if they did not believe it, to take hold of it and hold it still. But when they did so, the man made it dance, and soon, instead of the two men holding it still, it made them dance, one holding to an arm on each side of it, nor could they stop or let go, but after dancing a while in the house it took them outside, dancing toward the salt-water. All the people followed, trying to stop it, but could not. It took them

into the water, and then all three became changed into something like the fish called a skate, went underneath the water like a fish, and were seen no more.

They also say that one woman, called Jane, now on the reservation, could, before the whites came, make certain blocks of wood which she had, and which were a foot or two long and about a foot in diameter, dance by means of her tamanamus without touching them, but cannot do it now, and since the whites came she has taken them off into the woods and buried them.

They also say that a long time ago a man who lived at Union City, and was very successful in catching porpoises, had a brother who was his enemy, who lived up the river, and who tried to injure him, but could not. He especially tried to injure him by seeking to prevent his catching porpoises, but could not. Failing in this, he made a wooden porpoise, put his tamanamus into it, and put it into the water, where he thought his brother would catch it. His brother at Union City found it, and thinking that surely it was a porpoise, caught it, but found really that it was too strong for him, and that he was caught by it, for it took him north under water to the unknown place where ducks live in summer, which is also inhabited by a race of pigmy men a foot or two high, between whom and the ducks there is war. He helped the pigmies, killed many ducks and ate some, whereupon the pigmies called him a cannibal, and became enraged at him. At last, a whale caught him, and brought him back nearly to Union City. He very much wished to be thrown out on dry land or in shallow water near the land. But his wish was not granted, for by some means the whale vomited him up in deep water, and he swam to land. This is the reason why the dentalia, the species of shell formerly used as money, are found in deep water, for they were vomited up with him. If his wish had been granted, and he thrown on dry land or in shallow water, they would have been found there.

Many of these things have caused some white people to believe that their religion was a kind of spiritualism.

For a long time it troubled me to know what was meant by the word "tamanamus", it being most generally used in connection with the work of the medicine-men over the sick. It, however, means more; anything supernatural, except, perhaps, the direct work of God and Satan.

The noun good tamanamus hence means any spirit between God and man, and an evil tamanamus any between Satan and man. It also means any stick, stone, or the like in which this spirit may dwell, and also the work of trying to influence this spirit. The verb means to work in such a way as to influence these spirits, and is done in sickness by medicine or tamanamus men, but in other cases, as described above, by individuals alone, or in companies; so that a tamanamus is often the work of people tamanamusing.

I have sometimes asked them why their tamanamus does not affect

white men. In fact, the superintendent of Indian affairs offered their medicine-men a hundred dollars to make him sick or kill any of his horses, for they profess to have power to kill horses as well as persons, but they could do nothing, and say that the white man's heart is hard, so that the invisible stone cannot affect it, but the Indian's heart is soft like mud, and is easily affected.

The fifth, month, *sta-ko-lit*, was so named because it was the month for *tamanamus* formerly. The practice which gave it the name has now entirely ceased, and is hardly known to the younger ones, and indeed there are many who hardly know the old name, or indeed any of the names of the months. The ancient practice, it is said, in this month, was to go far off into the mountains, wash themselves very frequently, remain half-naked, build a very large fire a hundred feet long and twenty feet wide, and remain for seven days or thereabouts without sleep. I suppose that they *tamanamused* also in other ways. When they returned, they rested and slept very much.

E.—MYTHS.

Hades and heaven.—Their idea of heaven formerly was that it was be low, and a place for good hunting and fishing, for good Indians. They had no hell, as they supposed wicked persons would be turned into a rock or beast. Now most of them believe the heaven and hell of the Bible to be true, I think.

Omens.—When they see something very unusual, they think something bad will happen. For instance, if they find a fish very different from any they have ever seen, or a white squirrel, or find a frog cut open and laid on a rock, or anything very unusual, they think something bad will happen, as a great storm, or that some one will die, or something else bad, and if it does not occur till a year passes, but then occurs, they think the omen is fulfilled. To go near a dead person, especially if children should do so, is an omen that those doing so may die soon.

Inanimate objects.—There is a rock a few miles from Union City, which, if touched by any person, would cause the hand to dry up and wither. There is at Eneti, on the reservation, an irregular basaltic rock, about three feet by three feet and four inches and a foot and a half high. On one side there has been hammered a face, said to be the representation of the face of the thunder-bird, which could also cause storms. It is delineated in diagrammatic outline at Fig. S, Plate 25. The two eyes are about six inches in diameter and four inches apart, and the nose about nine inches long. It is said to have been made by some man a long time ago, who felt very badly, and went and sat on the rock, and with another stone hammered out the eyes and nose. For a long time, they believed that if the rock was shaken, it would cause rain, probably because the thunder-bird was angry. They have now about lost faith in it, so much so that about two years ago they

formed a boom of logs around it, many of which often struck it. That season was stormy, and some of the older Indians said, however, "No wonder, as the rock is shaken all of the time." It is on the beach, facing the water, where it is flooded at high tide, but not at low tide, and the impression is being gradually worn away by the waves.

Eclipse.—An eclipse of the sun almost annular occurred about two weeks ago, which gave me an opportunity to learn some of their ideas about it. They formerly, as near as I can learn, supposed that a whale was eating up the sun. At the time of the eclipse, several of the women and old persons told me that they stopped work, went to their houses and prayed in their minds to God. Many wished to know what I thought was the cause of it.

Prodigies.—(1) Stick Siwash, a great man or giant, by some thought to be as large as a tree, who would carry off women and children when alone or nearly alone, does not attack men. He lives in the woods. (2) A great land animal which carried off a woman was pursued by a large number of people, who attacked it, cut it with knives, speared it, and did many things, enough to have killed very many common animals, but were unable to kill it, and left it. (3) A great water animal, which has overturned canoes and eaten up the people, but cannot be killed.

Prayer.—In connection with their worship of the Great Spirit, or literally the Chief Above, as given (see Great Spirit, III, 17, F), they pray to the Great Spirit, asking Him to take care of them, help them, and make them good.

F.—BELIEF.

Animism or the existence of the soul.—They firmly believe in this.

Transmigration.—They believe that some wicked people have been turned to animals, or did formerly believe it.

They have a tradition of a dog which was bad, which swam from Eneti to Union City, and back near to the graveyard, a distance of about five miles, and was turned into a long rock, now lying there; also that a certain kind of round flat shell about four inches in diameter was formerly their gambling-disks, but that these disks were changed to these shells.

Worship of a Great Spirit.—They believe in Him and worship Him, chiefly as the Americans do; the old way, which has now ceased, being by girding themselves, singing, and dancing before Him.

Incarnation.—They have a tradition that God once came down to earth, because of a certain impression in a rock on this canal (now washed away), which looked somewhat like a large footprint, and since they have been told that Christ came to this earth, they say they know it to be true.

In addition to the tradition given in connection with gambling (see III, 10, A) they also have a tradition that when the Son of God walked over this land, as He was walking on the beach, north of the mouth of the Skokomish River, He slipped, and because of it He cursed the ground, and it has been a salt-water marsh ever since,

as it is now; also that in crossing a stream down the canal, which was very full of fish, He slipped again, and then cursed the stream, and hence fish never go up this stream, though they inhabit all others.

Resurrection of the dead.—None according to their old ideas; the spirit went to the spirit-land; the body was not raised in this world, but gradually, as it decomposed, was taken there also.

Retribution.—That the wicked will be turned into a rock or animal, formerly. Now, most believe in future punishment as taught in the Bible.

Merit and demerit in sight of Deity.—All were good except the very bad, formerly. They had no dividing line. The Great Spirit divided the good from the bad at death.

Eternity of happiness and woe.—Happiness was eternal. The wicked were turned into a rock and always remained so, or into an animal, as long as it lived. At present most believe in the eternity of happiness and woe, as taught in the Bible.

Progress in religion.—It is but four years and a half since the first Protestant services were held among them. About twenty-three years ago, a Roman Catholic priest taught them a little and baptized some; but this instruction was given up a long time ago, and most of them have given up their belief in it. When the present Indian policy began, four and a half years ago, this reservation was turned over to the Congregationalists under the American Missionary Association. The attendance on the sabbath services has been increasing every summer, the Sabbath attendance averaging about eighty during the past summer (1875). In the winter there are not so many, as most of them live from one to three miles away, and the weather is often bad. One of their number has united with the church here, and there are others whom I believe to be Christians. Most of them say they believe the Bible is true, and that Christ came to this world; but still they cling strongly to their *tamanamus*, some of them I think as a religion, and some merely as a superstition. The ideas of many in regard to the Bible are dim yet, even respecting the most important truths, and this is not strange when we remember that they cannot read. They are in a transition state in this respect, as in many others.

ART. V.—NOTES ON A COLLECTION OF NOCTUID MOTHS MADE
IN COLORADO IN 1875 BY DR. A. S. PACKARD, JR.

BY AUG. R. GROTE.

A small collection of *Noctuidæ* made in Colorado is here determined. It is doubtful that it offers anything peculiar to the region, so little is known with regard to the distribution of our *Noctuidæ*, although a new species of *Hadena* is here described. The species of *Agrotis* noted have a wide range. A single *Anarta* indicates a new species, but the specimen is imperfect. No species of *Oncocnemis* are included. This genus is interesting from its distribution. Lederer, in 1857, recorded four species from the Ural and Altai. From collections made in Colorado by Mr. Theo. L. Mead, I was enabled to announce the discovery of the genus in North America (Bulletin Buffalo Soc. Nat. Sci., i, 105 *et seq.*). I have described four species from Colorado, two of which, *hayesi* and *dayi*, have yellow secondaries, like the species of *Agrotis*, formerly referred to *Triphena*. We have this yellow color to the hind wings constantly recurring in different genera in this group. In *Mamestra*, we have *M. flava* Grote; in *Anarta*, *A. cordigera*, with yellow secondaries. Besides these four species of *Oncocnemis*, a fifth, which I have not seen, has been described from Colorado, under the name of *O. meadiana* Morr. Of these five species, the range of *O. chandleri* Grote has alone been extended by subsequent discoveries. Mr. Fred Tepper has taken on Long Island specimens which I refer to this species, and it has occurred in the vicinity of Buffalo, N. Y. *O. chandleri* seems to offer a variation in the distinctness of the markings of the primaries without the possibility of establishing intermediate grades; the typical specimen was strongly marked with black; the eastern material, being faintly marked, has unnecessarily given rise to a varietal name. In addition, I have described a Californian species, *O. behrensi*, allied to the European *O. confusa*. I add here a new form from Nevada.

It has also been found by Dr. Harvey that *Copihadena atricollaris* from Texas belongs to this genus; while another species, *Onc. augustus* Harvey, has been described from the same locality, while I have added to the genus *O. occata* Grote from Texas and California, and *O. saundersi* Grote from Ontario, Canada. As thus constituted, we have eleven North American species, separable generically from *Agrotis* Hübn. by the middle and hind tibiæ being without spinules, and by the anterior tibiæ being provided with a terminal claw; and from *Adita* Grote by

the first-named character. The naked eyes separate the genus from *Mamestra* Ochs.; the tibial claw, from *Hadena* Schrank. As so constituted, the genus comprises species of varying pattern of ornamentation: *dayi* and *hayesi* might, at first sight, be taken for species of *Anarta* allied to *cordigera*; *behrensi* and *glennyi* resemble the European species of the genus; *augustus* has a strong resemblance to some of the species of *Agrotis*, so also *chandleri*; *atricollaris* resembles the species of *Homohadena*; *occata* and *saundersi* look much like the European species of *Cleophana*. On the other hand, the single North American species *C. eulepis* Grote, from Oregon, which I refer to *Cleophana*, resembles greatly a species of *Oncullia*. The gray, striate, and long primaries deceive one until the fore tibiæ are seen to be provided with a claw, and then the essential characters of *Cleophana*, the hooded collar and armed fore tibiæ, are apparent.

It will be seen that the genus *Oncocnemis* in North America is not restricted to a mountainous country, although the majority of the species yet known inhabit elevated lands. Nothing is known of the food-plants or the larvæ, even of the European species. To this point, the attention of collectors in Colorado is invited.

The following is the synonymy of the North American species of *Oncocnemis*:

1.—ONCOCNEMIS DAYI.

Oncocnemis dayi Grote, Bull. Buff. Soc. N. Sci., i, 105, plate 3, fig. 8.

Habitat.—Colorado (Mr. Theo. L. Mead, No. 17). In this and the following species, the hind wings are yellow, and this color obtains on the under surface of both primaries and secondaries.

2.—ONCOCNEMIS HAYESI.

Oncocnemis hayesi Grote, Bull. Buff. Soc. Nat. Sci., i, 106, plate 3, fig. 13.

Habitat.—Colorado (Mr. Theo. L. Mead, No. 18).

3.—ONCOCNEMIS GLENNYI.

Oncocnemis glennyi Grote, Bull. Buff. Soc. Nat. Sci., i, 141, plate 4, fig. 17.

Habitat.—Colorado (Mr. Theo. L. Mead, No. 36, taken July 20).

4.—ONCOCNEMIS BEHRENSI.

Oncocnemis behrensi Grote, Bull. Buff. Soc. Nat. Sci., ii, 65.

Habitat.—California (Sanzalito, February 10 to 14). Taken by Mr. James Behrens. This species is allied to the European *Oncocnemis confusa*.

5.—ONCOCNEMIS AUGUSTUS.

Oncocnemis augustus Harvey, Bull. Buff. Soc. Nat. Sci., iii, 73, plate 3, fig. 5.

Habitat.—Bosque County, Texas (Mr. Belfrage, No. 524, October 7).

This species presents a casual resemblance to Millière's figure of the European *Heliothobus hispidus*, but the antennæ are impunctate.

6.—ONCOCNEMIS CHANDLERI.

Oncocnemis chandleri Grote, Pull. Buff. Soc. Nat. Sci., i, 107, 142, plate 3, fig. 9.

Oncocnemis chandleri var. *riparia* Morr., Can. Ent., vii, 213.

Oncocnemis chandleri Grote, Bull. Buff. Soc. Nat. Sci., iii, 87.

Habitat.—Colorado (Mr. Theo. L. Mead, No. 27, August 31); Nevada (Mr. Hy. Edwards, No. 2739); Buffalo, N. Y. (Miss Mary Walker); Long Island (Mr. F. W. Tepper). This species has an extended range. My original figure represents a strongly-marked specimen. Eastern examples have less black on primaries (*riparia*), but there is hardly room for a varietal term.

7.—ONCOCNEMIS MEADIANA.

Oncocnemis meadiana Morrison, Proc. Acad. Nat. Sci. Phil., 1875, 60.

Habitat.—Colorado (Mr. Theo. L. Mead, No. 47, taken August 18). I have not seen this species. Its description is subsequent to that of *O. occata*, which this somewhat resembles.

8.—ONCOCNEMIS OCCATA.

Cleophana occata Grote, Trans. Am. Ent. Soc., 5, 114.

Oncocnemis occata Grote, Bull. Buff. Soc. Nat. Sci., 3, 77, 87, plate 2, fig. 6.

Habitat.—Texas (Mr. Belfrage, May 13, No. 96; and April 29, No. 487); California (Mr. Hy. Edwards, No. 4473).

9.—ONCOCNEMIS SAUNDERSIANA.

Oncocnemis saundersiana Grote, Can. Ent., 8, 29.

Habitat.—Canada (Mr. J. Pettit, Grimsby, Ont.).

10.—ONCOCNEMIS ATRICOLLARIS.

Homohadena atricollaris Harvey, Bull. Buff. Soc. Nat. Sci., ii, 273.

Copihadena atricollaris Morrison, Can. Ent., vii, 91.

Oncocnemis atricollaris Harvey, Bull. Buff. Soc. Nat. Sci., iii, 73.

Habitat.—Texas (Mr. Belfrage, No. 92, March 12).

The long claviform (recalling that of *O. chandleri*) is visible below the median longitudinal stripe.

11.—ONCOCNEMIS OBLITA n. s.

Fore tibiae with a short claw. Fore wings hoary gray, with pale brown shades on disk across the reniform and on submedian interspace. Lines obliterate. Orbicular elongate, with fine white annulus. Reniform dark, narrow and lunate above, below joined to a white patch on median vein, bordered with dark scales above and stretching backward so that the whole spot is L-shaped. Claviform curved, very long, reaching to the t. p. line, bordered with white, wide and prominent. T. p. line barely indicated by a gray shade, produced opposite the cell, curved inwardly below the median vein. Subterminal line composed of blackish spots in a whitish internervular shade, situate very near the margin.

Hind wings pale fuscous with white fringes. Thorax and head gray, being composed of black and white scales. Abdomen pale fuscous. Fore wings pointed at apices, with straight costal margin. Wings hoary beneath. Expanse 30 mil.

Habitat.—Nevada; from Dr. J. S. Bailey. In color and ornamentation, this species resembles the genera *Morrisonia* and *Actinotia*. In its present position, it comes nearest to *O. chandleri*.

The collection before me contains the following species of *Noctuidæ*:—

Agrotis saucia (Hübner).

One specimen, "Manitou, July 15".

Agrotis auxiliaris Grote.

Two specimens, "Pike's Peak"; one (apparently accidentally stained) is also labeled "Manitou, at light, July 14". This species was originally described from Colorado. Specimens from Texas have been since received. The form originally described is strongly marked, dark-colored, with the stigmata and sometimes the costa whitish or gray. The three specimens determined above belong to this typical form. Two other specimens in the present collection belong to a form of this species, first collected by Mr. Jas. Ridings in Colorado, and described by me in the Proc. Acad. N. S. Phil., 1875, 422. In this variety, which I call *agrestis*, the ornamentation is not contrasted, the color is paler, the stigmata are not filled with gray, and the insect bears a certain resemblance to *A. messoria* Harr. The two specimens in the present collection of this form are ticketed "Pike's Peak". The primaries above are shaded with brown.

Agrotis atro-purpurea Grote.

Through the kindness of Mr. S. H. Scudder, I have been able to compare my material with the specimen of *tessellata* in the Harris collection, now in the museum of the Boston Society of Natural History. Harris's species is shown to be the equivalent of *maizi* of Fitch, as I previously considered it in my check-list, November, 1875. Mr. Mead has collected the typical *tessellata* in Colorado, his specimen being numbered "58". The present form may not prove ultimately specifically different. Specimens from Albany (Lintner, No. 3707) and the East agree with one in the present collection, ticketed "Denver, June 27", in being blackish, with a purple cast, darker and smaller than *tessellata* or *campestris*, with the lines obliterate and the stigmata picked out by gray scales. The same gray scales mark the lines as far as these are visible. The black filling on the cell is distinct. This completes the separation of four closely-allied forms, *tessellata*, *atro-purpurea*, *campestris*, and *albipennis*. *Campestris* seems to be generally regarded as a valid species, and possibly of this *albipennis* is only a variety with white secondaries. In the task of separation of closely-related forms, we have to test differences and agreements at first by their persistency, in considering the advisability of bestowing a fresh name on groups of individuals.

Hadena diversilineata n. s.

Female.—This species is well sized, with naked eyes and unarmed tibiae. It is purplish gray, and resembles the species of *Apatela* in that there is a short, black dash crossing the median shade and transverse posterior line (which are very near each other) on submedian space. It resembles the Californian *olorina* in the shape of the subterminal line; this is followed by a blackish shade following its indentations and rendering the usual W-mark apparent. Lines blackish. A short basal dash. T. a. line slightly waved, a little outwardly oblique. Orbicular very small and pale. Reniform, large or well sized, outwardly indented, pale, shaded with rufous. Median shade strongly angulated; commencing at costa between the stigmata and appearing at the outer and lower extremity of the reniform, thence, approximate to the t. p. line, to internal margin. T. p. line a little notched, nearly even, followed by a pale gray shade. Hind wings whitish, with a central line and gray borders. Collar with a faint line. Thorax gray; abdomen pale gray, with a black basal tuft. Beneath, whitish gray, with obliterate markings. One specimen expanding 42 mil., ticketed "Manitou, at light, July 14". The species bears a certain resemblance in color to *Apatela albarufa* Grote.

Heliophila prae-gracilis n. s.

The most slender species of the genus. Eyes hairy. Smaller and slighter than *pallens*. Yellow-white, not buff as in *pallens*, absolutely immaculate. Head and thorax more yellowish. Length of primary 12 mil. One specimen, Idaho, "July 6". This species seems slighter than *Senta defecta* Grote.

Plusia simplex Guenée.

One specimen. "Arapahoe, 11-12,000 ft. elevation." Does not differ from eastern specimens.

Anarta sp.

One specimen. "Pike's Peak, 13,000 feet, July 12, Packard." The specimen is too much injured to describe. It has a greater admixture of pale, whitish hair, than in any species known to me. The eyes are hairy; ocelli present. The latter character should be observed, since it distinguishes the Heliothid genera from *Brephos* and allies.

Lygranthæcia jaguarina Guenée.

"Denver, June 27."

Heliothis phlogophagus G. & R.

"Denver, June 27." Two specimens.

Tarache angustipennis Grote.

"Denver, June 27."

Drasteria erichthea Cramer.

"Salt Lake City, July 21." One strongly-marked specimen.

Renia Guenée.

In this genus, the male antennæ are provided with a tuft of hair at

apical fourth. In the present collection, there are four specimens apparently referable to this genus. One of these indicates a new species (Boulder, June 29); but since the limits of variation are wide in the genus and as yet little understood, it would be unadvisable to increase the number of species from such scant material.

Zanclognatha cruralis Guenée.

“Manitou, July 12.”

Scoparia centuriella (S.V.).

“400 feet above Georgetown, July 8.”

In the present collection there is also a specimen of this Pyralid, which has an extended geographical distribution, being also found in Europe.

ART. VI.—THE TINEINA OF COLORADO.

BY V. T. CHAMBERS.

Descriptions and notes of many of these species have heretofore been published in the Cincinnati Quarterly Journal of Science, and in the Canadian Entomologist. It has, however, been deemed best to give a list of the species, with brief notes upon them, in the present paper, which, with the new species now first described, presents a compendium of all that has been published upon the subject to this time.

Pronuba yuccasella Riley.—Very abundant in the flowers of “soap-weed” (*Yucca*) as high up on the mountains as 7,000 feet, in the vicinity of Colorado Springs. Mr. Riley says (Fifth Annual Report Noxious and Beneficial Insects of Missouri, p. 151), “Front wings uniformly silvery white”, but at least half of the numerous specimens observed by me in Colorado had the wings more or less spotted with black (like *Hyponomeuta*, to which in the form and neuration of the wings it seems somewhat allied, though its affinities seem to be rather with the true *Tineida*; it is, however, *sui generis*). These spots vary in number from 0 to 13, and when all are present are arranged as follows: one (the largest) at the end of the disk, with three others before it, making a coffin-shaped figure; one on the dorsal margin before the cilia; and eight others around the apex. The one at the end of the cell is found oftener than any of the others, and those around the apex oftener than the other four. The expanse of wings is given by Mr. Riley at 1.00 inch for the ♀ and 0.90 inch for the ♂. The largest ♀ specimen observed by me scarcely exceeded 10 lines and the smallest ♂ was scarcely 6 lines, so that it seems to attain a greater development of wings in the East than in the West, contrary to the rule said by Prof. Baird, Dr. Packard, and others to prevail among other insects and birds.

A large proportion of the seed-pods examined by me, fully one-third, showed no trace of the larva.

Anesyehia mirusella Cham. (Can. Ent., vol. vi, p. 233).—First described from Texas, from numerous specimens, all of which seem to have been somewhat faded, or are a little different from the Colorado specimens. In these, the outer surface of the second joint of the palpi is dark-brown, the inner surface white; third joint white, with the tip and a wide annulus in the middle brown; antennæ fuscous; head, thorax above, and patagia white; a brown spot on the middle of the anterior margin of the thorax, and four others, two on each side, one of them about the

middle and the other before the tip; costal margin and dorsal half of the fore wings white; a wide brownish-ocherous basal streak occupying the remaining portion of the wing from base to tip. In the white of the dorsal margin before the middle is a small brown spot, and there are some others extending around the apex, four of them on the dorsal, three on the costal side; cilia white; hind wings and cilia pale fuscous; abdomen stramineous; anal tuft yellow; legs sordid grayish-white. Expanse of wings, $\frac{11}{16}$ inch. Edgerton, among oaks; altitude, 6,500 feet.

A. discostrigella n. sp.—Allied to the preceding species, but having the fore wing of nearly the same general color with the wide basal streak of that species, and the margins not white; this color may perhaps be called a purplish-gray, with a slight ocherous tinge in this species, and it is sprinkled with white. The scales are fine. A white streak extends along the fold, and contains three blackish streaks, the first near the base, the last about the middle. Above the fold is a narrow, wavy, blackish line, margined with white, ending, at the end of the cell, in a distinct blackish spot, beneath which is a white spot, margined behind by another small black spot, and a row of black spots around the base of the cilia, which are white. Head and upper surface of thorax white, with a black spot on the anterior margin of the thorax, a small one on each of the patagia, and two others (one about the middle, and before the tip on each side of the thorax); antennæ with alternate annulations of white and black, the white prevailing in the basal and the black in the apical portions; palpi white, the second joint dusted externally with black, with a black annulus near the tip, and the tip of the third joint blackish; abdomen and anal tuft ocherous-yellow; legs blackish on the anterior, and ocherous-yellow on the hinder surface. Expanse of wings, 1 inch. Edgerton, among oaks; altitude, 6,500 feet.

To the naked eye, the fore wings appear of a watery-gray or leaden hue, with a row of white spots along the middle, each margined by one or two smaller blackish spots, and a row of black spots around the apex.

Nothris? bimaculella n. sp.—Third joint of palpi slender and much longer than the second, pointed; second joint with a brush, as in *N. verbascella*; hind wings trapezoidal, wide, not incised beneath the tip. Pale creamy-yellow, with a silky luster, with a minute brown spot on the fold and one at the end of the cell; outer surface of the second joint of palpi fuscous. Expanse of wings, 8 lines. Edgerton, in June.

Harpalyce tortricella Cham. (Can. Ent., vol. vi, p. 235).—A single damaged specimen was taken among scrub-oaks. I am convinced, however, that it is identical with the Texas species.

This generic name, of course, cannot stand. How I came to overlook the fact that it was pre-occupied among *Geometridæ*, by Stephens, need not now be explained.

Plutella cruciferarum Auct.—Captured on Bertboud's Pass. Altitude about 11,500 feet.

Gelechia serratipalpella n. sp.—From the peculiar structure of the palpi, this species will probably be excluded from the true *Gelechia*; they resemble those of *G. gallasoliā aginis* Riley, except that the scales along the lower edge or surface are arranged like the teeth of a saw, more especially those of the second joint, as in *gallasolidaginis*, both the second and third joints are laterally compressed, the third joint having a blade-like form. In this species, the tip of the third joint projects as a minute point beyond the scales. Hind wings sharply emarginate beneath the tip, and again a little so behind the anal angle (that is, there is a slight projection, or tooth, between the tip and the anal angle, and another very little one *at* the anal angle). Both pairs of wings rather narrow. Palpi, head, thorax, and antennæ gray (under a lens of higher power they appear pale-gray, dusted with brown), with one or two faintly-indicated pale gray annuli on the palpi, and the antennæ are alternately annulate with pale gray and brown. Fore wings pale orange-yellow, the base and the dorsal margin to and around the apex gray; cilia of the costal margin and the extreme costal margin to the base also gray; base of the cilia dusted with brown, and the orange-yellow of the apical part of the wings is also sparsely dusted with brown. At the base of the wing, the gray portion is externally margined with brown, and the gray of the hind margin sends three small projections, or teeth, into the yellow. One of these projections is beneath the fold before the middle of the wing-length; the others are above the fold, one of them about the middle of the wing-length, and the other a little farther back. Each of these projections is tipped with brown scales, and immediately behind the last one the usual costal and dorsal spots, the dorsal being the largest, are indicated by a paler gray than that of the surrounding portion of the wing. In the cilia, at the apex of the wing, is a small brown spot, and there are one or two others before it in the costal cilia. Hind wings pale leaden-gray, with pale stramineous cilia. Legs and abdomen gray, the tarsi annulate with white. Lower surface of abdomen pale-gray; anal tuft white. Expanse of wings, $7\frac{1}{2}$ lines. Edgerton, in July.

G. pedmontella n. sp.—Resembles the preceding species somewhat structurally and slightly in the pattern of ornamentation. Palpi but little compressed laterally; third joint not blade-like, but with the point projecting, as in the preceding species; second joint serrated, but less distinctly so than in *serratipalpella*. Both pair of wings rather narrow, the hind pair sharply emarginate beneath the apex, but the margin not toothed. Palpi dark reddish-brown, marked with white, especially along the upper and inner surface of the second joint, and forming an indistinct annulus on the third joint. Head, upper surface of thorax, and the antennæ rich brown. Fore wings red-brown or maroon color, sparsely dusted with dark-brown on the disk, but densely so along the margins, especially in the apical part of the wing, where brown is the prevailing hue and is dusted with white: cilia of the hind margin of a

pale smoky hue. Hind wings pale leaden-gray, with stramineous cilia; abdomen above of the same hue with the fore wings, but paler, and the under surface gray and reddish-brown mixed; anal tuft silvery-gray; legs and tarsi dark reddish-brown or brown, the tarsi annulate with white. Expanse of wings, $\frac{9}{16}$ inch. Edgerton, June.

G. glycyrhizæella n. sp.—I hesitate about giving this species this specific name, because of some doubt whether it really feeds on *Glycyrhiza lepidota*, although it—a single specimen—and only it, came from a collection of leaves of that plant, with larvæ of a *Gelechia* feeding on them. The larvæ and their mode of feeding seemed to me to be identical with others feeding on an allied plant, *Amorpha fruticosa*, and from which I bred the very different species described (*post*) as *G. amorphæella*.

In ornamentation, this species resembles that just described (*G. pedmontella*), but is paler, larger, and with wider wings, and the palpi are very different, not being at all compressed or serrated; the second joint is brush-like and longer than the third; hind wings emarginate beneath the apex. Second joint ochereous, paler on the inner side, brownish on the outer surface; third joint brown, with a whitish line along the inner surface; head ochereous, each scale tipped with blackish; antennæ brown; upper surface of thorax and fore wings yellowish-ochereous, the wings dusted densely with brown and somewhat with white along both margins, the dusted portion on the dorsal margin wider than that on the costal margin; cilia whitish or pale ochereous, dusted with fuscous, the dusting forming three hinder marginal lines, one before and one behind the middle of the cilia, and a fainter one at the tip; hind wings of a pale leaden hue, with pale stramineous cilia. Upper surface of abdomen and anal tuft ochereous, the under surface of the abdomen ochereous, dusted with fuscous, as are also the legs and tarsi. Expanse of wings, 8 lines. Edgerton, July and August.

G. amorphæella n. sp.—Bred from larvæ sewing together the terminal-leaves of young specimens of *Amorpha fruticosa*, and, as stated above, supposed to be the same larva found feeding in the same way on *Glycyrhiza lepidota*. It may therefore turn out, either that these four specimens did not come from the larva feeding on *Amorpha*, or that the species described above did not come from the larva on *Glycyrhiza*.

Second joint of the palpi brush-like; hind wings slightly emarginate. Dark steel-gray, with two minute darker spots, one on the disk, the other at the end of the cell; under surface of abdomen yellowish. Expanse of wings, $8\frac{1}{2}$ lines. Edgerton, July and August.

Larva.—Head and next segment pale straw-color, the hind margin of the first segment brown, and with two small black spots on top of each of the first three or four segments; five longitudinal pale purplish stripes beginning on the second segment. It becomes bright pinkish-red before becoming a pupa.

A captured specimen which I believe belongs to this species has the head and palpi paler than the thorax.

G. equipulvella Cham. (Can. Ent., vol. iv, p. 192).—Two specimens taken at Edgerton in June. A widely-distributed species, having been heretofore described from Kentucky, Texas, and California. It is possible, however, that two closely-related species have been confounded by me.

G. rososuffusella Clem. (Proc. Acad. Nat. Sci. Phila., 1860).—Rare in Colorado. Two specimens taken at Edgerton in July. As widely distributed as the preceding.

G. monumentella n. sp.—Second joint of palpi with the scales thickened beneath, hind wings excised beneath the tip. Pale ochreous, irrorate with pale gray, with several small fuscous specks on the fore wings, two of which are on the fold, and a series of indistinct ones around the base of the cilia; fourth, fifth, sixth, and seventh segments of the abdomen fuscous on top, and segment pale straw-color; tarsi brown, annulate with whitish; hind wings pale fuliginous. Expanse of wings, $6\frac{1}{2}$ lines. Monument Park, June.

G. trilineella n. sp.—Second joint of the palpi with a divided brush, the scales of the brush longest at the base and gradually shortening to the apex; third joint rather slender, pointed, and about as long as the second. Hind wings excised beneath the tip. Gray; face and inner surface of palpi pale or whitish-gray; thorax gray, with a narrow line along its middle, and one at the patagia darker gray. Upper surface of the fore wings suffused with whitish-gray, with three short black streaks, one of which is about the middle of the fold, another (sometimes this one is interrupted) about the middle of the disk, and one at the end of it; sometimes this latter one is absent. At about the apical third of the wing-length is a dark spot or streak of irregular form and not very definitely outlined, and behind it an angulated fascia, formed by the usual opposite costal and dorsal spots touching or nearly touching each other, is indicated by a paler or whitish-gray portion of the wing; it is much more distinct in some specimens than in others; behind it, nearly to the apex, the wing is darker than before it, but becomes whitish again around the apex, with an indistinct dark spot at the apex. Cilia gray, with a dark hinder marginal line at their base, and dusted with dark scales. In some specimens, the courses of the veins beyond the cell in the dark apical portion are indistinctly marked by still darker lines. Scarcely any two specimens are alike in the marks on the wings, some being much darker than others; some have a distinct fascia, nearly straight; in others, it is angulated, or not distinct, and in some only traces of the opposite costal and dorsal spots are visible, and in some the hinder marginal line is not distinct from the dusting of the cilia. In all my specimens, however, the black longitudinal lines on the fold and disk are distinct. Hind wings pale fuscous or smoky, with pale stramineous cilia; abdomen pale yellowish above, pale gray dusted with darker scales beneath; legs gray; tarsi annulate with white. Expanse of wings, 8 lines. Edgerton, in July. It shows strong affinities with *G. depressostrigella* Cham. from Texas. •

G. ? ocellella n. sp.—Second joint of palpi with a tuft, as in the ♀ *Anarsia*, except that it does not project quite so far forward; something between that of *Anarsia* and *Chelaria*, as figured in Ins. Brit., v. 3. Hind wings slightly emarginate beneath the apex; third joint of palpi smooth and pointed, and as long as the second antennæ, slender, simple, with close-set joints, not denticulate. Basal half of outer surface of second joint of palpi blackish, apical half whitish, the two colors distinctly marked, and not shading into each other; inner surface pale gray; third joint pale gray, except the outer surface at the tip, which is blackish; antennæ dark gray; head, thorax, and fore wings pale gray, the course of the veins beyond the cell distinctly marked by dark lines, the discal cell dark gray, with a nearly circular disk, central whitish spot containing a dark gray pupil; abdomen pale gray above, whitish beneath, with a dark line along each side; on the upper surface of each of the first three segments are two ochereous yellow spots separated by a dark gray line; legs brownish. Expanse of wings, 9 lines. A single ♀ taken at Edgerton in July.

G. ? anarsiella n. sp.—This species, which is quite common about Edgerton in June and July, has very much the appearance of an *Anarsia*, though the brush of the second joint of the palpi scarcely projects enough in front, being almost exactly as in *G. ocellella* (*supra*). Eight specimens before me are all ♀. I have not seen the male. The antennæ are slender and not denticulated. The neuration of the hind wings is the same with Mr. Stainton's figure (Ins. Brit., v. iii) of that of *G. rufescens*, except that in this species the cell is closed; that of the fore wings is identical with *Nothris verbascella*. A worn specimen of this species (?) was also taken at Twin Lakes, altitude 10,000 feet.

The hind wings are sharply emarginate beneath the tip. Dark steel-gray except a whitish spot on the second joint of the palpi; white annulations on the tarsi and two or three microscopic whitish specks or white scales scattered over the wings, and the cilia are pale-gray, dusted with dark gray or blackish scales. Hind wings of a bluish smoky hue, with paler cilia. Expanse of wings, $7\frac{1}{2}$ lines.

G. ochreostrigella n. sp.—Palpi robust, not very long, with the scales of the second joint divided beneath, but scarcely forming a brush; third joint with the tip suddenly sharpened; hind wings emarginate beneath the tip.

Several attempts to describe this species without looking at the previous trials have each given a different account of the wings. Under a strong lens, the color appears to be hoary, almost white, but so densely dusted with brownish as to obscure the ground-color, and streaked with ochereous; under a lower power, it appears pale grayish, tinged with ochereous, and with the ochereous streaks still distinct, and with some short blackish streaks; while to the naked eye it appears very pale gray, tinged with ochereous. Under the lens, the two most distinct ochereous streaks are one along the fold and one from the base within the costal

margin, and one along the hinder portion of the cell, which contains two small dark spots, one of which is at the end of the cell; both of these spots, however, are sometimes wanting. Hind wings pale grayish, with stramineous cilia. Antennæ whitish, annulate with brown. Head and thorax of the general hue of the wings or more ochereous; outer surface of the second joint of palpi densely dusted with brownish, and two brownish annuli on the third joint. Expanse of wings, $6\frac{1}{2}$ lines. Edgerton, June.

G. bicostomaculella n. sp.—Palpi slender and simple; antennæ robust, with the joints very distinct; hind wings scarcely emarginate beneath the apex. Second joint of palpi pale yellow, marked externally with fuscous; third joint fuscous, with the tip and an annulus about the middle yellow; antennæ fuscous, annulate with yellow; face yellow; vertex and thorax brown. Fore wings pale creamy-yellow, with a silky luster, very sparsely (microscopically) dusted with fuscous, with the base, a small triangular costal spot before the middle, and a large one behind the middle brown, and a line of brown scales around the apex. Hind wings paler than the fore wings; abdomen and legs pale yellowish, the tarsi annulate with brown, and the tibia stained with fuscous on the outer surface. Expanse of wings, 7 lines. Edgerton, in July.

G. triocellella n. sp.—Second joint of palpi with a spreading brush; third joint about as long as second; posterior wings incised beneath the tip. Brownish-gray; second joint of palpi white on inner and upper surfaces; third joint with a large white spot on top about the middle and a minute one close to the apex; antennæ annulate with whitish. On the fore wing are three ocellated spots, one on the disk, one at the end of the disk, and one on the fold; they are ochereous, with a brown pupil; a small ochereous basal streak near to the costal margin; hind wings pale grayish, with a slight fuscous tinge; legs and under surface of the body whitish, densely dusted with gray-brown. Expanse of wings, $\frac{1}{2}$ inch. The ocellated spots on the fore wings are indistinct to the naked eye. It is the most common "micro" about Edgerton in June.

G. concinnisella Cham.—Formerly described from Texas (Cin. Quar. Jour., vol. ii, p. 253). By some mistake the alar expanse is there stated to be $\frac{3}{16}$ th inch; it should be $\frac{9}{16}$ th. It may prove to be identical with *G. apicistrigella* Cham. from Kentucky, but I think not. *Apicistrigella* is silvery white, suffused with pale yellowish, while this species has the fore wings suffused with fuscous, especially the apical half, but it is white at the apex, while *apicistrigella* has the apex suffused with reddish-ochereous. In *apicistrigella* there are three short white costal streaks following the long oblique one; in this specimen there are only two, which are scarcely visible (owing to denudation?) in the Texas specimens. The "apical spot, or dash", is just within the dorsal margin, not strictly at the apex, and margins posteriorly the white of the apex. Edgerton, June.

G. collinusella n. sp.—Thorax, head, palpi, and antennæ white, the outer surface of the second joint of the palpi with two small patches of brownish dusting, the antennæ annulate with brown, and the thorax faintly stained with pale yellowish. Fore wings very pale yellow, almost whitish, with three whitish fasciæ not very distinct from the surrounding parts of the wing, except by the brownish scales with which they are dusted; the first is about the basal fourth, the second about the middle, and the third just before the cilia, and each of the first two contains a small brownish spot placed just above the fold; apex and cilia sparsely dusted with brownish scales. Hind wings pale fuscous, with paler cilia *excised beneath the tip*. Abdomen pale fuscous above, white beneath; anal tuft white. Expanse of wings, nearly 8 lines. Foot-hills near Edgerton; altitude about 7,000 feet.

G. galle-solidaginis Riley.—Specimens bred from galls in *Solidago* gathered in Middle Park (altitude 8,000 feet) in August are smaller and with the markings much less distinct than those from the Mississippi Valley. See remarks in Cin. Quar. Jour. Sci., vol. ii, p. 290.

G. 10-maculella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 290); *G. 4-maculella* Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 290); *G. 8-maculella* Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 291); *G. albimarginella* Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 291).—All captured at Spanish Bar in July and August; not met with elsewhere except a few specimens of the last two taken in Middle Park.

G. ribesella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 290).—A pretty species, the larva of which sews together the leaves of the red wild currant in the mountains. Altitude, 8,500 feet.

Larvæ of Gelechia.—Several larvæ of this species were met with which I did not succeed in rearing to the imago. One of these feeds on the leaves of *Thermopsis montana*, sewing many of them together in a bunch. It is pale greenish-white, head stramineous, next segment pale stramineous, and has five greenish-yellow or sometimes almost reddish longitudinal stripes extending over the other segments.

Another when very small mines, and when older sews together, leaves of *Physalia viscosa*. It has the head and next segment piceous, and on each of the other segments six minute black spots (two behind the other four), and in the latter part of June is one-fourth inch long. Young specimens scarcely show the black spots. It is at first pale greenish, then becomes bright apple-green, and when full grown the head and upper surface of the next segment are ferruginous, divided on the segment into two spots, that segment and the next one being bright apple-green and the remaining segments purple. I have little doubt that it is the larva of *G. physaliella* Cham., heretofore described from Kentucky.

Another feeds on oak-leaves. Head and next segment reddish stramineous or pale ferruginous. Next three segments green, remainder

yellowish-white, four small black spots on each segment, and six longitudinal purplish lines.

Another was taken at the highest altitude at which any Lepidopterous larva was observed; that is, at an altitude of nearly 12,000 feet. The timber-line on Mount Elbert, where this larva was found, is given by Hayden (Report, 1873) as 11,871, but the dwarfed and stunted willows usually extend along the courses of the little rivulets some feet higher than timber-line as popularly understood (that is, the limit of growth of trees—pines and aspens). Feeding on the leaves of these dwarfed willows, and sewing them together in little bundles, I found this larva, but, unfortunately, did not succeed in rearing it (one pupa still living may produce an imago next spring). It is at first green, but as the larva gets older it becomes dark olive-green, with the black tubercular spots placed 4-2. Head and upper surface of next segment black. It attains about one-half inch in length.

Another larva sews together leaves of aspens, and is found up to the extreme limit of the growth of that tree. The head and thorax are dark brown, the other segments purplish-brown, with black tubercular spots placed as in the last species (*supra*), and with six longitudinal white lines extending over the other segments; length over two-thirds of an inch. Another, or probably a younger stage of the same larva, has the head and next segment pale stramineous and the other segments paler.

Another, found also sewing together aspen-leaves, but possibly the larva of a *Tortrix*, is greenish-white, with a spot on each side of each segment piceous; length, three-fourths of an inch.

Geophora boreasella Cham. (Can. Ent., vol. v, p. 189).—From near Covington, Ky., altitude about 1,200 feet; London, Ontario, Canada; and Belleview Mountain, near Idaho Springs, Colorado, altitude about 10,000 feet.

G. 4-maculella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 292).—From Spanish Bar.

Glyphipteryx montisella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 292).—A handsome and very variable species, taken in large numbers in July and August at Spanish Bar, feeding on flowers of *Helianthus* and *Heliopsis*; altitude, 7,800 feet. The food-plant of the larva is unknown. A single specimen which I believe to belong to this species was observed but not captured on Mount Elbert, at an altitude of about 10,000 feet.

Lithariapteryx abroniella Cham. (Can. Ent., vol. viii).—Among all the little gems (*Litharia*) of the entomological world, a large proportion of which belong to the *Tineina*, I know of none that surpass this species in the beauty and elegance of its adornment. As a mere object of beauty for the low powers of the microscope (say 5 to 10 diameters), it is almost unrivaled. It is also interesting structurally, for its relation to four other genera of *Glyphipterygidae*, being about equally related to *Glyphipteryx*, *Æchmia*, *Perittia*, and *Tinagma*. The imago is fond of

the bright sunshine of July and August, and may be found especially in the afternoon fluttering about the food-plant of the larva, the fragrant *Abronia* (*A. fragrans*), the leaves of which are mined by the larvæ. A more detailed account of it is given in the Canadian Entomologist.

Argyresthia montella n. sp.—Face and palpi yellowish; tuft and thorax white; antennæ fuscous, annulate with white; fore wings fuscous, the apical portion indistinctly dusted with white, and with indistinct short, white, costal streaks before the apex, each dark-margined before; the dorsal margin is white as far as the fold, and very faintly dusted; *no dorsal fuscous streak*; there is a row of fuscous scales around the base of the cilia, which at the apex have to the naked eye the appearance of a minute spot. Hind wings, cilia, and upper surface of the abdomen pale grayish; under surface of the wings grayish-fuscous, and tuft whitish; legs whitish, the tarsi stained with yellowish. Expanse of wings, 7 lines. Among scrub-oaks at Edgerton in July.

A. quercicolella n. sp.—Palpi, head, thorax, and antennæ white, the antennæ dusted with brown. Fore wings pale saffron-yellow (in some lights pale golden), with the basal fourth of the dorsal margin white, terminating in an oblique white dorsal streak, which crosses the fold; there is also a basal white streak, which extends along the fold to the dorsal oblique streak, so that with the white of the dorsal margin it incloses a basal streak of the pale saffron hue between the fold and the dorsal margin; the oblique dorsal streak is dark-margined both before and behind. The basal white streak along the margin is sometimes faintly dark-margined internally, and the one along the fold is sometimes dark-margined on both sides. Behind the middle of the wing is an oblique, white fascia, which is nearest to the base on the dorsal margin, and is dark-margined both before and behind; the space before it as far as the dorsal oblique streak is suffused with fuscous, and the costal half of the fascia is sometimes dusted with fuscous. The apical part of the wing is rather densely dusted with fuscous, and has two small white costal spots, and a dorsal one placed opposite to the first of the two, giving the appearance of a fascia, the middle of which is dusted with fuscous. Sometimes all these spots are small and inconspicuous, and the apical half of the wing is dusted with white and fuscous intermixed. Cilia pale fuscous, with the tips and a hinder marginal line at the base dark brown. Hind wings pale fuscous; both fore and hind wings dark fuscous beneath. Under surface of the body white; legs yellowish-white; upper surface of abdomen pale fuscous, with a bluish tinge. Expanse of wings, 5 lines.

The neuration of the hind wings is like that of *A. nitidella*, as figured in Ins. Brit. vol. iii; the fore wings have the apical vein furcate, as in *A. arcenthina* (*loc. cit.*), but have five instead of four veins beneath it. Edgerton, in June, among scrub-oak.

A. altissimella n. sp.—Of a leaden hue, except that the vertex is whit-

ish, the antennæ annulate with white, the palpi are a little darker than the general hue, except the under surface of the second joint, which is whitish. Cilia paler than the wings. Expanse of wings, scant 6 lines. In some lights, the fore wings appear silvery or pale golden. Taken in July, among dwarf-willows, on the side of Mount Elbert. Altitude, 11,000 feet.

A. pedmontella n. sp.—Resembles *A. bélangerella* Cham. closely, and possibly a larger series of specimens might connect them. Head and appendages white, the antennæ annulate with brown; thorax white; fore wings grayish-brown above the fold, white beneath it, the white sparsely sprinkled with grayish-brown, but in the apical part of the wing the grayish-brown is densely dusted with white; about the middle of the dorsal margin, the white is interrupted by a slightly oblique brown, nearly square spot, which extends to the fold, and is faintly outlined by whitish margins across the fold as far as the middle of the wing; there are three or four very indistinct whitish costal streaks in the apical part of the wing, scarcely distinguishable from the white dusting of that portion. A brown streak extends around the apex at the base of the cilia, interrupted by two small white spots on the dorsal margin, and by one on the costal margin, and with another one before it. (Perhaps it would be as correct to say that a row of alternate brown and white spots extends around the base of the cilia, becoming fainter the farther we proceed away from the apex.) Cilia fuscous, with an indistinct whitish hinder marginal line about their middle; hind wings grayish-fuscous, with paler cilia; abdomen fuscous; legs brown on their anterior, white on their posterior surfaces. Expanse of wings, 6 lines. Edgerton, in July, among oaks.

A. gædartella ? Linn.—This species was first recorded from this country by me on the strength of a single specimen received by me from M. Bélanger, taken at Quebec; and I then noted some points in which it seemed to differ from *gædartella* as described by Mr. Stainton. I have found it abundant in the mountains among willows and alders, and one specimen was taken among willows on the side of Mount Elbert at an altitude of about 11,000 feet. *A. gædartella* feeds in Europe on birch, and it is possible that the American insects which I have placed in the species may belong to a new species closely allied to *gædartella*, or it may be a mere variety of *anduegiella*.

A. anduegiella ? F. v. R.—Taken at Edgerton in July among scrub-oak. In all my specimens there is a short basal streak slightly diverging from the costa, and the second fascia is produced along the middle of the apical part of the wing nearly to the apex, where it is furcate, one branch going to each margin, and both branches connected by a distinct golden-brown hinder marginal line around the base of the cilia, which are tipped with golden brown. The first fascia is dark-margined on each side, the vertex is white, and the face and palpi are pale yellow-

ish. In these respects they seem to differ from Mr. Stainton's description of *anduegiella* and from Dr. Clemens's description of *oreasella*, which Mr. Stainton says is the same species; but I have little doubt they belong to that species, though the absence of apple and thorn bushes, on which *anduegiella* feeds, from that region, and the fact that these specimens were found among oaks, might suggest a doubt.

Gracilaria alnivorella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 298); *G. alnicolella* Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 298).—Both species feed in the larval state upon leaves of the black alder (*Alnus* sp.?) as far up on the mountain-sides as those plants are found—over 10,000 feet.

G. acerifoliella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 299).—The larva feeds upon the bush-maple up as high as the food-plant is found, say nearly 10,000 feet.

G. populiella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 301).—The larva feeds on leaves of aspen up to over 10,000 feet altitude.

G. negundella Cham. (Can. Ent., vol. viii, p. 18).—The larva feeds upon leaves of the box-elder at Denver; altitude, 4,500 feet. No doubt, it will be found in the states east of the plains.

G. ribesella Cham.—This species is known only in the larval condition. It folds the leaves of the red wild currant so that the folded leaf resembles exactly one folded by *Gelechia ribesella*.

G. thermopsella Cham. (Cin. Quar. Jour., *loc. cit.*).—The larva mines leaves of *Thermopsis montana*. The mine is like that of *G. (Parectopa) robiniella* Clem., which the imago resembles.

The relationship of this species to *G. bosquella* Cham., *G. (Parectopa) robiniella* Clem., and *G. (Parectopa) lespidegafoliella* Clem., affords a parallel to that of *Lithocolletis robiniella* Clem., *L. amphicarpeælla* Cham., *L. amorphæella* Cham., and *L. texana* Zell., mentioned on a subsequent page. In each genus, four very closely allied species are found feeding on allied genera of *Leguminosæ*. The species of each genus are closely allied, not only structurally and in ornamentation, but in larval habits and the character of mines made by the larvæ in the leaves. The resemblance in ornamentation, however, is perhaps scarcely so close between the four *Graciliarie* as between the four species of *Lithocolletis* (*vide post, Lithocolletis amorphæella, &c.*).

Corisceum, sp. indet.—Fifteen mines and larvæ of a species of this genus were met with in Cheyenne Cañon, but all died after spinning their cocoons. They were found upon a single bush of scrub-oak. The mine is on the upper surface, and is a *fac simile* of that made by *C. albanotella* Cham. on the under surface of white oaks in Kentucky. It is, however, a different species, I think.

Corisceum may be considered as a *Gracilaria* with tufted palpi.

Ornix.—This genus is also very closely allied to *Gracilaria*, differing from it mainly in its plainer colors and tufted vertex.

O. prunivorella Cham. (Can. Ent., vol. v, p. 50).—Described originally from Kentucky, but it is also found mining leaves of the wild cherry in the mountains up at least to 8,000 feet altitude.

Gracilaria and its allies are common everywhere, but seem to be especially numerous, both in individuals and species, in the mountains.

Coleophora argentialbella Cham. (Can. Ent., vol. vii, p. 75).—Formerly described from Texas. Taken also at Edgerton, Colo., among scrub-oak; altitude, 6,000 feet.

C. bistrigella Cham. (*loc. cit. sup.*).—Also originally described from Texas. A better description of it, however, will be found in Can. Ent., vol. ix. Taken in company with *C. argentialbella*.

C. basistrigella n. sp.—Antennæ simple; second joint of palpi with a minute tuft. Second joint of palpi white, marked with blackish scales on the outer surface; third joint with a blackish line *beneath*. Head whitish; antennæ and upper surface of thorax sordid grayish or pale fuscous; patagia and margins of thorax whitish. Fore wings pale egg-yellow, with a white streak from the base along the fold to the basal third of the wing-length; then leaving the fold, it passes backward above it as far as the end of the cell, the basal portion along the fold being margined *beneath* by a narrow brown line, and containing a small dark brown spot just before its end. The fore wings are narrowly margined along both the costal and dorsal margins from base to apex with white, the basal half of the white margins being narrowly margined internally by a line of brown scales, and the apical half by a series of brown dots or short lines. Hind wings pale grayish-fuscous; cilia of both wings pale stramineous. Abdomen brown above, whitish beneath, and tuft whitish. Hind legs yellowish, with tibia pale egg-yellow, and tarsi white. Legs of first and second pair fuscous on the anterior surfaces, with the joints and tarsi white. Expanse of wings, $6\frac{1}{2}$ lines. South Park, in July; altitude, 9,500 feet. A pretty and singularly-marked species.

C. artemisicolella n. sp.—Second joint of palpi with a small tuft; basal joint of antennæ a little enlarged. Whitish, in some lights showing a faint ochereous tinge, and the fore wings well dusted with brown scales. Head, thorax, and palpi but little dusted; antennæ white, annulate with fuscous; abdomen brown above, paler beneath; anal tuft yellowish silvery; legs fuscous on their anterior surfaces. Expanse of wings, $7\frac{1}{2}$ to 8 lines. Common in July about Twin Lakes up to about 10,000 feet altitude among sage-brush (*Artemisia*), upon which probably the larva feeds.

C. luteocostella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 294).—From Spanish Bar.

C. sparsipulvella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 294).—From Spanish Bar.

Bedellia somnulentella St.—Common in Europe and America. The

larva mines the leaves of morning-glory (*Ipomœa*). I have found it in Colorado at an altitude of over 6,000 feet.

Cosmopteryx montisella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 297).—One of the prettiest species of this splendid genus.

Batrachedra clemensella n. sp.?—Six specimens (2 ♂ 4 ♀) taken at Colorado Springs in June differ so much from two others (1 ♂ 1 ♀) taken in the valley of the Upper Arkansas on Cottonwood Creek, near Mount Harvard, in July, that I fail to recognize them as of the same species, while the resemblance is such as to make their separation as distinct species hazardous. I have not seen *B. salicipominella* Clem., but I cannot recognize either of these forms in his description. Neither have I seen *B. prœangusta* Hw., and the description in Ins. Brit., vol. iii (necessarily very brief in a work of that character), is my only means of determining whether my specimens belong to that species. Before I found the specimens from the Upper Arkansas, I had doubtfully referred those from Colorado Springs to *prœangusta*; but the resemblance of the specimens from Colorado Springs to those from the Arkansas is such that I am unwilling to separate them, while the latter differ so much from the description of *prœangusta* (*loc. cit.*) that I am equally unwilling to unite them. Both forms were found among cottonwoods, poplars, and willows. *B. prœangusta* is said to sew together the leaves of poplars, while *salicipomonella* feeds, according to Mr. Walsh, as quoted by Dr. Clemens (Proc. Ent. Soc., Phila., vol. v), in Dipterous and Teuthredinous galls in willow-leaves. Great numbers of these galls were found in willow-leaves from the foot of the mountains nearly up to timber-line, and in a few of them a Lepidopterous larva was found, but I have been unable to find my notes upon it, and cannot say whether it is the same described by Mr. Walsh or not. So, likewise, the leaves of cottonwoods, aspens, and willows are sewed together by Lepidopterous larvæ up to the limit of the growth of those trees; but none of these larvæ agree at all with Mr. Walsh's description of the larvæ of *salicipomonella*. Some of them are larvæ of *Gelechia*; some, I think, belong to the *Tortricideæ*. One of them, a greenish-white larva, with the head and a spot on each side of each segment piceous, approaches nearer to the larva described by Walsh than any of the others. *B. salicipomonella* evidently resembles *prœangusta* (as indeed Dr. Clemens states) closely; and in view of the doubt which seems to rest on the food-plant of *prœangusta*, and of the habits of the larvæ of *salicipomonella* which (on a very similar larva) Mr. Walsh found not only in the two species of galls above mentioned, but also on oak-leaves, I would suggest that all, including the Rocky Mountain species, may belong to one variable species, but for the fact that Mr. Stainton, who has seen both *prœangusta* and *salicipomonella*, makes no question (Staint., ed. Clem., *pass.*, p. 261) of their specific difference.

The specimens taken at Colorado Springs (*prœangusta*?) are sordid or ochreous white, dusted with dark grayish-brown or blackish scales, the

dusting almost equally dispersed over the head, thorax, and fore wings, but in fresh specimens it appears to be a little more dense above than below the fold, and is not quite so dense on the head. Palpi of the general hue, the second joint dark brown externally, with the tip and a band across the middle whitish third joint with two annuli, and the extreme tip fuscous; antennæ of the general hue, annulate with fuscous to a point beyond the middle, and thence to the tip fuscous, with only four or five wide whitish annuli. (Thus far the species from the Arkansas agree with those from Colorado Springs, except that the former have only two whitish annuli in the apical brown part of the antennæ.) The dusting is a little more dense on the wings of two of the six specimens than on the others; in all there is a distinct though faint golden ochereous streak along the fold, interrupted in one specimen by two fuscous dashes and in the others by one; there is another pale golden ochereous streak parallel to the fold, beginning on the disk and extending to the apex, interrupted by two brown dashes in four specimens and by only one in the other two, one of these two being the same that has two dashes on the fold; cilia whitish, those of the dorsal margin with a fuliginous tinge; hind wings of a smoky hue. Abdomen of the general hue, densely dusted above with fuscous, and with the posterior margin of each segment white without dusting; anal tuft whitish; legs dark gray-brown, annulate with white. Evidently this is much nearer *præangusta* than *salicipomonella*, but the alar expanse scarcely exceeds five lines, nearly that of *salicipomnoella*, which Mr. Stainton gives as $5\frac{1}{2}$ lines, while he gives that of *præangusta* as seven lines.

The first thing which strikes one on comparing with the above the two specimens from the Arkansas (*clemensella*) is the much greater size and darker color of the latter. The expanse of wings of these is a little over seven lines, and while the Arkansas species appear to the naked eye as of a dark gray hue, those from Colorado Springs appear whitish. In the one, the dusting almost obscures the ground color; in the other, it is scarcely apparent to the unaided eye. Indeed, I would describe the Arkansas specimens as having the thorax rather densely dusted above with dark gray-brown, and the wings dark gray-brown, sparsely dusted with white, with a narrow white streak from the base to the middle of the disk, a creamy spot on the fold almost surrounding a dark gray-brown spot, and a row of somewhat confused white spots (eight or nine in number) more or less confluent, and one at the apex; but the two specimens differ somewhat, one of them (δ) having the whole basal part of the wing above the fold creamy-white and only a little dusted with fuscous. Abdomen dark gray-brown, each segment margined behind with silvery-white, except that in the δ the anal segment is entirely brown and tuft silvery-white.

Cottonwood Creek (Upper Arkansas, near Mount Howard), altitude about 8,000 feet.

A specimen of *Batrachedra clemensella* and two of the supposed *B.*

præangusta were sent to Mr. H. T. Stainton, the English authority on the *Tineina*. Unfortunately, they were almost utterly destroyed *in transitu*. One wing, however, Mr. Stainton recognized as that of the European species *B. præangusta*. But whether it was the species referred by me to *præangusta* or that which I have called *clemensella* could not be determined. But on comparing my specimens with two of *præangusta* sent to me by Mr. Stainton, I find that my *clemensella* only differs from this species as follows:—It is a trifle larger; a larger part of the wings is dark-colored, so that in the Colorado specimens there are no blackish spots surrounded by ocherous, as in the European species, and thereby separated as distinct from the other blackish parts of the wing, but the blackish spots have, as it were, become confluent or coalesced with the other blackish parts of the wing. I therefore now refer *clemensella* to *præangusta*. Then in the very points in which the European specimens of *præangusta* differ from *clemensella*, they approach the supposed *præangusta* from Colorado; and wherein they approach *clemensella*, they recede from the supposed *præangusta* of Colorado. Thus the supposed *præangusta* from Colorado is smaller than the European species, and while they have the blackish wing-spots as in the European species, those spots can scarcely be said to be surrounded with ocherous but rather with sordid whitish, and the entire wing is sordid white, comparatively little dusted with blackish. Thus the European *præangusta* seems to be almost equally near my supposed *præangusta* from Colorado and my *clemensella*. I consider all the specimens as variant forms of *præangusta*.

Laverna? coloradella n. sp.—Guided by the analogies of the palpi, tongue, form and neuration of the wings, I place this species provisionally in *Laverna*, though the smooth wings, ornamentation, basal joint of the antennæ, and perhaps the form of the head might exclude it from that genus, which, however, as now accepted, is not very strictly limited. The vertex in this species is longer than wide, and so is the face; the basal joint of the antennæ is a little enlarged, and has a minute projecting tuft behind the stalk; tongue scaled; palpi overarching the vertex, with the second joint enlarged toward the apex and the third one pointed.

White; apical third of the primaries deeply stained with ocherous, especially along the base of the dorsal cilia, and a pale ocherous patch on the costal margin near the base extends to the fold; hind wings grayish; upper surface of abdomen grayish-ocherous, each segment margined behind with white; legs yellowish. Expanse of wings, $5\frac{1}{2}$ lines. Edgerton, in July.

Neuration of fore wings as in *L. Staintoni*, that of the hind wings as in *L. langiella*, except that this has 5 instead of 4 veins to the hind margin, and the submedian and dorsal veins more distinct, perhaps more like *Chauliodus charophilellus*.

A larva of a species of *Laverna?* burrows in the stem of *Physalis*

viscosa among the foot-hills about Edgerton. It makes a fusiform swelling in the stalk near the ground. I did not succeed in rearing the species. Four other species (*L. albella*, *L. albapalpella*, *L. guinella*, and *L. grandisella*) have also been described by me from Colorado in Cin. Quar. Jour. Sci. (*loc. cit. sup.*).

Eriphia concolorella, Cham. (Can. Ent., vol. vii, p. 55).—Formerly described from Texas. A single specimen much injured, but which I believe belongs to this species, was taken at Edgerton, Colorado, in July.

Tischeria.—Mines of two species of this genus belonging no doubt to species already well known in the Mississippi Valley were found in scrub-oak leaves near Colorado Springs.

Lithocolletis amorphavella n. sp.? or var.? and *L. amphicarpeavella* sp.? or var.?—These belong to the *robiniella* group, and entomologists will consider them species or varieties according to their ideas of what constitutes species. I have discussed this question elsewhere as to the specimens from *Robinia*, *Amphicarpeaea*, and *Asmodium*, and Dr. Clemens noted some of the differences between the species from *Robinia* and *Amphicarpeaea*, but did not consider the latter distinct from the former, and did not name it. As it seems to be an unsettled question whether they are distinct species or only what Mr. B. D. Walsh called "phytophagic varieties", it is, I think, best, or, at least, most convenient, to give them distinct names. Another allied species has been described, from Texas, by Prof. Zeller, as *L. texana*. It resembles *amorphavella* except that the latter has no white basal streak on the fold, has the first costal streak less oblique, has a minute silvery dorsal spot opposite to the last costal spot, and has a distinct apical blackish spot smaller than it usually is in *robiniella*. It (*amorphavella*) is smaller than *robiniella*, with the ground-color of the wings paler, and the dark color of the dorsal margin ceases abruptly just before the fascia. Its mine, like that of *robiniella* and all the others of the group, is white, but it is much smaller. The difference in width between the wings of *robiniella* and *texana*, as figured by Zeller, seems to me to be greater than that between *robiniella* and *amorphavella*. Indeed, Zeller's figure seems to me to represent the wing of *robiniella* a trifle too wide in proportion to its own length, and the first costal and second dorsal streaks are too distinct. In several specimens of *robiniella* (bred) now before me, the first dorsal is short, passes gradually into a silvery-gray streak, which is very oblique, and which, crossing the fold, unites with the second costal streak, forming a strongly-angulated fascia, which is produced (of the silvery-gray hue) a short distance back along the disk. This silver-gray streak is, it is true, not a clear white, like the streaks which it unites, yet it is of a different color from the surrounding portion of the wing, and in some lights glistens with a silvery-white luster. It is not represented in Zeller's figure, and that figure also represents the apical spot as a little larger and more indistinct than it is in my specimens; but, as I have elsewhere stated, it varies both

in size and form in bred specimens of *robiniella*. That which I have called above the "first dorsal streak" in *robiniella* is the one which is so denominated by Clemens; but, in fact, as I have elsewhere stated, there is on the dorsal margin, much nearer the base, and in the darkest part of the wing, another faint streak or spot which is only faintly indicated by a paler or more silvery portion surrounded by a dark margin, and which, in some lights, has a decided silvery hue. It is more distinct in some specimens than in others, and is well shown in Professor Zeller's figure. This faintly-indicated spot in *robiniella* becomes in *texana*, in *amphicarpeæella*, and in *amorphæella* a very distinct white streak, which Dr. Clemens noticed as one point in which *amphicarpeæella* differed from *robiniella*. Specimens (bred) of *amphicarpeæella* are also before me. This variety is a little larger than *robiniella*, of a richer reddish-golden hue, and the marginal streaks have a brighter silvery luster. The single specimen of *amorphæella* has no trace of a basal streak on the fold, nor has *robiniella* usually, though a few white scales are sometimes sprinkled on it. *L. texana* has a distinct white streak extending along the fold, and in *amphicarpeæella* this streak is still longer and brighter. In addition to what has been written above as to the true first dorsal streak (the one faintly indicated in *robiniella*), it is proper to add that I have bred specimens of *amphicarpeæella* in which the dark color of the dorsal margin ceased abruptly at about the basal fourth of the wing-length, and in which the remainder of the dorsal margin to the fold and as far back as the cilia is snowy white, only interrupted by a narrow oblique dark brown dorsal streak, placed about the third of the wing-length, and representing the dark margin of one of the usual dorsal white streaks; and in other specimens the true first dorsal is as faint as in *robiniella*. Usually, however, there is a greater or less proportion of white scales, intermixed with the dark color of the dorsal margins. There is as much variation in the size of the apical spot in *amphicarpeæella* as in *robiniella*, and sometimes it covers the entire apex, and in this respect both, like *amorphæella*, seem to differ from *texana*. The marginal streaks in *amphicarpeæella* are less oblique than in *robiniella*, but more so than in *texana* or *amorphæella*. The last costal spot in *amphicarpeæella* is smaller than in *texana*, and has a small dorsal spot opposite to it, in these respects agreeing with *amorphæella*. In *texana* and *amorphæella*, the first costal and its opposite dorsal streak meet, and form a not very strongly-angulated fascia; in *robiniella*, as before stated, these streaks do not distinctly meet, but are connected by a silvery-gray line, and in *amphicarpeæella* they are still more distinct.

Thus the species or varieties differ in the size of the apical spot; but as specimens of the same variety differ among themselves, this cannot be considered specific, and, besides, *texana* and *amorphæella* are not known by a sufficient number of specimens. They differ also in the distinctness of the true first dorsal streak, but neither is this specific. They differ in the presence or absence of the basal streak, but its place

is sometimes indicated in *robiniella* by a few white scales on the fold; a single specimen of *amorphavella* does not afford sufficient ground for saying that it is always absent in that variety, nor the few specimens of *texana* that it is always absent in it, while in *amphicarpeavella* it is sometimes faint and sometimes spreads over the whole dorsal margin behind the basal fourth. We cannot separate the varieties on this ground. There is a difference in brilliancy of coloring, *amphicarpeavella* being the most and *amorphavella* the least brilliant; but this may be only the effect of different food, and this may also cause the difference of size, *amphicarpeavella* again being the largest and *amorphavella* the smallest. But the remaining differences are more important; for although if the marginal streaks were equally oblique, the fact that opposite ones sometimes united and sometimes did not might easily be paralleled by other instances, yet when we find streaks so oblique as in *robiniella* and not distinctly confluent, and in *amorphavella* and *texana* streaks so nearly perpendicular to the margin, and so distinctly confluent, and also wings so much narrower in proportion to length as they are in the two latter species, we must admit that we have something more than merely accidental variations. It is at least a case of Mr. Walsh's phytophagous varieties.

L. salicifoliella Clem. & Cham. (Clem., Proc. Ent. Soc. Phila., vol. i, p. 81; Cham., Can. Ent., vol. iii, p. 163; Cin. Quar. Jour., vol. i; Can. Ent., vol. ix).

L. scudderella? Frey.—There is no doubt in my mind that Professor Frey's species is identical with *salicifoliella*. *L. salicifoliella* appears to be more common in high than in low latitudes and altitudes. I have found the larva mining leaves of aspens and willows up to near 11,000 feet.

L. alnivorella Cham. (Cin. Quar. Jour., vol. ii, p. 302).—I have not found it above 8,000 feet. There is another species which mines the leaves of a different species of *Alnus*, but which I did not succeed in rearing, the larva of which belongs to the *flat* group. (There are two larval forms in this genus; one cylindrical, and making a tentiform mine, usually on the under side of the leaf, like that of *L. alnivorella*; the other having a flat or depressed larva, which makes a flat mine, almost always on the upper surface of the leaf.) The mine has a central opaque portion containing the "frass", or excrementitious matter, with clear branches, or streaks radiating from it. I only met with it in a few instances at Manitou; altitude, 6,000 feet.

L. quercitorum Frey = ? *L. fitchella* Clem. (*Argyromiyes quercifoliella* Fitch).—*L. fitchella* seems to be common in the Eastern States. I have not seen it, and cannot determine certainly as to its identity with *quercitorum* Frey. If it is the same, *fitchella* has priority. I think they are most probably distinct. Frey described *quercitorum* from Texas. I have also bred it from mines in scrub-oak leaves at Edgerton, Colorado; altitude, 6,500 feet.

L. hamadryadella Clem. (Proc. Acad. Nat. Sci. Phila., 1859).—Very common east of Kansas, and not uncommon mining scrub-oaks in Colorado. I did not breed it, but the mine is easily recognized. I did not meet with it at a higher altitude than 6,000 feet.

L. cincinnatiella Cham. (Can. Ent., vol. iii, p. 149).—The remarks above made as to *L. hamadryadella* apply also to this species. The two, so far as my observation goes, are nearly always found together; frequently in the same leaf. They are, however, very distinct, and so are their mines.

Lithocolletis, next to *Gelechia*, is usually a genus of numerous species; but it is less so in Colorado than I have found it elsewhere.

Lyonetia abniella Cham. (Cin. Quar. Jour. Sci., vol. ii, p. 303).—This species up to 10,000 feet is more numerous in individuals than any other.

Phyllocnistis populiella Cham. (Cin. Quar. Jour., vol. ii, p. 106).—Common mining poplar-leaves in the Mississippi Valley at an altitude of 400 feet, and in Colorado mining aspen-leaves up to about 11,000 feet.

P. ampelopsiella Cham. (Can. Ent., vol. iii, p. 207).—Common in Kentucky, altitude 400 feet, and in Colorado, altitude 6,000 feet.

Eurynome.—In the Cincinnati Journal of Science, I have described a species from Colorado, allied to *Bucculatrix* and to *Phyllonome*, as *E. luteella*. The neuration of that species was not examined. In other respects, this species appears to be congeneric with it. The tongue and maxillary palpi are absent, while the labial palpi are moderately developed, with the second joint longest, and thus they differ from *Bucculatrix*. In repose, the antennæ are carried forward, diverging so as to form a wide letter V. They are a little more than half as long as the fore wings, with the stalk simple, and the basal joint, which is a little enlarged, covered with a small eye-cap and partly concealed by the long, loose scales of the roughened vertex, which extend down between the eyes, but do not cover the face. Fore wings lanceolate; hind wings narrowly lanceolate. The neuration of the fore wings in the species described below resembles that of *Bucculatrix crategi*, as figured in Ins. Brit., vol. iii, p. 8. The subcostal vein gives off two branches to the costal margin before the end of the cell, another just behind it, and is furcate before the tip, one branch going to each margin. The median divides into three nearly equidistant branches; the fold is well indicated, and the submedian distinct; the cell is closed; and the costal vein attains the margin before the middle. In the hind wings, the cell is closed, (or nearly so); the subcostal furcate before the apex, one of the branches going to each margin; the median subdivides into three nearly equidistant branches, and the submedian is indicated.

E. albella n. sp.—Snowy white; the hind wings with a silvery tinge, and three faint, pale, ochereous, minute spots on the fore wings, two of which are on the fold (one of them near the hind margin of the wing), and the third is at the end of the cell. (Sometimes these spots are in-

visible.) Apex of the fore wings sparsely dusted with ochereous, and there is a row of minute ochereous specks forming a hinder marginal line about the middle of the cilia. Scales rather coarse. Expanse of wings, $4\frac{1}{2}$ lines. Near Edgerton; altitude about 6,500 feet.

When the three ochereous spots are not visible on the fore wings, the insect is scarcely distinguishable from the species described below as *Bucculatrix albella* except by the neuration and by the presence of the labial palpi.

Bucculatrix albella n. sp.?—Snowy white; apex of fore wings and dorsal cilia very sparsely dusted with brownish scales. Expanse of wings, $4\frac{1}{2}$ lines. Very near *B. niveella* Chamb. from Texas, and possibly only a variety of that species. Also resembles *B. immaculatella*, Cham. from Texas, but is smaller, and *immaculatella* has no dusting on the wings. Altitude, 6,000 feet; Edgerton.

A similar species (perhaps the same denuded) was taken among wild sage (*Artemisia*), on which it probably feeds, at Twin Lakes, altitude 9,500 feet.

Nepticula.—Both species and individuals of this genus appear to be rare in Colorado. In two years, I have not met with a specimen of it. Mines of three species have, however, been observed. One specimen of a mine of a (new?) species in an aspen-leaf was met with at an altitude of over 10,000 feet; another of another species, in a leaf of *Alnus*, altitude 8,000 feet; and two mines of another species in leaves of cottonwood, altitude 6,000 feet.

Of the seventy-nine species hereinbefore referred to (including those known only by mines, but not including the *Gelechia* larvæ, which I did not succeed in rearing), one (*Batrachedra prævangusta*) (if it is that species), though well known in Europe, is not known in this country except in Colorado; five (*Pronuba yuccasella*, *Plutella cruciferarum*, *Gelechia roseosuffusella*, *G. aequipulsella*, and *Bedellia somnulentella*) are almost universally distributed in the United States; seven (*Anesyehia mirusella*, *Harpalyce tortricella*, *Gelechia concinnisella*, *Coleophora argyrestialbella*, *C. bistrigella*, *Eriphia concolorella*, and *Lithocolletis quercitorum*) have been found only in Colorado and Texas; seven (*Gelechia gallasolidaginis*, *Lamna griseella*, *Ornix pennivorella*, *Lithocolletis cincinnatiella*, *L. hamadryadella*, *Phyllocnistis populiella*, and *P. ampelopsiella*) have only been found in Colorado and in latitude 35° to 40° in the Mississippi Valley; and four (*Coleophora boreasella*, *Argyresthia gadartella*?, *A. andregiella*?, and *Lithocolletis salicifoliella*) in Canada, as far south as Kentucky, and in Colorado.

The other fifty-five species have not as yet been found outside of Colorado. Of course, it is not meant that any or all of these species may not hereafter be found in other localities. The seven species common to Colorado and Texas alone have all been found only south of the divide between the waters of the Platte and the Arkansas. One of

those common to Canada and Colorado and the Ohio Valley was only found north of that divide (*Æcophora boreasella*); the other species appear to be generally distributed.

It thus appears that while several species found in Colorado have heretofore been found only in Texas, and others have been found in Texas and the Ohio Valley, or in the latter only, four Colorado species have been found in Canada; and these four have also been found in the Ohio Valley; and none of the described species appear to pertain to Colorado and Canada alone. This appears somewhat anomalous, the more especially as the flora and the birds of Colorado generally are supposed to show northern rather than southern affinities. But it may be explained partly at least by the following considerations:—

1. The number of known Texan species is at least four to one greater than those of Canada, and the proportion of species from the Ohio Valley is even greater still. Therefore it was to be expected that a larger proportion of these would be found in Colorado than of the comparatively little known northern species.

2. The greater number of Coloradan species are from the plains and foot-hills south of the divide between the Platte and the Arkansas, say below altitude 7,000 feet and latitude 39° , just as among birds, *Geococcyx californianus*, common in California, Arizona, New Mexico, Texas, and the foot-hills of Colorado south of the "divide", has never been found north of it. But this consideration is not so weighty as it might seem to be, because, since the distribution of the *Tineina* is so largely dependent on that of the plants on which they feed, many species thus far found only in the plains and foot-hills may be expected to be found at still greater heights.

3. The greater proportion of Texas species thus far made known are from the region of Dallas—not of a very southern character.

Still it remains a little strange that Colorado species from latitude 38° to 40° , and altitude 6,000 to 8,000, should seem to show greater affinities with species from the Ohio and Mississippi Valleys and Texas, latitude 34° to 40° , altitude 300 to 1,500 feet, than with species from Canada and New England, at much higher altitudes and latitudes.

Possibly further investigations may throw some light on it. But the *Tineina* are not very numerous in species in Colorado, though some species are very numerous in individuals; seventy-five species have been described. I do not believe twenty-five more remain to be described, and these will be found—or most of them—in the extreme northern, southern, or eastern portions of the State. Additional discoveries will generally extend the range in latitude, longitude, and altitude of species already known, rather than make known new species. Nevertheless, of the fifty-five species as yet only known to Colorado, a large proportion may, and probably will, be found in Canada, and thus it will result—as from other reasons might be anticipated—that the *Tineina* of Colorado will show greater affinities with those of Canada than with those of Texas.

ART. VII.—NOTES ON A COLLECTION OF TINEID MOTHS MADE
IN COLORADO IN 1875 BY A. S. PACKARD, JR., M. D.

BY V. T. CHAMBERS.

Since the foregoing paper was written, another small collection of Coloradan *Tineina* has been submitted to me, concerning which I add the following remarks:

Glyphipteryx montisella Cham.—Specimens from Boulder, Colo. In the original account of this species I referred to a single specimen of a variety having a white spot on the base of the dorsal margin of the fore wings. This variety predominates in the collection from Boulder.

Elachista pramaturella? Clem.—A single specimen, with the head wanting, from "Kelso's" Cabin, foot of Gray's Peak, altitude about 11,200 feet. Not heretofore recorded from Colorado. It possibly may not belong to this species.

Gelechia packardella n. sp.—Closely allied to *G. cercirisella* Cham. Labial palpi white on the inner surface, prettily spotted with black scales; the external surface of the second joint black to the tip, which is white, with a black spot; third joint black, with the base and an annulus about the middle white; basal portion of the antennæ black (the remainder broken off from the single specimen). Head white, dusted with black scales, especially on the vertex, where the black predominates, irrorate with violaceous. Patagia black, tipped with white; thorax black, with a white spot on each side before the tip. Fore wings black, the dorsal margin to the fold white from the base to the cilia, the black color projecting across the fold into the white, but not far enough to touch the margin. There is a narrow white dorsal streak about the apical fourth of the wing-length pointing a little obliquely backward, and indistinctly connected with a nearly square costal white spot, which is a little farther back than the dorsal streak. The disk is somewhat obscurely streaked with ochreous, and under a lens small white specks and scales appear scattered in the apical part of the wing; cilia pale fuliginous, with a blackish hinder marginal line. (The hind wings and abdomen are wanting in the single specimen before me.) Expanse of wings, 8 lines. "Georgetown"; altitude about 8,000 feet.

G. solaniella Cham.—This species was originally described from specimens taken and bred in Kentucky and Missouri. Afterward, specimens received from Texas were referred, with some little doubt, to the same species. The single injured specimen in this collection, like those from Texas, lacks the grayish or whitish dusting of the original specimen, and may prove to be distinct or a variety.

This collection also contains the following species heretofore described: *Coleophora artemisicolella* Cham., from Kelso's Cabin, Gray's Peak; *Laverna grandisella* Cham., Georgetown; *Laverna albocapitella*? Cham., Georgetown.

I am not absolutely certain of the correctness of this identification. The head and palpi in these two specimens are rather pale-gray than white, and there are other minute differences. One of the two specimens is badly rubbed, and the other is so mounted as to nearly destroy the thorax and prevent any satisfactory view of the wings. But I believe it to be *albocapitella*. That species has heretofore been described only from Texas. Thus another species is added to those common to Texas and Colorado, and this one is found at a considerable elevation in the mountains and north of "the Divide".

Laverna miscelorella Cham., heretofore described from Texas only, now from Central Colorado.

Plutella cruciferarum auct.

Anesychia discostrigella Cham., Manitou.

Aetote bella Cham., heretofore known only from Texas. This specimen is labeled "Denver".

Butalis immaculatella Cham.—Originally described from Texas. While the differences between the species of *Butalis* which have been described in this country by Dr. Clemens and by me are as great as those which separate the recognized European species, I doubt very greatly whether they are all, or perhaps even half of them, really distinct. The differences which separate them are chiefly in ornamentation, and are not great. I have bred specimens of *B. matulella* Clem. (the larva of which mines leaves of the "hogweed" (*Ambrosia trifida*), which presented greater differences than many of those that are recognized as distinct species in this country and in Europe.

Blepharocera gen. nov.—This genus is allied structurally to *Dasycera* perhaps as closely as to any other, but is altogether unlike it in coloration. There are no maxillary palpi; the labial are slender (more so than in *Dasycera*), recurved, overarching the vertex; tongue of moderate length and scaled; antennæ not reaching the tips of the wings by about one-third of the length of the latter, with the basal joint a little thicker than the stalk, which is slender and rather densely clothed in the male with long cilia (longer than in *Dasycera* and more thickly); forehead rounded; face but little retreating; head smooth. Cilia of both pairs of wings rather long. Fore wings broadly lanceolate. (Having but a single specimen, one fore wing of which was ruined in denuding it, and not wishing to injure the other, I can give no satisfactory account of its neuuration.) Hind wing narrower than fore wing, lanceolate, more elongate in proportion to width than in *Dasycera*. Costal vein long, near the margin; subcostal attenuated toward the base and reaching the margin

close to the tip; the median subdivides into three branches, the last two of which are close together at the end of the cell; cell closed by a distinct discal vein, which sends two branches to the dorsal margin; submedian *indistinctly furcate at the base*.

B. haydenella n. sp.—Grayish-fuscous. Fore wings rather densely dusted with white, having a transverse fuscous spot (not dusted) on the fold before the middle; a smaller one at the end of the cell, and the apex fuscous, not dusted with white. Articulations of the tarsi whitish. Expanse of wings, $7\frac{1}{2}$ lines. *Dasycera newmanella* Clem., to which this species is structurally allied, and *Hamadryas newmanella* Clem., which is still more closely allied to *Dasycera* than this species, are found from Texas to New England, but not as yet in Colorado. The separation of *Bassettella* from *Dasycera* as a new genus is perhaps questionable, and the generic name *Hamadryas* has also been given to an Australian genus of butterflies.

Besides the species above mentioned, this little collection also contains a specimen of *Tinea* (sp.?) and two other *Tineina*, all too much injured for recognition or description. Two only of the thirteen recognizable species are new, but four others are new to Colorado, three of the four having been heretofore found in Texas, and the fourth both in Texas and in Kentucky. All of these four were taken north of "the divide" in Colorado, and three of them at an altitude of about 8,000 feet near the Snowy Range, and where frost and snow are not infrequent in August. It is true that both Texas and Colorado are included by Mr. Wallace in one subdivision of the Nearctic Region. But one would scarcely expect such a division to hold good in such a group as the *Tineina*, whose distribution is governed more perhaps than any other insects by that of particular plant-species. On the contrary, I had expected to find the species of the high plains and cold mountain-regions in latitude 38° to 40° approximating those of British America and the Northern United States in latitude 44° , rather than those of even the Ohio Valley, latitude 39° , or those of the Texas prairies, latitude 32° . Possibly this may yet prove to be the case when we are better acquainted with the species of Canada and New England. But so far as we can now determine, the *Tineina* of Colorado are to a much greater extent allied to those of Texas than to those of Canada or even of the Ohio Valley. Mr. Wallace suggests that so little is known of the distribution of the *Noctuidæ* and *Tineidæ* that any study of the subject as to their general distribution over the earth must lead to erroneous conclusions, which is no doubt true. Yet enough is known to establish the fact that the families and many if not most of the leading genera are of very general if not of universal distribution; such genera, for instance, as *Depressaria*, *Gelechia*, *Plutella*, *Elachista*, *Laverna*, *Cosmopteryx*, *Glyphipteryx*, *Coleophora*, *Lithocolletis*, *Bucculatrix*, and others, each of which is represented in all or the greater number of Mr. Wallace's "regions".

ART. VIII.—ON THE DISTRIBUTION OF *TINEINA* IN COLORADO.

BY V. T. CHAMBERS.

Dr. Packard mentions, in Hayden's Report for 1873 (p. 548), that Lieutenant Carpenter found a *Tortrix* larva somewhere in the mountains of Colorado, at an altitude of above 12,000 feet, and this seems to have been the only Microlepidopteron seen above timber-line by Lieutenant Carpenter. I do not find that any other species has been recorded from high altitudes in the Rocky Mountains. At an elevation of nearly 14,000 feet, I saw a specimen of a *Tortrix* and two specimens of a *Pterophorus*, but unfortunately was not able to capture either. This was near the top of Mount Elbert. *Argresthia altissimella* Cham. was captured on the same mountain at an altitude of about 11,000 feet, and a specimen of *A. gædartella?* Auct. was taken at the same place. *Plutella cruciferarum* was taken, and a specimen of a *Coleophora* observed but not captured, at about the same elevation, near Berthoud's Pass; and *Phyllocnistis populiella* Cham. was found in the larval state up to the extreme limit of the growth of the aspen, 11,000 feet or more. Larvæ of two species of *Gelechia* were found as high up, sewing together aspen-leaves; and the larva of another species was found at a higher altitude than any other larva of *Tineina*, fairly above timber-line as it is generally understood; that is, the limit of the growth of pines; for it sews together the leaves of the stunted willows which creep along the margins of little rivulets for a short distance higher up the mountain-side than the limit of the pines, up in fact to a height of nearly 12,000 feet. But the distribution of the *Tineina* is governed by that of the vegetation on which they feed. Of butterflies and the larger moths, each species feeds usually on a variety of plants, and their distribution is not determined by that of a single plant. But the species of *Tineina*, and especially the leaf-mining *Tineina*, are usually confined to a single food-plant. Comparatively few of them feed on more than a single plant-species; and when a species does feed on more than one species of plant, those on which it feeds are usually closely allied. Of course, there are numerous exceptions, but this is the rule, and when the rule prevails the geographical range of the moth is generally determined by that of its food-plant, so that when the plant is not found, of course the moth cannot be; and where the plant is indigenous, there the moth will usually be found with it. To a much greater extent, therefore, than in other *Lepidoptera*, the distribution of a species

of *Tineina* is dependent upon that of a single plant-species, and consequently in passing above timber-line *Tineina* might be expected to become exceedingly rare. In point of fact, I found none except the *Gelechia* larva on willows before mentioned, and in all probability that species will be found also far below timber-line. Hayden, if I remember aright, gives 11,776 feet as the height of timber-line on Mount Elbert.

The *Pterophorus* observed by me as above stated was probably *P. cinereidactylus*, which has been taken in the mountains of New England; and it is to be regretted that I did not succeed in taking it, so that this fact might have been determined; and that it might also be determined whether it differs in size, in relative length of peripheral parts, or in depth or intensity of color, from the New England specimens. Dr. Packard's observations (*loc. cit.*) tend to establish the rule that the western species are larger, with greater relative development of peripheral parts, and greater depth and intensity of color than their eastern congeners; and in view of his observations, and those of Mr. Wollaston and others, on insects of other orders and of other countries, and in consideration of the bright sunlight and prevailing high winds in Colorado, I had expected to find the rule confirmed among the *Tineina*, or else to have found a much larger proportion than usual of apterous species, since the bright light would tend to develop color; and either the absence of the power of flight, or its greatly-increased development, would tend to the protection of species against atmospheric influences. But I found nothing to confirm these views. On the contrary, so far as color is concerned, the *Tineina* of Colorado, and, so far as I have had an opportunity of observing them, those of California likewise, are plainer and more obscurely colored than those of the Mississippi Valley; and, so far as size and extent of peripheral parts is concerned, the individuals, when they belong to species found also in the Mississippi Valley, differ usually in no respect from those found in the latter region; and when species are allied to eastern species, they do not differ from them more than eastern species differ from each other. Thus the ♀ *Tinea* and allied genera are frequently apterous in the States and in Europe; but I saw only a single *Tinea* (damaged beyond recognition) in Colorado, and that was not apterous, nor was there any unusual development of the wings or other peripheral parts. *Tinea* appears to be but poorly represented there. The average size of *Pronuba yuccasella* Riley, in Colorado, is less than that given for it by Mr. Riley in Missouri; and it differs from Missouri and Kentucky specimens only in the fact that a large number of specimens have small black spots on the fore wings. *Hyponomeutida* are represented by numerous specimens of two species of *Anesychia*, one of which (*A. mirusella* Cham.) is common in Texas; they give no support to the theory. *Plutella cruciferarum* is, in Mr. Staintons's language, "found wherever man eats cabbage", and it appears to be the

same everywhere, or, if it varies, varies in the same way everywhere *Gelechia*, usually so numerous, both in species and individuals—more so than any other genus of the family—is but poorly represented in the mountains, more numerous in the foot-hills and plains than in the mountains, and *seems* to be more numerous in southern latitudes, as well as in lower altitudes. The species are usually of plain grayish or brownish colors, and present no contrast with their congeners from the East, either in ornament or structure. *Glyphipterygidae* are represented by *G. montisella* Cham. and *Lithariapteryx abroniella* Cham., the latter perhaps more brilliantly ornamented than any other species of the family, but neither showing any greater extent of peripheral parts. *Holcocera* (*Blastobasis*) *gigantella* Cham., however, on the other hand, has certainly a greater expanse of wings— $15\frac{1}{2}$ lines—than any other species of the genus, or perhaps I might say greater than any other species of the *Tineina*; but the wings are rather narrow for their length, and unlike all other species of the genus known to me (instead of having a deeper or more brilliant or intense color) it is white. Indeed, it seems to me that if the *Tineina* of Colorado have any characteristic colorational peculiarity, it is that there is perhaps a larger proportion of uncolored species. *Argyresthia* and *Gracilaria* are more numerous represented in Colorado, both by species and individuals, than any other genus, except *Gelechia*, and their species are decidedly less brilliant, and are plainer than the species of the Mississippi Valley, and where the species are the same they present no peculiarity of either form or color. *Coleophora* is well represented by characteristic species; *Laverna* by a few plain species; *Batrachedra* by a species which I believe to be the European *praangusta*, and by another new species (?) which certainly has a decidedly greater wing-expanse than any of the known species, besides being more *deeply* colored, not more brilliantly. *Eriphia concolorella* Cham., found as yet only in Colorado and Texas, is the same in both, so far as we can judge from the scanty material. *Tischeria* is represented by two species found in the Eastern States. *Lithocolletis* is less numerous, both in species and individuals, than in the States, where, next to *Gelechia*, it is perhaps the most abundant both in species and individuals. Three out of seven species are identical with those found in the East, and perhaps the fourth and fifth will also be found there, and the sixth is found in Texas, while the seventh, a variety of *robiniella* Clem., is smaller and of duller colors. The others show no departure from the common forms. The two species of *Phyllocnistis* have already been found in the East; they present no variation. *P. populiella* Cham., from an altitude of over 11,000 feet in the Snowy Range, is indistinguishable from the same species in the foot-hills at 6,000 feet, or from Kentucky at 500 feet. The single species of *Lyonetia*, more abundant in individuals than any other species, is unknown in the East as yet; and while not supporting the theory as to color, is, on the other hand, certainly larger than the other species of the genus. *Bucculatrix* has two species, both

paler in color than any of their eastern congeners and not larger. *Eurynome*, a genus founded on two species, found as yet only in Colorado, does not differ from the allied *Bucculatrix* in size or coloration. And the two or three species of *Nepticula* (or *Trifurcula*?) are rare and known only by their mines.

These are the only genera which are known to be represented among the *Tineina* of Colorado, and notwithstanding the cases of *H. gigantella*, *Batrachedra* sp.?, and *Lyonetia alniella*, the weight of evidence, such as it is, does not support the theory suggested, and if these three species seem to lend it any support, it would yet require the accumulation of a very much greater number of instances of increased size or peripheral development, or depth, or intensity of color, to demonstrate that these things have any necessary connection with the western habitat of species.

The *Tineina*, however, are generally not well adapted either to the proof or disproof of such a theory, so far as size and increase of peripheral development are concerned, since their minute size would make it difficult to detect any such small increase as would be likely to occur from such a cause, and if detected it might be considered to be within the range of variation of the species. As to color, however, they afford as good an opportunity of testing the theory as any other group, and here their testimony is decidedly against it.

Some of the species above mentioned are not yet known by published descriptions.

ART. IX.—NEW ENTOMOSTRACA FROM COLORADO.

BY V. T. CHAMBERS.

FIGS. 1-4.

Cypris grandis n. sp. (Fig. 1).—Valve oblong, slightly subreniform, highest behind the middle, sloping thence regularly toward the anterior end, with a slight bulge on the hinge-margin just where it rounds off in front. Greatest thickness about the middle. In side-view somewhat resembling Brady's figure of *C. tessellata* (Trans. Linn. Soc., v, 26, plate 23, fig. 39), but this species is longer in proportion to height and has the highest point of the dorsal margin a little farther behind. Ventral margin very slightly emarginate. In dorsal and ventral view, somewhat resembling Brady's figure of *Macrocypris minna* (loc. cit., plate 28, fig. 34). Right valve slightly overlapping the left; surface smooth, with minute punctures and short hairs, but with a group of scattered, large, sordid, yellowish punctures about the middle of each valve. Color bluish-

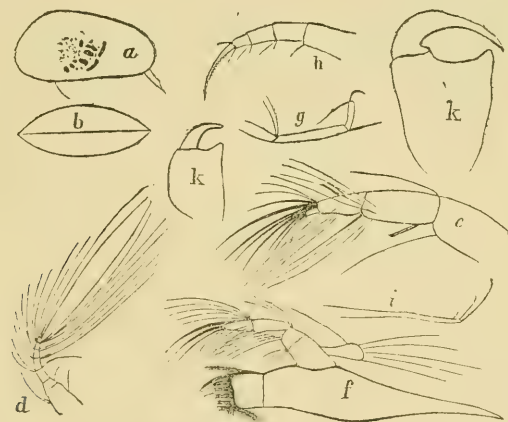


FIG. 1.—*Cypris grandis*, CHAM., n. sp.

white (nearly that of very thin milk), though some specimens show a decided pale greenish tinge. Basal joint of superior antennæ with two short setæ above and one below; second joint with a single short one below; third with two short unequal setæ above and one below; fourth with two above like those on the third, and two long ones below; fifth as the fourth; sixth with the two upper setæ as in the third and fourth, but with four long ones below; seventh with two long and two shorter setæ. Inferior antennæ with one moderately long and two short claws, and two setæ from the end of the last joint, and with four long

claws (one shorter than the other three), and two moderately long setæ, and one long one from the end of the penultimate joint, besides four rather long ones above, and two beneath about its middle. Third joint with the usual single stout seta from its end beneath, and the usual fascicle of five long and one short one above near the end, and the usual articulated process. Post-abdominal ramus similar to that of *C. incongruens* as figured by Brady (*loc. cit.*, plate 23, fig. 20), but longer, having three unequal setæ, the terminal one longest. Seminal gland very similar to that of *Notodromus monachus* (*loc. cit.*, plate 37, fig. 36). Length, $\frac{1}{7}$ of an inch; height, $\frac{1}{12}$; greatest thickness, $\frac{1}{18}$. Probably the largest known species of the genus. It is abundant in ponds along the Upper Arkansas River in the Mount Harvard region, at an altitude of about 8,000 feet. When first taken, my specimens were brownish from adhering mud, but alcoholic specimens have the livid white color above mentioned. The lucid spots are indistinct and difficult to make out; there are about nine, the two anterior obliquely transverse and long, the two posterior small.

C. altissimus n. sp. (Fig. 2).—Valve oblong, slightly subreniform, highest about the middle, rounding regularly before and behind; the side-view resembling somewhat Baird's figure of *C. tristriata*, but less distinctly reniform, perhaps rather resembling in the form of the dorsal margin *Cypridopsis vidua*; it is, however, much more elongate in proportion to height. Brady's figure of *C. virens* (= *C. tristriata* Baird) is a little nearer to this species, but is too distinctly reniform. *C. virens* also agrees with this species in the number (seven) of the lucid spots, and approaches it in their position on the shell, and in relation to each other, but they are differently shaped. In this species, the extremities are more

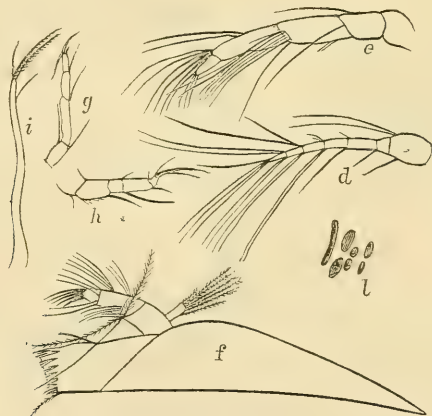


FIG. 2.—*Cypris altissimus*, CHAM., n. sp.

nearly equally rounded than in *virens*, the dorsal margin being evenly rounded before and behind the middle, and the ventral likewise, both before and behind the slight sinuation in the middle. But the anatomy of the appendages differs more decidedly from that of *virens*, as will be

seen by a comparison of the following account with Brady's figures. Superior antennæ with only twelve instead of fourteen long setæ, arranged as follows:—There are two short setæ (one longer than the other) from the third joint, which has none in Brady's figure; two short and two long ones from the fourth joint, where *virens* has four long ones; three long ones and one shorter one from the fifth joint, which in *virens* has four long ones; four long ones from the sixth joint, where *virens* has only three; and three long ones and one short one from the last joint, where *virens* has three long ones. In the inferior antennæ, similar differences are found, and in the mandibular palpus even greater ones. The feet of the first pair appear to be identical in the two species, except that this species has a short seta on each of the joints 3 and 4, which are not represented in Mr. Brady's figure. His figure, however, shows one seta more on each of the joints 2 and 3 of the feet of the second pair than I find in this species, which likewise is much smaller than *C. virens*, being only one-twentieth of an inch long and one-fortieth high, instead of one-fourteenth of an inch long and one-twenty-fifth high, as in *virens*. In ventral and dorsal view it also resembles *virens*. Surface smooth pubescent, with minute punctures. Color bright deep green.

Common in a pond fed by melting snow on the side of Mount Elbert, Colorado, at the height of about 12,000 feet (some distance above timber-line). The water is clear and cold, and seems to contain but little decaying animal and vegetable matter. I did not observe in it any other Entomostracan, though small *Coleoptera* (*Dytiscidæ*) and *Hemiptera* were common in it. This species, or one very similar in external appearance was also found at an altitude of near 8,000 feet, in a puddle by the side of Fall River, Colorado, but my specimens of these were unfortunately all lost.

C. mons n. sp. (Fig. 3).—Ovoid; tumid; highest immediately before the middle. Length, $\frac{1}{36}$ inch; height, $\frac{1}{37}$. Dorsal margin regularly arched, sloping more rapidly behind the highest point than before it. Extremities rounded; the anterior widest ventral margin very slightly sinuated. Seen from above, ovate, but less tumid than *Cypridopsis vidua* as figured by Baird and Brady (Brit. Ent. and Trans. Linn. Soc., v. 26). But little or not at all narrowed in front; widest a trifle behind the middle. Lucid spots seven, near the middle of the valve; the three lower ones in a line and small; one of them very small. Valves white.



FIG. 3.—*Cypris mons*, CHAM., n. sp.

shining, smooth, with numerous almost confluent puncta. The setæ of the lower antennæ extend beyond the apex of the claws, and the articu-

late appendage of the third joint has its apex swollen or enlarged. Superior antennæ with two long and one short seta from the end of the fourth joint; two from the end of the fifth joint; four long ones from the end of the sixth; two long and two short from the end of the seventh; (there are also other short setæ on the different joints). The last joint of the inferior antennæ is small, almost rudimentary, bearing a single large claw. (Indeed, it seems to be bifid, with a claw from each branch.) There are three other claws articulated to the end of the penultimate joint, from which also arise four setæ shorter than the claws; two moderately long setæ arise from about the middle of the fourth joint above, and three longer ones below; the usual fascicle of five long and one short setæ form the third joint, just behind which is a bunch of short cilia and another bunch on the under side. Abdominal ramus straight, slender, with two claws one under the other. The mandibular palpus, with branchial appendage and two large pulmose and one simple setæ from the end.

Pond on Mount Elbert; altitude about 11,000 feet. I took also, at the same time and place, a single specimen resembling those above described, but which I believe to be distinct; but, having only one example, I have not dissected it. It is smaller, narrows more rapidly in front, and is of a grayish-white color.

Daphnia brevicauda n. sp. (Fig. 4).—Carapace thin and easily injured. Animal sluggish, and very easily killed. Head forming a short, blunt beak; dorsal margin evenly arched to a point near the spine, where the slope is much greater, and the posterior margin, both above and below the spine, is sinuated, and armed with minute spines. Ventral margin convex, evenly rounded. The head is not distinctly marked off by a suture in the carapace. The spine is nearer to the dorsal than to the ventral margin, and is small and blunt. Superior antennæ small; inferior very large, with plumose filaments. Carapace marked by very numerous, fine, transversely oblique striæ, *but not reticulated*. In young specimens, the spine continuous, or nearly so, with the dorsal margin, but it is removed farther and farther from it as age increases. The largest specimens exceed a little the largest of *D. pulex*, and the height is about two-

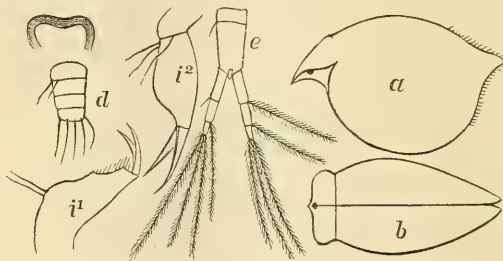


FIG. 4.—*Daphnia brevicauda*, CHAM., n. sp.

thirds the length. The color usually brownish-red; the ventral portion paler than the dorsal, and marked by about four alternate, rather indis-

tinged, brownish or smoky streaks, which, however, are sometimes absent. Eye-spot small. The inferior antennæ have a small spine near their base, another at the bifurcation, and one from the second joint of the outer branch. In the helmet-like beak and lateral compression, this species approaches Schodler's genus *Hyalodaphnia*.

A few specimens were taken from a pond on the side of Mount Elbert, altitude 11,000 feet; and it is abundant in ponds near Covington, Ky., altitude about 500 feet. It is possible, however, that the Kentucky specimens may belong to a different species. The above description applies more nearly to the Kentucky specimens. The only ground, however, on which I could separate them as distinct species is that the form of the post-abdomen differs somewhat, as will be seen by reference to the figures.

Lynceus (Chydorus) sphericus? Baird.—My specimens, taken in a pond on Mount Elbert, at an altitude of about 11,000 feet, were all lost before I had examined them sufficiently to be certain of their identity with *sphericus*. I believe them to be identical with a species which is common in Kentucky, and which differs from *sphericus* as described by Baird and by Norman and Brady only as follows:—This species has five distinct striæ passing obliquely from the oral region back over the dorsal margin, which are not mentioned in the descriptions above mentioned (Baird, Brit. Ent., and Norman and Brady, Monograph Brit. *Lync.*, &c.). Baird says, color olive-green; but the color of this species is yellowish-white.

But little has heretofore been done among the fresh-water Entomostaca of the United States. The species are, however, very abundant. Some of them seem to be identical with European species. Among species that have fallen under my observation, besides many that are certainly new, are those that I am unable to separate on any satisfactory grounds from *Cypris incongruens* Baird, *Cypridopsis vidua* Baird, *Daphnia pulex* Auct., *Moina branchiata* and *Daphnia mucronata* Müller. One interesting new *Cypris* seems to be peculiar to the brackish water of Big Bone Springs, Kentucky, where I have also found a new *Tachidius*. I have also found a new *Diaptomus* and a *Canthocamptus* in ponds in Northern Kentucky, besides several new species of *Daphniadæ*, *Lynceidæ*, and *Cypridæ*.

Explanation of figures.

- | | |
|----------------------------|--------------------------|
| a. Carapace, side view. | g. Foot, first pair. |
| b. Carapace, dorsal view. | h. Foot, second pair. |
| c. Carapace, ventral view. | i. Post-abdominal ramus. |
| d. Superior antennæ. | k. ♂ claspers. |
| e. Inferior antennæ. | l. Lucid spots. |
| f. Mandible and palpus. | |

In the figure of *Daphnia*, *i* represents the Kentucky form; *i'*, the mountain form.

ART. X.—ON A NEW CAVE FAUNA IN UTAH.

BY A. S. PACKARD, JR., M. D.

FIGS. 5-10.

While attached to the United States Geological and Geographical Survey of the Territories in the summer of 1875, during a visit to the Great Salt Lake, my attention was called by Jeter Clinton, esq., to a curious cave on his estate, about half a mile east of his hotel at Lake Point. It is, at a rough guess, about two hundred feet above the level of the lake, and the mouth faces the northeast. It was evidently due to wave-action, being situated on an ancient beach-line, while the top and bottom of the cave were formed by a breccia. As my examination of it was a hasty one, no measurements having been taken, I quote the following account of it by Mr. G. K. Gilbert, in his report "On the Geology of Portions of our Western Territory, visited in the years 1871, 1872, and 1873": —*

"Along many of the beaches, and especially at points where they are carved in solid rock, the beach or terrace below the water-line is composed of calcareous tufa usually full of small Gasteropod shells, and often involving so many fragments of the contiguous rock as to constitute a breccia. In the localities where I found it best exhibited, the beach was carved in limestone, but the deposit is probably independent of the character of the adjacent formation. Mr. Howell observed it upon Granite Mountain, coating granite, and remote from limestone exposures; and a similar association was seen by Prof. W. P. Blake on the Colorado Desert. Down some steep slopes it stretches as an apron for several rods, and, when it rests on soft materials, the waves of the retiring lake have undermined it and formed caves. Several of these are to be seen on the north end of the Oquirrh range, and the largest, which is popularly reputed to have been excavated by Spaniards years ago as a mine, is remarkable as a specimen of 'Purgatorial' wave-work. The Carboniferous strata have a local northward dip of 80° , and trend parallel to the face of the declivity. Two beds of limestone, which constitute the walls of the cavern, are separated 12 feet at the entrance, and evenly converge to the rear end, where they are 4 feet apart. At the end, a shale, in place, fills the interval, but I was unable to determine whether this had once occupied the entire excavated space. The roof is built entirely of recent

* Extracted from vol. iii of the United States Engineer Reports of Explorations and Surveys West of the 100th Meridian, Lieut. G. M. Wheeler in charge.

calcareous breccia, and the floor is evenly spread with earthy *débris*. The height of the gallery is uneven, ranging from 2 to 25 feet, and the length is 275 feet. The breccia of the roof pertains to one beach of the great series, and the floor is near the level of another. The wonderful depth of the excavation, in a direction nearly parallel to the shore, is explained by the convergence of the straight walls, between which the waves gained in their progress, on the principle of the hydraulic ram, enough velocity to compensate for the loss by friction."

In order to feel entirely certain that the cave I examined was the same as the one thus described, I wrote Mr. Gilbert, and received such information from him as placed the matter beyond a doubt.

The specimens occurred entirely under stones, none upon the walls, as the cave is perfectly dry, a very slight degree of moisture gathering under the flat pieces of brecciated limestone, which had fallen from the roof above. The darkness was not quite total, a faint glimmer of light appearing, although it was necessary to use candles in exploring the cave as well as in searching for specimens. Having previously examined a much larger cave in the Carboniferous formation in Williams Cañon at Manitou, Colo., without finding any signs of indigenous life, except *Diclidia latula* and its larva, which occurred on the steps near the entrance, and which had been evidently a recent introduction, I was much interested to find in this small isolated cave in Utah a well-marked cave fauna, nearly as characteristic as that inhabiting the caverns of Kentucky, Indiana, or Virginia. Four forms occurred, of each of which several individuals were found in a few minutes' search.

The spider-like form (*Nemastoma troglodytes*) belonging to the group of "harvestmen" was perhaps more abundant than the others. It belongs to a group not before known to inhabit North or South America; none of the family occurring in caverns east of the Mississippi River. Species of the genus occur, however, in Europe. It had well-marked eyes. The Myriopod belongs to a widely-distributed genus (*Polydesmus*), but which in this country has not been hitherto known to be a true troglodyte. Like all the species of the genus, which as a rule live in the twilight under stones and leaves, &c., it is eyeless. Its entirely white color, when all the other known species are highly colored, shows that it is also a true cave-dweller. The Poduran *Tomocerus plumbeus* is found abundantly in Europe, Greenland, and North America. It occurred of very large size under stones at an elevation of 11,000 feet on Gray's Peak. It will probably be found on the Pacific coast. The individuals, moreover, discovered in Clinton's Cave, Utah, represented a white variety peculiar to caverns, and which differed in no respect from bleached individuals found in the smaller caves of Grayson County, Kentucky, by myself, in 1874, while attached temporarily to the Kentucky Geological Survey, Prof. N. S. Shaler in charge. A small *Zonites* was discovered, which was white. Its occurrence was of a good deal of interest, from the fact that of the numerous *Helices* which occurred in

the caves of Kentucky, none were bleached out or differed notably from those found in their usual habitats, though I am told by Prof. E. S. Morse that adult white individuals do occur in ordinary habitats.

None of these animals occurred out of the cave, no species of *Nemastoma* or *Polydesmus* having been met with; but that other forms closely allied to these cave species may exist in Utah is suggested by the discovery in Colorado, by Mr. E. Ingersoll (while attached to the United States Geological and Geographical Survey of the Territories, in 1874), of a species of *Scotolemon*, a genus represented by cave species in Indiana, Eastern Kentucky, and Virginia, and very numerous in the caves of Southern Europe. The occurrence of *Scotolemon robustum* in Colorado is an evidence that we may have had an out-of-door form from which the cave rniculous species of the Mississippi Valley may possibly have been derived, or at least that the cavernicolous species of *Scotolemon* were not independent creations.

DESCRIPTION OF THE SPECIES.

THYSANURA.

Tomocerus plumbea (Linn.) var. *alba*.—Several specimens of a pale variety of this species of "spring-tail" occurred, some of which were pure white, thoroughly bleached out, while others were more or less dusky. Several of the larger specimens were pale, with traces of dark markings on the body; the antennæ, legs, and "spring" were white, much paler than the body. In such examples, the antennæ are whitish, with the two basal joints tinged with brown, the flagellum white, with a slight purplish tinge. Legs and spring almost pure white. Eyes black and well developed. Specimens one-half or two-thirds grown are pure white, except the small black eyes, which are connected by a double black line; while other specimens fully grown are perfectly white.

Similar individuals occurred in the Carter Caves of Eastern Kentucky, and still others occurred which were much darker than the Utah ones, forming a series connecting the extreme white variety, *alba*, with the ordinary plumbeous form, which latter is found in the United States east of the Mississippi, Greenland, and Europe. The occurrence of the white variety in a cave indicates that the ordinary form is probably to be met with west of the Rocky Mountain range.

Had I not had a series from the Carter Caves connecting the white variety with the ordinary out-of-door plumbeous form, I might have been inclined to regard it as a new and undescribed species, although it presents no structural differences in the form or length of the appendages from the normal form. But the series affords a capital example of the successive steps in the formation of a new form, whether we call it a new variety or species, while the causes of the changes are sufficiently apparent. Examples such as these and others I have before me to be hereafter described amount almost to demonstrative evidence of the truth of the doctrine of the transformation of species.

ARACHNIDA.

Nemastoma troglodytes, n. sp., (Fig. 5, enlarged*), 10 ♀.—Body rather long and slender compared with the European *N. dentipalpis* Koch, the latter being short and ovate, while our species is contracted at the base of the abdomen. The eye-tubercle is rather large and prominent; the eyes themselves well developed, black in recently-moulted specimens, but in others scarcely distinguishable from the dark-brown, finely-shagreened tegument. Behind the eyes the body contracts dorsally as well as laterally. On the front edge of the cephalothorax is an acute median spine. The six basal abdominal joints are coalesced, forming a single piece, segments 3-6 being indicated by a pair of somewhat transverse, high, well-marked tubercles (not forming true spines as in *N. dentipalpis*). The four terminal segments are free; the terminal one subtriangular, one-fourth shorter than wide. Beneath are seven well-marked sterna, with lunate, dark spiracles on the sternum of the second segment.

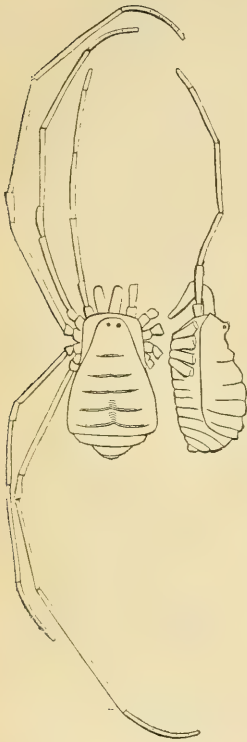


FIG. 5.—*Nemastoma troglodytes*,
PACK., n. sp. (enlarged).

Mandibles hairy, with the basal joint not so long as broad; second joint of the same width throughout, not swollen toward the end; third joint bent downward and inward at right angles, the hand directed a little outward. Maxillary palpi very long and slender, hairy, nearly twice as long as the body, while in the European *dentipalpis* they are scarcely half as long in proportion; 6-jointed (in *dentipalpis* 5-jointed), the basal joint subtriangular in outline, owing to the upper edge being dilated; second a little longer and much slenderer than first, and slightly curved; third a little more than twice as long as the second, very slender; fourth a little shorter than third; fifth, three-fourths shorter than fourth; and sixth slightly shorter than the second, rounded at the end, being cylindrical, ovate, and unarmed, though with rather stiff hairs.

Legs much longer and slenderer than in *N. dentipalpis*, with all the coxæ of nearly the same size, the hinder pair being a little shorter and broader. First pair about twice as long as the body, with eight tarsal joints; joints 4-7, together a little longer than the terminal one; a single, long, stout, curved claw. Second pair nearly three times as long as the body; tarsi very long and sinuous like a whip-lash, 16-jointed, the sec-

* The drawings of this and Figs. 6 and 8 have been made, under my direction, by Mr. J. S. Kingsley, Salem, Mass.

ond joint half as long as the first. Third pair of legs of the same length as the first pair; tarsi 8-jointed, the two terminal joints subdivided into two joints. Fourth pair nearly three times as long as the body; tarsi 8-jointed, the two last sometimes subdivided into two subjoints (inter-nodes). Length, 3 millimeters.

Found under stones on the bottom of the cave, in a damp place, not infrequent, July 28, 1875. Quite active in its movements. Most of the specimens were apparently distended with eggs.

This is the first occurrence of the genus in America. I have been able in drawing up the above description to compare our species with the European *Nemastoma dentipalpis* of Koch, a specimen of which has been kindly loaned me for the purpose by Mr. J. H. Emerton. It differs from its European congener by the maxillary palpi being twice as long, while the tarsal joints of the three hinder pairs of feet are much fewer in number, there being twenty-four well-marked ones on the second pair of legs of *N. dentipalpis*, while the fifth joint of the leg (including the coxa) is subdivided in *dentipalpis* into thirteen subjoints, these divisions in *N. troglodytes* not being well marked.

From the European *N. bimaculatum* (Fabr.), French specimens of which have been kindly loaned by Mr. J. H. Emerton, our species differs in the body being much narrower and slenderer, while the maxillæ and legs are much longer, the tarsi especially being much slenderer, and the joints very much less distinct. The back of *N. bimaculatum* is not tuberculated.

Judging by its shorter limbs, the better-marked tibial and tarsal joints, and the dark integument, the European *N. dentipalpis* probably lived under stones in the open air. The effects of a cave life on the American species is seen in the very long palpi and legs and the indistinct subjoints.

The genus *Nemastoma* of Koch is regarded by Thorell as the type of a distinct family, *Nemastomidae*. It differs from the *Opilionidae* in the more distinct abdominal segments and unarmed maxillary palpi, and for this reason I do not see that the genus differs sufficiently from *Phalangium*, the type of the latter family, to constitute a family-type but should advocate regarding it as the type of a subfamily of *Opilionidae*, for which the name *Nemastominae* Thorell might be used, the genuine *Phalangidae* (*Phalangides*, Leach, 1812) being thrown into a subfamily, which may be named *Phalanginae*.

MYRIOPODA.

Polydesmus caricola, n. sp. (Fig. 6.—*a*, antenna; *b*, section of a segment; *c*, two segments, dorsal view; *d*, two terminal segments, all enlarged).—Body consisting of 19 segments exclusive of the head, long and unusually narrow, more cylindrical than usual. Head rather large and full, much broader than the body, the sides bulging out more than usual, the body in transverse section being much more rounded than either in *P. seri-*

ratus, *P. granulatus*, or *P. canadensis*. The median suture is well marked. Though like the other species of the genus and family it is blind, the hexagonal markings which indicate the normal position of

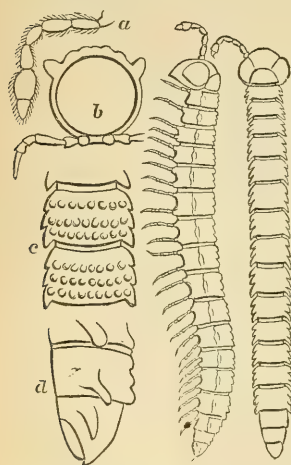


FIG. 6.—*Polydesmus caricola*, PACK., n. sp., (enlarged.)

the eyes are nearly as distinctly marked as in *P. canadensis*. Antennæ rather longer than in *P. canadensis*, being twice as long as the head, 7-jointed,—the first, as usual, conical, small, and short; second and third oval cylindrical, of the same form and length; fourth and fifth considerably shorter (three-fourths) than the second and third, the fifth a little thicker than the fourth; sixth much thicker and more spherical than in any other species of *Polydesmus* figured by Wood or known to me; seventh joint small, conical, a little more than half as long as the sixth. They are pubescent, with scattered, stiff hairs. The first segment behind the head is crescent-shaped, but little more than half as wide as the head, bearing two rows of tubercles. The remaining joints from the fourth backward are about half as long as broad, with three rows of conical tubercles, those in the hindermost (third) row the largest; the sides of each segment emarginate, and produced posteriorly into a large spine, much as in *P. canadensis*. Terminal segment conical, ending in a conical, pointed, curved spine, and bearing a large spine on the side. Body covered with fine hairs. Legs as usual, 6-jointed; the fourth and fifth joints taken together as long as the sixth, which is slender, very hairy, ending in a long spatulate claw. Color uniformly pale white, including the head and appendages. Length, 5 millimeters.

It differs from any other American species known to me in its large round head, which is much wider than the body, in the unusually cylindrical body, with the three rows of conical papillæ or spines, and the swollen sixth antennal joint. It is allied in the granulated and narrow body to *P. granulatus*, but in the emarginate and posteriorly-produced segments to *P. canadensis*, but differs from both as well as Say's *P. serratus* in the much narrower, more cylindrical body, as well as in the proportions of the joints of the antennæ. Thus far no species of *Polydesmus* has occurred in Utah, so that a careful comparison with more closely-allied forms than those mentioned has not been possible. Four examples occurred under stones in a damp spot in Clinton's Cave, Lake Point, about twenty miles west of Salt Lake City, Utah.

So far as these specimens prove anything, the results of a life in almost total darkness upon this Myriopod are seen in the antennæ being a little longer than in allied forms and in the hairy, attenuated body. That it is a descendant of some out-of-door form is attested by the large, well-marked tubercles on the body, like those in *P. granulatus*,

and a certain species inhabiting Ceylon, *Polydesmus cognatus*, which it resembles more nearly than any American species known to me, both in the cylindrical body and form of the antennæ.

Julus, sp.—A fraction of a galley-worm comprising a few segments only, agrees in form and color with an undescribed species from Colorado, and is probably not a cave species.

MOLLUSCA.

Of the following species, described by Mr. W. H. Dall, several examples occurred. Specimens were sent to Mr. W. G. Binney, who regards it as "apparently an albino variety of *Zonites indentata*". Specimens were submitted to Prof. E. S. Morse, who judged it to be quite distinct from *Z. indentata*. Other specimens were sent to Mr. Dall, who describes it as a new species, and has kindly prepared the following notice:—

"*Hyalina subrupicola*, n. s. (Fig. 7).—This little shell is best described by a comparison of its various characteristics with those of *H. indentata* Say, as given by Dr. Binney in his Land and Freshwater Shells of the United States (part I, p. 35).

"*H. subrupicola*, while exhibiting radiating lines of growth, some of which are more conspicuous than others, does not show any such well-marked grooves or indentations as are figured by Morse (Land Shells of Maine) in *indentata*, and which form its most striking specific character. The former has five and a half whorls, with a greatest diameter in the largest specimen of 0.14 inch, while *indentata* has but little more than four, with a diameter of 0.20 inch. The former is perfectly pellucid, while the latter has a peculiar whitish spermaceti-like luster. *H. subrupicola* has the last whorl smaller proportionally than *indentata*, and in fact the increment of the whorls in the former is much more regular and even. The umbilicus in both is precisely similar.

"The animal of *subrupicola* varies from whitish to slaty; the granules of the upper surface of the foot are remarkably coarse and well marked. The tentacles are, as contracted in alcohol, hardly perceptible; the eye-peduncles, are from the same cause, not extended, but appear to be as usual in the genus, and to possess normal ocular bulbs. The office filled by these, however, being quite as much of a tactile nature as for purposes of sight, the usual rule in regard to the blindness of most cave animals does not apply in the case of the *Helicidæ*. With the exception of *H. indentata*, this species does not seem very near to any of the described American species, and it is totally dissimilar to *Ammonitella yatesii* J. G. Cooper, a remarkable form found in caves in Calaveras County, California.

"*Hab.*—Cave in Utah. Collected by Dr. A. S. Packard, jr., of Dr. Hayden's Survey.

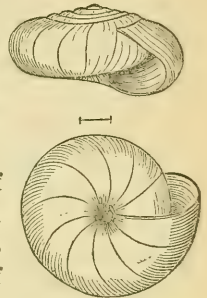


FIG. 7.—*Hyalina subrupicola*, DALL, n. sp.

"It may be noted that *H. indentata* does not appear to have been collected west of the Rocky Mountains."

I am indebted for the accompanying drawing (Fig. 7) of this species to Mr. A. F. Gray, of Danversport, Mass.

The following species of harvestman is described, as either this or an allied form may be found to occur in caves in the Rocky Mountains:—

Scotolemon robustum, n. sp., ♂ ♀. (Fig. 8.—*a*, maxilla; *b*, *c*, mandible, all enlarged).—Tegument deep-reddish, with the hinder segments

finely bordered with brown; tarsal joints paler, with dense blackish specks; cephalothorax a little paler red, marbled with reticulated darker lines. Body pyriform, two-thirds as long as broad; cephalothorax a little more than half as long as wide, the front edge slightly rounded, with the angles well marked. The eye-tubercle not so large and high as in *S. terricola* Simon, being of moderate size. Eyes black and large, fully developed, while those of *S. terricola* are nearly obsolete. Abdomen a little longer than broad; the first five segments

well marked, the sutures being much more distinct than in *S. terricola*, or

probably any other European species, judging by Simon's drawings. The last three segments, with the outer edge of each segment, free, not united with each other, as are the five basal joints; last segment with the ventral slightly projecting beyond the tergal portion. Beneath are seven well-marked sterna, the first and second being united without suture.

Mandibles of the usual form, rather stout at base of first joint, but much as in *S. terricola*; second joint moderately long; hand of the usual form, a little unequal. Maxillæ unusually short and thick, much more so than in *S. terricola* or any other species described by Simon; basal joint broader than long, with a pair of stout, sharp spines and four small ones; second joint nearly two-thirds as broad as long, full and swollen above, beneath with four large spines; third joint much slenderer, one-half as long as the second; fourth joint nearly twice as long as broad, with five stout spines, of which the fourth is much larger than the others, the fifth minute. Fifth joint as long as, but slenderer than, the fourth, with five stout spines, the fifth and terminal spine much larger than the others, and as long as the joint is wide. This joint is a little hairy, while the others are nearly naked.

Legs stout, much more so than usual in the genus; anterior pair with three tubercles ending in hairs on the second joint; a larger tuber-

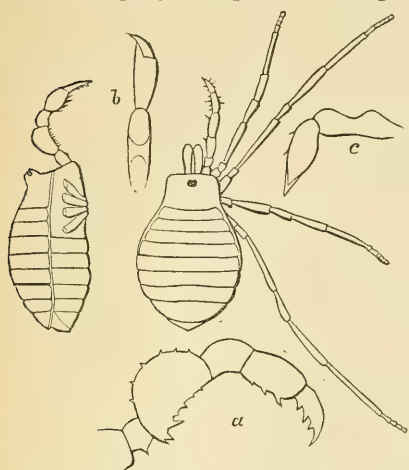


FIG. 8.—*Scotolemon robustum*, PACK., n. sp. (enlarged).

cle on the fourth joint; the three other pairs are unarmed. Second pair of legs longer than the first by one-third of their length. The second and fourth pairs are of nearly equal length, the fourth pair differing in having the third joint considerably swollen. The third and first pairs of the same length. On the coxæ of the second pair of legs is a pair of stout conical spines, meeting over the median line of the body. The anterior tarsi are 3-jointed, as in *S. terricola* of Europe, the middle one much shorter than the other two, which are of equal length. Those of the second pair 5-jointed, those of the third and fourth pairs 4-jointed, the end of the tibiæ being constituted so that the limbs appear as if they had five tarsal joints. Ungues rather long and moderately curved. The legs are stouter and shorter than in *S. terricola*, and none of my specimens have the long, singular, sinuate appendage on the first joint present in *S. terricola*. (They are not referred to by M. Simon in his description, though my specimens were received from him.)

Length of body, exclusive of the mandibles, 3.5^{mm}; breadth, 2.5^{mm}.

Compared with *S. terricola* Simon from Corsica, which also lives under very large stones, and is found common at Porto-Vecchio after the heavy spring rains, but which has not yet occurred in caves, our out-of-door form is much stouter, with much shorter legs, and also differs in its well-developed eyes, dark brick-red tegument, and dark markings. It was discovered in Colorado in 1874 by Mr. Ernest Ingersoll, while attached to Hayden's Geological Survey of the Territories. He tells me that it did not occur in any cave, the exact locality and mode of life being forgotten. It will most probably be found under stones.

Compared with *Scotolemon flavescens* (*Erebomaster flavescens* Cope, American Naturalist, vi, 420, 1872, from Wyandotte Cave, Indiana), which is allied to the European *S. piochardi* which inhabits caves near Orduno, it differs in the basal segments being much more distinct, where the sutures in the tergum are obsolete in *S. flavescens*. The eye-tubercle is a little smaller proportionately, while the eyes themselves are much larger. The mandibles and maxillæ are shorter, while the legs are very much shorter and stouter. The color is deep-red, the cave species being pale-yellow. These are all differences such as we should expect to find between a cave-dweller and one which has lived out of doors under stones, &c. In these two species, we have forcibly brought before us the great structural differences brought about by striking differences in the environment of the two species.

A high degree of interest attaches to this cave fauna, because we are able to determine with much precision the period when the cave was made, and the time of its subsequent colonization by the ancestors of the present inhabitants. On turning up the loose material constituting the bottom of the cave, I found that it was largely composed of a shell-marl, in which occurred in abundance little fresh-water shells which Mr. G. W. Tryon determines as *Ammicola decisa*

Hald., *A. cincinnatiensis* Anthony, and *Pomatiopsis lapidaria* Say. It is plain that this marl is from the Bonneville beds of Mr. Gilbert, containing shells which lived in the lake when the waters were at the level of the mouth of the cave. Prof. F. V. Hayden, in 1870, found in these beds *Fluminicola fusca* Hald., *Valvata sincera* Say, *Limnæa catascopium* Say, *L. desidiosa* Say, *Ammicola limosa* Say,* *Pomatiopsis cincinnatiensis*. Afterward Mr. Gilbert found the following additional species:—*Pomatiopsis lustrica* Say, *Succinea lineata* Binn., and a *Cypris* (?). This formation was regarded as Quaternary by Dr. Hayden. Mr. Gilbert regards the deposit as a lacustrine one, thrown down during the Glacial epoch, when “the great climatal revolution which covered our Northeastern States with ice was competent to flood the dry basin of Utah”. The cave, then, is of very recent origin, and as it is only perhaps 200 feet above the present level of the lake, the highest terrace or raised beach being 1,000 feet above the present level, Clinton’s Cave was not excavated until the latter half or last third of the Quaternary epoch, and it was not until some time after then that the ancestors of the present inhabitants obtained a foot-hold, and that nearly the present relations of the existing fauna of Utah were established. That this was the case is further supported by the fact that the species of animals found in the cave are such as may have been descendants of an assemblage which flourished when the country was more humid than now.

These species have been nearly as highly modified as the cave animals of the Eastern States, and now that we know the exact geological age of this Utah cave fauna, we seem warranted in assuming, as has been suggested by Professor Cope† and the writer (*American Naturalist*, v, 758, 1871), that the caves of Kentucky, Indiana, and Virginia were formed during the Quaternary period, and that they were first tenanted late in this period.

This fact—for it is not simply a theory—is important in its bearings on the evolution theory. The modifications undergone by these animals, which consist chiefly in the absence of eyes or their partial development, the elongation of the appendages of the mouth and thorax, and the loss of color, are changes probably wrought with comparative suddenness, namely, after perhaps a few hundred generations, rather than a great number of generations, such as are demanded by extreme followers of Mr. Darwin. Two sets of causes, it seems to us, have, by their resultant action, produced the present cave forms,—first, we have the characters inherited from their out-of-doors ancestors; and, second, those superadded by a cave life. Those due to the latter cause are slight compared with those due to inheritance-force, since the former have evidently acted for a brief period and have little of the cumulative force due to

*Mr. Tryon writes me that *Ammicola galbana* Hald. was collected by Dr. Hayden from an ancient lake-terrace on Salt Lake.

†Proceedings of the American Philosophical Society, April, 1871.

inheritance. This seems indirect proof that cave faunæ are of comparatively recent origin. In the production of these cave species, the exceptional phenomena of darkness, want of sufficient food, and unvarying temperature, have been plainly enough *vera causa*. To say that the principle of natural selection accounts for the change of structure is no explanation of the phenomena; the phrase has to the mind of the writer no meaning in connection with the production of these cave forms, and has as little meaning in accounting for the origination of species and genera in general. Darwin's phrase "natural selection" or Herbert Spencer's term "survival of the fittest" expresses simply the final result, while the process, the origination of the new forms which have survived, or been selected by nature, is to be explained by the action of the physical environments of the animals coupled with inheritance-force. It has always appeared to the writer that the phrases quoted above have been misused to express the cause, when they simply express the result of the action of a chain of causes, which we may with Herbert Spencer call the "environment" of the organism undergoing modification; and thus a form of Lamarekianism, greatly modified by recent scientific discoveries, seems to meet most of the difficulties which arise in accounting for the origination of species and higher groups of organisms. Certainly, "natural selection" or the "survival of the fittest" is not a *vera causa*, though the "struggle for existence" may show us the causes which have led to the *preservation* of species, while changes in the environment of the organism may satisfactorily account for the original tendency to variation assumed by Mr. Darwin as the starting-point where natural selection begins to act.

In our examinations of cave animals, from extensive material collected in the Middle States, and not yet wholly worked up, we find that a life of perpetual darkness, and perhaps the want of sufficient food, as well as other physical agencies, cause animals to vary either in color, the general proportions of the body, the length of the mouth-parts and legs, the distinctness of the joints of the appendages, where the possessors are articulated animals, and the greater or less modification of the eyes. These modifications occur in different degrees in different species or genera, but the sum of the change in the environment due to an introduction into a cave acts differently on the different forms, depending most probably on the out-of-door habits of their ancestors, but resulting in either (*a*) the production of what is usually called a distinct variety, or (*b*) a distinct species, or (*c*) a distinct genus. No cave form, vertebrate or invertebrate, has, so far as we are aware, yet occurred which could not have been derived from forms existing out of the cave; or, in other words, all are, as a rule, for there is a notable exception in the case of the blind fish, related more or less closely to organisms existing in the vicinity of the caverns.

Note on a Beetle and Larva found in a cave at Manitou, Colorado.

I made a brief examination of a large but very dry cave, about 600 feet long, opened to travelers in 1874, in the Carboniferous limestone in Williams Cañon, at Manitou, Colo. The only life found in the cave was a beetle, identified by Dr. Horn as *Diclidia latula* Le Conte, two flies, and three Coleopterous larvæ. The beetle occurred near the entrance, and did not differ materially from other specimens which I collected under stones in the cañon near the entrance to the cave. A species of Mycetophilid fly also occurred near the door, as well as a specimen of *Blepharoptera defessa*, Osten Sacken,* not differing from specimens which occur in various caves in Indiana (Wyandotte), Mammoth Cave, and adjoining caverns.

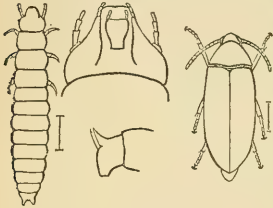


FIG. 9.—*Diclidia latula* and larva.

* *Blepharoptera defessa*, n. sp., ♂ ♀.—A sparse pubescence on the under side of the pleuræ, a single vibrissa on each side of the epistoma, a single strong bristle above the middle tibiæ; costa beset with moderately long bristles; length 5-6^{mm}.

Antennæ red, third joint brownish red; arista rather long; front yellowish-red; frontal orbits grayish; a paler triangle on the vertex, bearing the brownish ocellar tubercle; anterior frontal bristle short, the one behind not quite twice as long. Thoracic dorsum yellowish-gray; the eight large dorsal bristles are inserted on brown spots, which are sometimes confluent; the finer pubescence on very minute dark spots, an often faint brown stripe in the middle, and a still less distinct one on each side; humeral callosities reddish, the flat scutellum likewise. Pleuræ pale brownish-gray, darker below. Abdomen grayish-pollinose, the ground color being blackish; male hypopygium yellow, with delicate black pile; tip of the female abdomen also yellowish; hind margins of segments pale. Halteres whitish. Wings with a brownish-yellow tinge; bristles on the costa of moderate length; posterior cross-vein rather near the tip of the fifth vein, the last section of that vein being less



FIG. 10.—*Blepharoptera defessa*, OSTEN SACKEN, n. sp.

than half of the cross-vein. Legs reddish-brown or brown; knees and base of middle femora paler.

Habitat.—Hundred Dome Cave, near Glasgow, Ky. (F. G. Sauborn, Geological Survey of Kentucky, N. S. Shaler in charge); a male and two females. The specimens having been kept in alcohol were very much injured. The species is related to *B. cineraria* Lw. (syn. *armipes* Lw.), but is easily distinguished by the absence of the peculiar armature on the hind femora of the male, the much darker legs, larger size, &c. The anterior frontal bristles of *B. cineraria* are much shorter, but the pair above them much larger than in *B. defessa*. In one of my specimens, the male, the tibiæ are somewhat yellowish in the middle; the frontal bristles were observed on the female, as they had disappeared from the male specimen.

Blepharoptera are often found in caves, where they are said to breed in the excrement of bats. [This species also occurred in Mammoth Cave, Wyandotte Cave (Packard), and numerous smaller caves (Sauborn), and will be further noticed in the Monograph of Cave Life in the Memoirs of the Kentucky Geological Survey.—(A. S. P.)]

The occurrence of this species in caves so remote is interesting. No *Diptera*, I am informed by Baron Osten Sacken, are peculiar to caves, though this species is common in most of our caves, especially near the entrance, and has not been found elsewhere. Associated with the beetle were three larvæ, which I am inclined, with some doubt, to regard as the young of *Diclidia latula* LeConte. It seems to agree with the family characters of the larvæ of the *Mordellidæ*, as laid down by Chapuis and Candèze; but, of course, until some one rears it, the identification will be uncertain. I give meanwhile a brief description of it.

In general form it is like the larva of *Anaspis*, the body being rather long and narrow, the head nearly as wide as the prothoracic segment, the body a little wider than the head, thickest in the middle, and gradually tapering toward the end; head as long as broad, subtrapezoidal, somewhat square, the sides not very convex, the surface depressed, with a few scattered hairs. Antennæ as long as from the base of the head to their insertion; 4-jointed; 2d joint a little wider and one-third as long as the 3d joint; the 4th joint as long as the 3d is thick, ending in three or four hairs. Mandibles acute, not very long. Maxillary palpi one-third as long as the entire maxilla, being small and short, appressed to the head; 3-jointed, the joints subequal; 2d joint short, the 3d nearly twice as long as the 2d. Labium small; palpi feeble, short, and small; 2-jointed, the joints subequal. No eyes can be detected. Prothoracic segments well rounded in front, nearly as long as broad; 2d abdominal segment not much longer than the 3d; the terminal segment narrows rapidly behind, ending in a pair of upcurved spines, which are rather long and slender, acute, tipped with brown, with the anal proleg rather large. Legs rather long and slender; tarsi ending in a single claw. Color whitish; head and prothoracic segment slightly tinged with honey-yellow. Length, 5^{mm}. Three specimens, apparently not fully grown, as they were small in comparison with the beetle. They were found on boards forming the steps in the entrance of the cave, in perpetual darkness, however, and had evidently been artificially introduced.

This genus belongs to an interesting family, as the larvæ of *Metococcus*, *Rhipiphorus*, *Symbius*, and *Horia*, live in wasps' nests, and *Rhipidius* is a parasite on *Blatta germanica*. The young of *Mordella* and *Anaspis*, however, burrow in the stems of herbaceous plants, while the larvæ of *Mordella fasciata*, Fabr. in Europe lives in the "dead wood of the poplar".

ART. XI.—DESCRIPTIONS OF NEW PHYLLOPOD CRUSTACEA
FROM THE WEST.

BY A. S. PACKARD, JR., M. D.

FIGS. 11-14.

The species described in the following paper were discovered by Dr. L. Watson, at Ellis, Kans., in 1874, and by Dr. Elliott Coues, United States Army, naturalist to the United States Northern Boundary Survey. The collections of Dr. Watson from Kansas were of much interest, as containing a remarkable new form of the group *Branchipodidae*, quite unlike any other known genus; an interesting *Streptocephalus*, forming the second species known to inhabit North America; a new *Limnadia* and *Lymnetis*, while the occurrence of *Apus lucasanus*, in great numbers, shows that the range of this species is wide, and that over that range it is exposed to little or no variation. Regarding the collections he made, and which are here identified and described, Dr. Watson writes me as follows, dated Ellis, Kans., July 8:—"I have to-day sent you, by express, a small box, containing the *Crustacea* mentioned in my letter of June 26, and such as I could collect from various pools up to July 4. The pool from which I pulled the weeds, and from which I got what I sent by mail, was all dried up upon my visit to it a few days afterward. I worked diligently up to July 4, when I got the last. I have ceased to look farther, for the pools, where they are likely to have been, are all dried up." On November 12, he writes:—"The first slight frost we had was on the morning of October 12; the next slight one on the 16th; none again till the 29th. On the 31st, the temperature was 18° in the morning, and 24°, 26°, 28°, November 1-3. After that, no frost till November 8. On November 6, I got a few *Estheria* [*clarkii*] from a pool in which I had seen *Apus* [*lucasanus*]; but the latter had disappeared at that date. All but the smaller *Branchipus*-like form [*Streptocephalus watsonii*] have not been abundant this fall. I have had to watch for single ones, and could capture only one at a time, except, occasionally, two *Estheria* would be united, possibly in copulation." In July, when collecting the others, the thermometer stood at 103°-110° in the shade. On December 21, 1874, he again wrote me as follows:—"I drop you a postal card to say, that from some dried mud of an extinct pool, to which, in a goblet, I added water, there are now hatched out some of the *Branchipus*-like forms [*Streptocephalus watsonii*]; also *Estheria* [*clarkii*] and some insects. The former have grown to the length of two-tenths of an inch within a few days from mere specks, only noticeable by their

motions. They swim about actively. The young *Estheria* are crawling actively over the surface of the sediment. Temperature of the room pretty uniformly 68°, rarely over 70° during the day, subsiding at night to 50° or 40°."

The collections made by Dr. Coues were from the Northern Boundary line of the United States, latitude 49° north, in Montana Territory, and are of great interest, from the discovery of a genus (*Lepidurus*) new to temperate North America.



FIG. 11.—Front of head of *Lymnetis* spp.—a, *L. gouldii*; b, *L. gracilicornis*; c, *L. brevisfrons*; d, *L. gouldii*.

Lymnetis brevisfrons, n. sp. (Fig. 11, c, front of head).—Many females. Carapace decidedly triangular in outline, more so than in *L. gouldii*, while it differs very decidedly in this respect from *gracilicornis*, and is considerably larger than *gracilicornis* or *mucronatus*, and is flatter than both. Front shorter and broader than usual; less contracted in width at the base of the antennæ than usual. The frontal carina is high, especially a little in front of the eyes. Compared with that of *Lymnetis gracilicornis* (Fig. 11, b), it is much broader, shorter, the keel reaching to the end, which is squarely docked, the end being a flattened triangle; the end of the front reaches to the middle of the antennæ, while in *L. gracilicornis* the end reaches two-thirds of their length. It differs from *L. gouldii* (Fig. 11, d) in the front being thicker, the truncated end forming, seen from the end, a much less flattened triangle.

Lower antennæ considerably longer than in *L. gouldii*, the terminal joint extending well beyond the end of the front, while in *L. gouldii* it does not extend beyond the front; the upper branch of the flagellum has 22 joints; the lower, 20. (In *L. gouldii*, there are 14 joints in the upper, and 12 in the lower branch of the antenna.) There are twelve pairs of feet. Terminal segment less prominent than in *L. mucronatus*, while the dorsal edge is less excurved.

Average size of most of the specimens: Length, 4^{mm}; breadth, 3½^{mm}. Several larger examples were 6^{mm} long and 5^{mm} broad.

Ellis, Kans., June 28 and 29, Dr. L. Watson, in pools, associated with several other species of Phyllopod.

A few eggs were contained in most of them. This is the largest species known, and is as a rule flatter and more triangular than any other species, while the truncate front of the head is shorter and broader than in any other American species yet known.

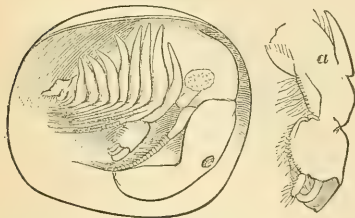


FIG. 12.—*Lymnetis mucronatus*, PACK.; male; a, claw; both enlarged.

Lymnetis mucronatus Pack. (American Naturalist, ix, 1875, 312) (Fig. 12, male, much enlarged,—a, hand, much enlarged; Fig. 11, a, front of head of female, enlarged).

Male.—Carapace much flattened, oval-triangular, the dorsal edge of the valve but slightly curved, the posterior end well rounded, while the front end is but slightly curved. Head in front truncate, much as in the females of *L. gouldii* and *gracilicornis*, the end being broad and square. Hand large, a little longer than broad, with the claw large, and as long as the hand is broad. There are nine pairs of limbs, the ninth ending in a pair of large, strong, recurved hooks. The end of the terminal segment on its ventral side is rather more produced, and with a more conspicuous spine than in the female. Two males occurred among forty-four females.

Length of carapace, 4^{mm}; breadth, 3.2^{mm}.

Female.—Carapace scarcely distinguishable from that of *L. gracilicornis* in outline, though it varies slightly in form, some being quite round and regular, others slightly ovate, and some quite flat and triangular. Muscular impression as in *L. gracilicornis*, but the vascular impression is much broader and proportionately shorter than in *L. gracilicornis*, where the front of the head is suddenly truncate, and wider at the extremity than behind in *gouldii*; while in *gracilicornis* it is also truncate, but does not contract so much in front of the eyes, the narrowest point being between the eyes and the end of the front. In the present species, however, the front is very much produced into a long, acute, mucronate point, with two teeth on each side, the middle tooth varying much in length. The carina is very high and sharp.

Antennæ with the second joint half as long as the basal; four succeeding joints very short, and together not as long as the succeeding seventh joint, from which arise the flagellum, the upper branch of which is 15-jointed, the lower one 17-jointed, with ciliated hairs, the longest ones as long as the entire antenna. Twelve pairs of feet.

End of the body blunt, squarely docked, the point blunter than in *L. gouldii*, and ending in a slender spine. Two dorsal terminal filaments, much as in *L. gouldii*.

Length of carapace, or shell, 4^{mm}; breadth, 3^{mm}. Forty-four females, nearly all with eggs, occurred with *Lepidurus couesii*, in pools on the west bank of Frenchman's River, Montana, 49° N. It also occurred in large numbers associated with *Lymnetis brevifrons* in pools at Ellis, Kans., collected by Dr. L. Watson June 29, 1874. The specimens were females with eggs, and as a rule were triangular in outline, compressed, only one or two of the Montana examples being so much compressed: but the species is so easily recognized by the mucronate, tridentate front of the female head, that I think no mistake has been made in the identification of the Kansas specimens.

Lymnetis gouldii Baird (Fig. 11, *d*).—I have received from Mr. S. A. Forbes male specimens of this species from Normal, Ill. The hand is much slenderer and the claw longer than in *L. mucronatus*, while the carina on the front of the head is unusually high. In the female, the front of the head is very sharply mucronate, with lateral angles, as in sharply mucronate specimens of *L. mucronatus*.

Estheria clarkii Packard (Sixth Report Peab. Acad. Sc., 55, 1874).—This species occurred in great abundance at Ellis, Kans., where it was collected by Dr. L. Watson June 24–29, September 27, and October 10 and 22, 1874. While the carapace varies slightly from Kentucky specimens, the body does not.

Eulimnadia compleximanus, n. sp., 10 ♂ 15 ♀ (Fig. 13, *a*—male hand; *b*, end of body).—Carapace alike in both sexes, delicate, thin, smooth, in form very closely allied to that of *E. agassizii*, the two species being nearly identical in outline, though larger; fourteen or fifteen lines of growth, while there are four in *E. agassizii* and five in *E. texana*; the lines much more distinct than in either of these species. The head differs from that of *E. agassizii* in being full, and bulging out over the eyes, but in this respect is like *E. texana*, though it is more retreating than in the latter species. The pedunculated tubercle on the front of the head is a little more produced than in *E. texana*. The antennæ differ decidedly from those of the two other species mentioned in the joints being much shorter and broader, with much shorter, stiffer hairs; flagellum with fifteen joints in each branch. Twenty pairs of feet.



FIG. 13.—*Eulimnadia compleximanus*, PACK., n. sp.: *a*, hand; *b*, end of body; enlarged.

Male hand long, and with a well-marked thumb-like process about half as long as the claw which opposes it, and which is much curved. Second pair of hands with the thumb bent at right angles, opposing a slender forefinger like a claw; a long, curved, blunt, supplementary appendage arises from the base of the "forefinger".

Terminal segment alike in both sexes, larger than in the two other species, and bulging more at base, where the two dorsal filaments arise. The edge is much more finely spinulate than in *E. texana*, it being coarsely spined in *E. agassizii*, while the terminal spine is very large, nearly half as long as in the other species. The large ventral spine is large, and broader at base, and tapers more rapidly than in the two other species. It is not so long, in proportion to the terminal segment, as in *E. agassizii*, and is naked, not hairy, as in *E. agassizii* and *texana*. Most of the females carried eggs, which were a little smaller than those of *E. agassizii*.

Length of carapace, 7^{mm}; breadth, 5^{mm}.

Ellis, Kans., in pools, June 24–29, 1874, associated with the other Phyllopod from this locality.

THAMNOCEPHALUS,* nov. gen.

Male.—Claspers (second antennæ) with the basal joint short, the upper forming a long, up-curved, chitinous, slender appendage, extending, when outstretched, to the first third of the body; the lower lobe fleshy and short, straight. A distinguishing and remarkable character is the

*Θάμνος, shrubby, bushy; κεφαλή, head.

frontal, interantennal, shrub-like, branched, biramous appendage extending out in front, the brush more than half the length of the body, and sending off branches anteriorly.

Female. The frontal shrub is entirely wanting, while the second antennæ are remarkably long and broad, oar-like, acute at the tip. The egg-sac is long, subconical, rather thick and broad at the base, which is concealed by the leaf-like feet; it ends in two valves.

In both sexes, the body is unusually short and thick, though the head is of the usual size. Feet with the lobes broad and short, much more orbicular than usual; the abdomen dilates into a remarkably large, broad, fin-like expansion, beginning at the sixth segment from the end, and expanding at the last segment until it becomes wider than the body, and extending a little way beyond the last segment. It is fringed, and canals from the body ramify in it; at the end deeply notched, forming two broad, rounded lobes.

This remarkable genus differs from any other known to me by the short and broad, spatulate, fin-like expansion of the abdomen, while the male claspers are curved and simple. In both sexes, the body is stout, broad, and the egg-sac of the female is subconical, spreading out at the base. It is quite unlike any European genus.

Thamnocephalus platyurus, n. sp. (Figs. 14, 15, male; 14, *a*, head of female; 14, *b*, ovisac).—*Male.*—Frontal shrub over half as long as the body, the two branches subdividing into about seven sub-branches, all directed forward. First antennæ long and slender, extending to the end of the basal joint of the second or male claspers. The latter with the basal joint rather short, the claspers long, slender, and recurved, simple, saber-like, chitinous, the lower lobe soft, acute, subconical. Genital appendages in the usual position, short, not so long as the segment to which they are attached, and bilobed, there being two short terminal tubes, with distinct, large openings, directed downward.

Female.—Second antennæ large and long, extending back a little beyond the base of the ovisac, oar-like, expanding broadly on the outer two-thirds, especially on the upper edge. The ovisac is subconical, the base broad and concealed by the limbs; it terminates at the posterior edge of the fourth segment from the end, ending in two unequal flaps, the upper four times larger than the under flap, and triangular in outline.

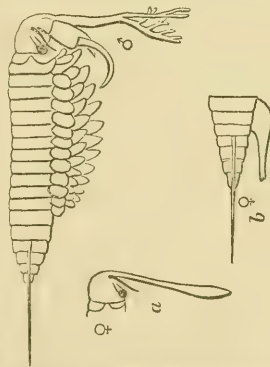


FIG. 14.—*Thamnocephalus platyurus*, PACK., n. sp., male, natural size. *a*, *b*, head and end of body of female, showing ovisac.

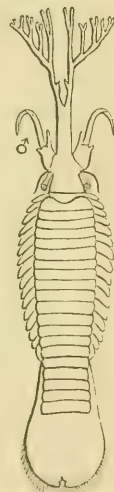


FIG. 15.—*Thamnocephalus platyurus*, male, natural size.

In both sexes there are eleven pairs of limbs, which are lamellar, short, and much rounded. A fin-like caudal expansion beginning on the sixth segment from the end, deeply incised at end of last segment on the median line of the body, spatulate, or like the blade of an oar in outline; edge fringed on the terminal third.

The sexual characters are very distinct when the animal is one-third grown, the oviducts being red with eggs, and the males with the frontal tree well developed.

Length, ♂, 23^{mm}; ♀, 26½^{mm}.

Ellis, Kans., Dr. L. Watson, June 26, 28, and 29, October 10 and 22, 1874. In pools of water on the plains in company with *Estheria* and *Lymnetis*. A full-grown male occurred September 27. On October 1-22, females of full size were collected, in company with *Apus lucasanus*, *Eulimnadia compleximanus*, *Estheria clarkii*. Ovisacs still with eggs, but empty at the end.

No striking variation was observed among several hundred specimens of different ages. Dr. Watson writes that they had "red tails".

Streptocephalus watsonii, n. sp.—Though this is closely allied to *S. texanus*, Packard (see Hayden's Annual Report of the United States Geological and Geographical Survey of the Territories for 1873, p. 622, plate iv, fig. 13), still the differences here pointed out are constant in numerous specimens.

Male.—The claspers (second antennæ) are much longer than in *S. texanus*, reaching, when extended, to the middle of the body, while in *S. texanus* they only reach a third of the length of the body. The median lobe of the head, which is very large and long in *S. texanus*, reaching nearly as far as the insertion of the basal filamentary appendage of the third joint of the claspers, is, in *S. watsonii*, not half as large. The two basal joints of the claspers are twice as long and much slenderer than in *S. texanus*; the third joint is nearly as long, while the branches and spines of the fourth joint, though of the same number, are much longer and slenderer. Of the longer branch, the supplementary spine is much longer, and without the small inner spine, while the main branch beyond is bent at nearly right angles, the elbow being much bent, the inside, however, regularly curved. At the base of the broader and shorter branch are four unequal teeth; one attached to the third joint, the other to the fourth, the two terminal ones very unequal, and the fourth square and three times as large as the third, while the corresponding tooth in *S. texanus* is long and narrow, and smaller than the one behind it. The genital appendages are long and slender, much as in *S. texanus*, as long as the three segments following the one to which they are inserted. The caudal appendages are much shorter and broader than in *S. texanus*, each blade being broader, and tapering regularly from base to tip, not contracted in the middle, nor curved, as in the male *S. texanus*; on the other hand, they are of much the same form as in those of the female *S. texanus*.

Female.—Very closely allied to the female *S. texanus*, though as a rule somewhat smaller, the eyes being decidedly smaller. The second antennæ are a little, sometimes much, longer in proportion, and are mucronate, as in the other species. The ovisacs are as in *S. texanus*, but the eggs are much smaller in proportion. The caudal appendages do not differ materially from those of the males, nor from those of the females of *S. texanus*.

Length of males, 16^{mm}; females, 12–18^{mm}. About fifty of each sex examined, although several hundred were casually looked over, without finding any that approached *S. texanus* any nearer than has been indicated.

Ellis, Kans., in pools on the prairie, June 28, 29, September 27, and October 10–22, Dr. L. Watson. A large number of half-grown males and females occurred in June. The largest females, those measuring 18 millimeters in length, occurred October 22, the ovisacs filled with eggs in some cases; in others, partially or entirely empty. The body was soft and in such a state of preservation as to indicate that they were at the point of dissolution. They were found associated with *Thamnocephalus*, *Lymnetis*, *Estheria*, *Eulimnadia*, and *Apus lucasanus*. The tails were red, says Dr. Watson, and in some the bodies were blue. This refers to those which were collected in June and early in July. "Those found in October and early in November (the 6th) were pure white, and the appendages to the tail seemed to me to be more divaricate than those of summer, in which those appendages were of a red color." While the males are easily distinguishable from those of *S. texanus* by the much greater length and different style of branching of the second antennæ, as well as in the smaller frontal tubercle and the slenderer caudal appendages, the females differ but slightly, but may still be distinguished by the smaller eyes and longer second antennæ. This species is dedicated to Dr. L. Watson, who has been indefatigable in his exertions to get me specimens.

Lepidurus couesii Pack. (American Naturalist, ix, 1875, 311) (Fig. 16, dorsal and lateral view).—Compared with *L. productus* Bose, of Europe, the carapace is of the same proportion, being large, broad, and leaving about five entire terminal segments exposed, including the telson. The denticulations on the hinder edge of the carapace are finer than in the European species, and show a tendency to become obsolete on the lower part of the incision. The eyes are slightly fuller, more prominent than in *L. productus*, and the interocular tubercle is smaller. The muscular area of the carapace is the same as in *L. productus*. There are usually from ten to twelve spines on the penultimate segment, as in *L. productus*. The chief distinction is in the very long spatulate telson, which is about

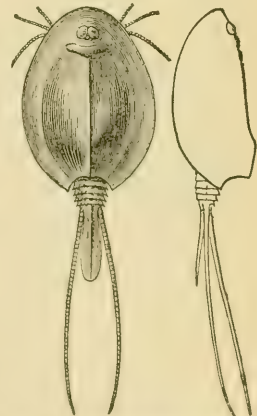


FIG. 16.—*Lepidurus couesii*, PACK.

twice as long in proportion as that of *L. productus*, and is long and narrow, varying somewhat in width and in size. The median ridge and edge are finely spinulose, the tip is well rounded; caudal stylet nearly as long as in *L. productus*; labrum a little smaller than in *L. productus*. The antennæ are the same as in *L. productus*, and the first maxillæ and second maxillæ do not differ essentially.

From *L. glacialis* Kroyer, of Greenland, it differs in the longer, larger carapace, eleven terminal segments being uncovered in *L. glacialis*. The spines on the excavation are much smaller; telson twice as long and not subtriangular, and excavated at tip, as in *L. glacialis*; eyes larger; interocular tubercle decidedly smaller; labrum smaller. The first maxillæ are much longer than in *L. glacialis*, in which the branches are very short and the second lamellate division very small and ovate, compared with the same part in *L. productus* and *coesii*.

Length of an average specimen from head to end of telson, 20.2^{mm}; telson, 5^{mm}; stylets, 15–19^{mm}.

This is the first occurrence of the genus in North America south of the arctic circle. It was collected by Dr. Elliott Coues, naturalist of the United States Northern Boundary Commission. He writes me that they "occurred in myriads in several small prairie pools, from a hundred yards to a half mile or so wide, exactly on the boundary-line, 49° N., just on the west bank of Frenchman's River, Montana. You will not find this stream on the map, perhaps, by this name. It is one of the first of the whole series of similar streams flowing south into Milk River. The species was not observed elsewhere. The ponds were extensive shallow sheets of sweet water, of a comfortable wading-depth, generally with a little open space in the deepest part, but mostly choked with luxuriant vegetation (*Gramineæ*, *Utricularia*, &c.). Date of collection, first week in July, 1874." Thirty-two males and thirty-one females were obtained by Dr. Coues; this equality in the number of the sexes is noteworthy.

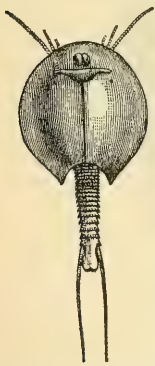


FIG. 17.—*Lepidurus bilobatus*, PACK., n. sp., male.

Lepidurus bilobatus, n. sp., 10, ♂ 3 ♀ (Fig. 17).—Male.—Carapace broad and short; as broad as long, measured along the median line. The eyes as in *L. coesii*. The excavation in the front edge of the carapace is much larger and broader than in *L. coesii*, and the teeth are more numerous, but very unequal in size, there being a few large teeth, with a number of smaller ones between them. The abdomen is longer than usual, with six (and part of another) segments beyond the last pair of feet, while in *L. coesii* there are only five. The spines on the edges of the abdominal segments are larger than in *L. coesii*, including the five teeth on the edge of the segments as well as the spines. There are about sixteen segments beyond the posterior edge of the carapace; in *L. coesii*, eight. On the dorsal side of the abdominal segments there are eight spines on the hinder edge, while there are nine in *L. coesii*. The species

differs from any others in the remarkably short telson, which is short and broad, nearly one-half as long in proportion as in *L. couesii*. The segment is broader at base and the telson is broader than in any other species; it is truncate at the end, and divided by a slight incision into two well-marked lobes, with about seven more or less well-marked median spines on the blade of the telson; this segment, including the telson, is as long as the preceding segments collectively. In the carapace, seen from beneath, the distance from the anterior edge of the hypostoma to the anterior edge of the carapace is much less than in *L. couesii*, while the hypostoma itself is much more convex. The antennæ are much longer and broader than in *L. couesii*. The first (shortest) branch is broad, not so long as in *L. couesii*; the second branch extends nearly two-thirds of its length beyond the edge of the carapace; third branch a little more than twice as long as the second, while in *L. couesii* it is but slightly longer than the second. The feet are broader than in *L. couesii*. Length, including caudal filaments, 48^{mm}; length of carapace (measured along median line), 18^{mm}; breadth, 18^{mm}; caudal appendages, 17½^{mm}; antennæ, 15^{mm}.

Female.—Differs from the male in the much shorter body and shorter antennæ. There are five segments beyond the last pair of feet, and twelve segments beyond the edge of the carapace. It is easily distinguishable by the shorter abdomen and antennæ, but otherwise it does not differ, the telson and caudal filaments being of the same proportion. The egg-sacs were empty; they are situated on the tenth pair of feet. Length of body, 35^{mm}; length of carapace (measured along median line), 15^{mm}; breadth, 17^{mm}; length of caudal appendages, 14^{mm}; antennæ, 10^{mm}.

Po Cañon, Vermillion River, Colorado; collected by Dr. C. A. White, of Major Powell's Survey. Described from specimens kindly loaned by Prof. H. A. Ward, of Rochester, N. Y.

This exceedingly interesting species differs from any other known to me in the large, broad, bilobed telson, that of *L. glacialis* being small, sub-triangular, while in *L. productus* and *L. couesii* it is long and spatulate. It differs from the two latter species in the longer, broader, second antennæ, the longer body, and shorter carapace.

North America seems to be richer than Europe-Asia in the species of this genus, one only occurring in the Eastern Hemisphere, while three species occur in North America, one in Greenland and Arctic America, and two on the plains and cañons east of the Rocky Mountains. No species of the family have as yet occurred east of the Mississippi River.

Apus lucasanus Packard (Amer. Jour. Sc. Arts).—This species occurred in great abundance at Ellis, Kans., associated with the other Phyllopods from this locality. It was collected in June by Dr. L. Watson. The specimens are not distinguishable from my types of *A. lucasanus* from Cape Saint Lucas, Lower California.

NOTE.—Figs. 11, 13, 14, and 15 were drawn under my direction by Mr. J. S. Kingsley, and Figs. 12, 16, and 17 by Mr. J. H. Emerton.

ART. XII.—NOTES ON SOME ARTESIAN BORINGS ALONG THE
LINE OF THE UNION PACIFIC RAILROAD IN WYOMING TER-
RITORY.

BY F. V. HAYDEN.

PLATE 26.

For some time after the completion of the Pacific Railroad across the continent, a "water-train" was employed by the road to transport water for steam purposes between Rawlins's Springs and Green River. For a distance of about 140 miles, the road passes through a region barren, arid, with scarcely any water, and that so alkaline that it could not be used for the purpose of steam, and therefore the "water-train" was employed to transport water from Green River at great expense and labor. Acting on the suggestion of the writer, Mr. T. E. Sickles, at that time the chief engineer and general superintendent of the road, determined to sink a number of artesian wells at different stations along this waterless interval. It was understood that the experiment would be a costly one, but the basin-like character of the strata from Separation to Rock Springs warranted a trial. Several points were fixed upon for sinking the wells; as, Separation, Creston, Washakie, Red Desert, Bitter Creek, Point of Rocks, and Rock Springs. With what measure of success the experiments were attended the accompanying diagram shows quite clearly.

Between Rawlins's Springs and Point of Rocks, the railroad may be said to pass over a synclinal basin, the strata of the Lignitic or Laramie group inclining in opposite directions at either end. From Creston to Bitter Creek Station, a distance of about fifty miles, the Tertiary beds are nearly or quite horizontal, so far as can be determined by the eye. The entire distance is a level, arid sage-plain, and although forming the "divide" of the continent, there is little or no water on the surface. It may render the diagram more easily understood if we present the prominent features of the geology from Rawlins's Springs to Green River.

At Rawlins's Springs, on the north side of the railroad, there is a group of low ridges of upheaval that extend to the northwest, in which are exposed the Archæan rocks at the base, with a series of Silurian, Carboniferous, Red Beds, Jurassic, Cretaceous, &c., uplifted on either side of the Archæan nucleus. On the west side, the sedimentary strata incline at various angles toward the west, the dip diminishing until at Separation the inclination of the Lignitic beds is not over 10°.

Overlapping the latter beds is a group of more modern Tertiary strata, which, in 1870, I named the Washakie group. The eastern limit of this group is near Creston, extending to a point just west of Bitter Creek Station. These beds, so far as they are exposed to the eye, are made up of soft clays and sands of various shades of brown and yellow, with here and there a thin layer of rather hard sandstone. In several places, beds of impure lignite are exposed. Fresh-water *Mollusca* in great quantities are found from point to point. At one locality, a stratum two feet in thickness is made up of fragments of *Uniones*. Near Table Rock, there is a bed of sandstone that is little else than an aggregate of fresh-water shells of the genera *Unio*, *Paludina*, *Melania*, &c.

So far as we at present know, this is a purely fresh-water group. We may say here, that although there is an apparent unconformity between this group and the Laramie group below, when exposed on the flanks of the Uinta Mountains, yet where the two groups can be found in conjunction and in a horizontal position, no line of separation can be found. Indeed, there is no absolute physical break from the brackish-water beds of the Upper Lignitic to the summit of the Bridger group, through at least 6,000 to 8,000 feet of strata. Near Bitter Creek Station there is a gradual elevation of surface, by which a portion of the upper beds of the Laramie group are brought up, and from thence to a point about two miles east of Salt Wells Station the Laramie beds are seen, inclining east and southeast at a small angle. Near Salt Wells Station the railroad passes across an anticlinal valley, in which are well-defined Cretaceous beds. These continue about six or eight miles, when the Laramie group appears again, with a reversed dip to the west. Soon after leaving Rock Springs Station, the Green River group overlaps the Laramie or Lignitic beds, with a moderate inclination to the west, and continues beyond Green River. The section will convey a true idea of the various changes that occur in the position of the groups of strata along the line of the artesian wells.

It is not the purpose of this article to discuss the geology of this region. I only wish to convey some idea of the age of the strata through which it was necessary to penetrate to reach the supply of water. The details of the geology will be fully set forth in the report of Mr. Clarence King, which will soon be printed. A beautiful geological map of a broad area in this district has already been published by Mr. King; a few copies were distributed November 15, 1875, and a notice was printed in the *American Journal of Science*.

The first boring given on the diagram is located at Separation, and passed entirely through rocks of the age of the Laramie group. The strata incline to the west. It will be seen that at 1,103 feet the water rose to within 10 feet of the surface, and yielded 2,000 gallons per hour. A few notes of the beds passed through are given, but the record is imperfect.

At Creston, no water was reached at 300 feet. Some two or three

years previously, the Union Pacific Railroad Company sunk a well to the depth of 100 feet. At 83 feet the workmen passed through 4 feet of coal and 4 feet of coaly shale. Just over the coal was a fine, bluish, indurated clay, with very distinct impressions of deciduous leaves in abundance, which Mr. Lesquereux refers to the genera *Acorus* and *Paliurus*. It so happened that the writer passed over this portion of the road soon after the well was dug, in 1869, before the clay was removed, and these specimens of the plants were collected. Such information as could be obtained from the workmen, was secured at that time.

At Washakie Station, a boring was made to the depth of 638 feet, through horizontal strata, but the record seems to have been very imperfect. A fair supply of water was obtained.

At Red Desert, water was obtained at the rate of 600 gallons per hour at the depth of 600 feet. It is probable that the red paint spoken of is the red earth that characterizes this group, which is probably the same as the Vermillion Creek of King and the Wahsatch group of Hayden. This group, though containing some thin beds of lignite, really rests on the true Lignitic or Laramie group.

At Bitter Creek Station, the strata are horizontal also. At the depth of 696 feet, it will be seen by the diagram that an abundant supply of water was obtained. A thin seam of coal and some oily shales were passed through, which would remind one of the peculiar oily shales of the Green River group, but they are believed to be far beneath them, and most probably in the upper portion of the Laramie group. Indeed, it has been found impossible to trace any physical line of separation between the brackish-water Lignitic beds below and the purely fresh-water group above.

At Point of Rocks Station, the Washakie or Wahsatch group has entirely disappeared in the immediate vicinity of the road, and the Lignitic group has risen up by a gentle dip toward the east and southeast. At this point, an artesian boring was made to the depth of 1,000 feet, from which an abundant supply of water was obtained.

Between Point of Rocks Station and Rock Springs the railroad passes across an anticlinal valley, in which a large thickness of the Fox Hills group is exposed, underlaid by the Fort Pierre group, or No. 4, with perhaps portions of the Niobrara group, or No. 3. Mr. King, in his excellent map of this region, very properly places under one general division the three groups, Fort Pierre, Niobrara, and Fort Benton, as the Colorado division. They cannot well be separated in this region, although on the eastern slope they might be separately defined on a map to a limited extent.

West of Salt Wells Station the dip is reversed. The entire series of coal-bearing beds comes to the surface above the true Cretaceous series, and gradually passes up into the Green River shales.

The well at Rock Springs is perhaps the most interesting one of the series in a geological point of view. The beds here dip to the west

or northwest at a moderate angle, and are much faulted, and yet at the depth of 1,145 feet water flowed to the surface at the rate of 960 gallons per hour, and at 26 feet above the surface at the rate of 570 gallons per hour. While the drill passed through alternate layers of clays, sands, and sandstones, as is usual in the Laramie group, not less than twenty or more seams of coal were found. From the position of the strata above the surface at this point, as many more seams of coal must exist above the top of the well in the Lignitic group before reaching the base of the Green River group. There must have been in former times in this immediate region a large number of basins, for at no other point can we detect any evidences of coal-seams.

Although the record of these artesian borings, as preserved by the railroad company, is very imperfect, it teaches an important lesson. I deemed it best to preserve it, however imperfect, in this form, as probably the only information we shall ever have of the interior of the earth's crust in this interesting region. That such an abundant supply of water should have been obtained in several different localities in one of the most arid portions of the West is a matter of the utmost practical importance. The annual rainfall in this district cannot be great—not more than 12 or 15 inches. According to the observations made for the Smithsonian Institution for many years, the average annual rainfall at Fort Bridger was only 6.12, while at Fort Laramie it was only 15.16. It could not be in excess of these figures at any of the intermediate points. It illustrates the value of the careful study of the position of the strata in the arid places of the West, and the feasibility of rendering available many millions of acres of land now lying useless. On the broad plains east of the mountains, wells may be sunk that will prove very useful for pastoral purposes.

The geology of this region is intensely interesting to geologists in another point of view, as showing, by the horizontality of the strata, the apparent continuity of all the groups from the Cretaceous to the summit of the Bridger group. The basin here is an extended one, and seems to have been partially disconnected from the one west of Green River at the present time; but it undoubtedly was connected more or less from near Rawlins Springs west to the Salt Lake Basin. In the Fourth Annual Report of the Exploration of the Survey in Wyoming, in 1870, I laid much emphasis on the continuity of the Cretaceous and Tertiary beds. I also separated the Tertiary group into four series, in ascending order, as follows:—

FIRST SERIES.—The coal strata, Lower Eocene, characterized by numerous impressions of deciduous leaves, marine and fresh-water *Mollusca*.

SECOND SERIES.—Arenaceous, Upper Eocene, characterized by a profusion of fresh-water shells, as *Unio*, *Goniobasis*, *Viviparus*, *Lymnaea*, &c., a portion of these being casts.

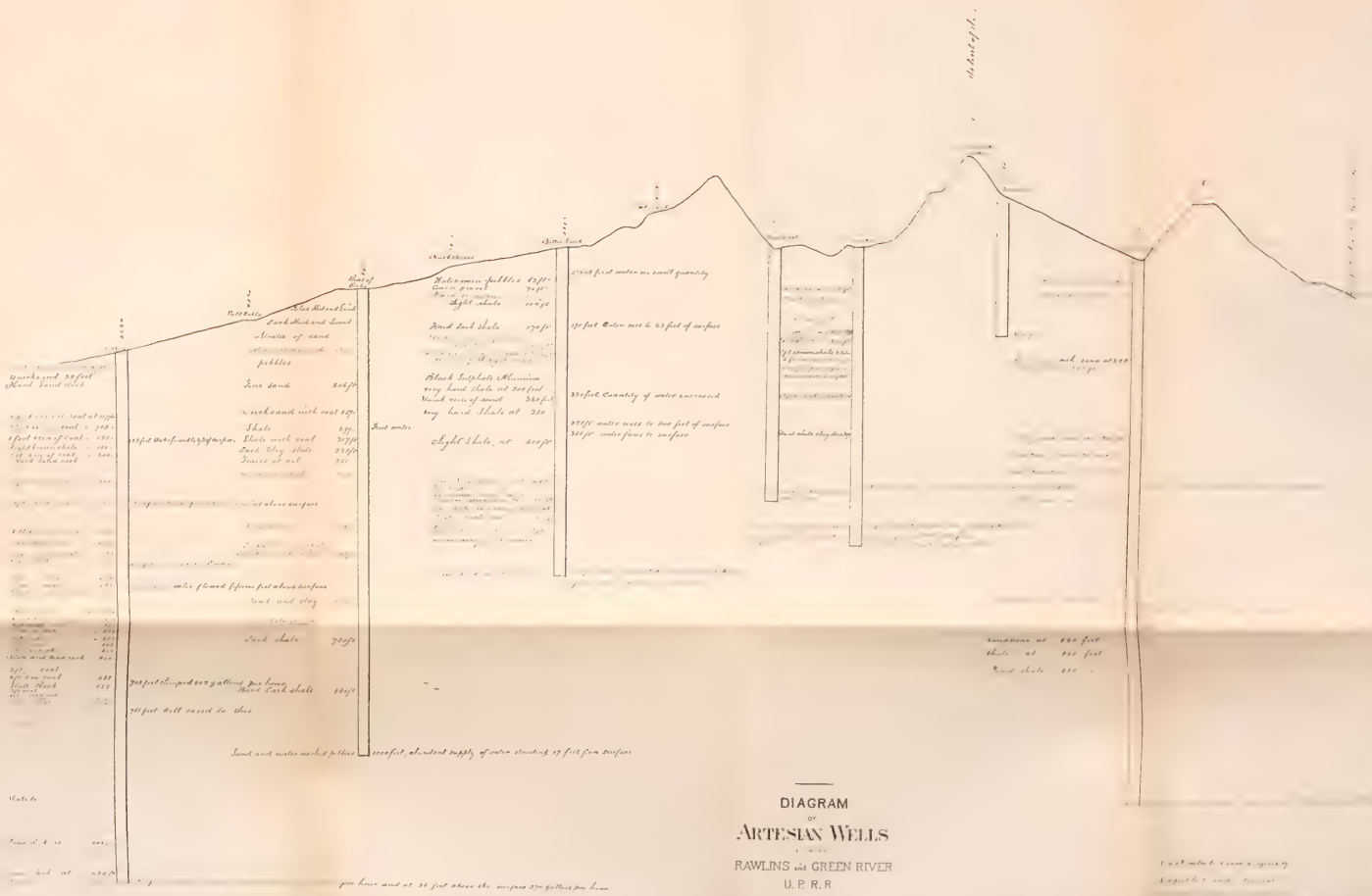
THIRD SERIES.—Calcareous, Lower Miocene, containing the greatest abundance of fresh-water shells, plants, fishes, &c.

FOURTH SERIES.—Arenaceous clays, Upper Miocene, turtle-shells; no other fossils observed.

The third series of beds contains the plants and shells that were found in such profusion near Barrel Springs on the Muddy.

The first series is the Laramie or Lignitic group; the second, the Wahsatch or Vermillion Creek group, the former name having the priority, and having been attached to the great group of reddish sands, clays, and conglomerates west of Fort Bridger, in 1870. This group has since been found to extend southward through Western Colorado into New Mexico. The third series embraces the Green River group. The fourth series is an extension eastward of the Bridger group. The Wahsatch group includes the lowest of the purely fresh-water beds in this region, and the evidence seems to be quite clear that it is the equivalent of the purely fresh-water Lignitic strata in the northwest along the Missouri River. There is every reason to believe that in this region, as is so well shown at Bitter Creek, the group is an extension upward of the brackish-water Lignitic strata without any break in the continuity. So in the Northwest, at the base there is a mingling of brackish-water forms with the fresh-water species, though on a far less extensive scale than in Wyoming, Utah, or Colorado. In the brackish beds in Wyoming, several species of *Mollusca* were determined by Mr. Meek to be identical with well-known forms of the Upper Missouri, as *Viviparus trochiformis*, *V. conradi*, and *Unio priscus*. As it is not the purpose of this brief article to discuss the age of these groups, we may conclude with the remark that the results of each year's explorations show more clearly the remarkable unity of the geological structure of the interior of our continent. All the older formations, from the Silurian to the Cretaceous inclusive, may even now be correlated with a good degree of certainty, and the vast number of Tertiary basins are brought into close relations with each other.





Stratigraphic Column (Left Side):

- 20 feet of sand at top
- 10 feet of coal
- 10 feet of sand
- 10 feet of shale
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Stratigraphic Column (Middle Side):

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Stratigraphic Column (Right Side):

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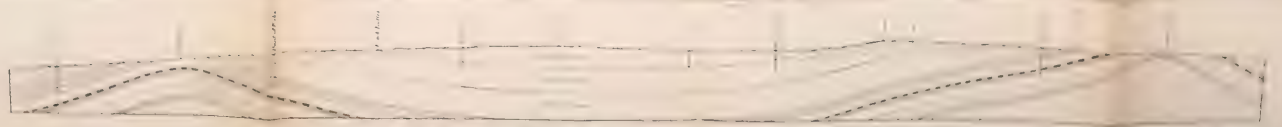
DIAGRAM
OF
ARTESIAN WELLS
IN
RAWLINS AND GREEN RIVER
U. P. R. R.

Level water table at this point, abundant supply of water standing up feet from surface

you have and at 10 feet above the surface 275 gallons per hour

conditions at 200 feet
 shale at 100 feet
 sand shale etc.

1 inch scale same as preceding
 2 1/2 inches = 100 feet



BULLETIN NO. 2, VOL. III.

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ART. XIII.—WESTERN DIPTERA: DESCRIPTIONS OF NEW GENERA AND SPECIES OF DIPTERA FROM THE REGION WEST OF THE MISSISSIPPI AND ESPECIALLY FROM CALIFORNIA.

BY C. R. OSTEN SACKEN.

PREFACE.

The *Diptera* of the Pacific coast are at present almost unknown. A few species picked up during the visit of the Swedish frigate *Eugenia*, probably in the environs of San Francisco, and described by Mr. Thomson; some four dozen species, published by Mr. Loew in his "Centuriæ"; a few other species, by Dr. Gerstaecker; and two *Limnobiæ*, by me, constitute about all we know of Californian *Diptera*. Even Chili is, in this respect, much better explored, with the 556 species contained in Dr. Philippi's publication.

In the present publication, I give a survey of the collection of *Diptera* which I formed during my recent western journey, and describe the most remarkable forms. The majority of the species described belong to California, where I collected the most; the fauna of Colorado and of the vast intermediate region will come in the second line only, the materials being less abundant. However, the more I proceed with my study, the more I am impressed with the fact that the western fauna is essentially *one*, and that many of the characteristic forms of California sooner or later will turn up in Colorado.

The times and places of my collecting in California are as follows: During the winter months (January to March, 1875), I collected a little in Southern California; my most active collecting, however, was confined to the months of April and May, 1876, in Marin and Sonoma Counties; a few days in Yosemite Valley in June; and a couple of weeks in the Sierra Nevada in July, especially about Webber Lake, Sierra County. What I brought together is therefore but a small fragment of the fauna, collected during a very limited season. And, yet, even this fragment yields some very interesting facts concerning the geographical distribution of insects, discloses unexpected analogies and coincidences between the fauna of California and those of Europe, Chili, and even Australia, and unforeseen differences from the fauna of the Atlantic States. To such facts, bearing upon the geographical distribution of insects, I pay especial attention in the introductory paragraphs to each family; and, at the end, I give a general survey of the results obtained.

For the fauna of Colorado, I availed myself of very valuable materials kindly contributed by Mr. P. R. Uhler, Dr. A. S. Packard, and

Lieut. W. L. Carpenter. Here and there I have introduced descriptions of some remarkable species from the Atlantic States.

In treating of the Californian fauna (or flora) it must be borne in mind that what is called Sierra Nevada is not only a mountain range, but a whole country—a high plateau from 6,000 to 8,000 feet above sea-level, forming a long and comparatively broad belt of land, with its lakes, rivers, forests, and plains—an upper story of California, partaking of some of its products, but on the whole entirely different. For the better understanding of the facts bearing on the geographical distribution of insects, I will state here, once for all, that my collections about Summit, Sierra Nevada, and Webber Lake were formed at an altitude from 7,000 to 8,000 feet above sea-level; that the altitude of Lake Tahoe is 6,200 to 6,300 feet, and that of Yosemite Valley about 4,000 feet. My collecting grounds in Southern California, as well as in Marin and Sonoma Counties, were all at comparatively low levels, except the Geysers, Sonoma County, which are about 3,000 feet above sea level.

It is not my intention to describe *all* the western *Diptera* which I possess or can get hold of. Always keeping the higher aims of science in view, my effort will be to contribute toward those aims. The detailed description of special entomological faunas must of necessity be left to local students. An outsider, a transient collector and describer, has to keep their interest in view, and to try to pave the way for them rather than to block up their progress by an indiscriminate and aimless publication of new species.

In prefixing diagnoses to some of my descriptions, my aim was to enable the reader at a single glance to get hold of the principal features of the described species, and thus to save his time in the work of identification. Such a diagnosis, in order to be useful, must be short, even at the risk of being applicable to more than one species. Wherever the species in a genus are more numerous, I prefer to give an analytical table. The attempt of some authors to draw diagnoses which are tantamount to definitions of the species is very difficult to carry out, especially in the larger genera; such diagnoses finally become as long as the descriptions themselves, and therefore practically useless.

In quoting species described in North American publications or in Dr. Loew's "Centuries", I will simply refer to them without repeating the descriptions, as it is to be expected that a dipterologist is in possession of the works thus quoted. In some cases I will reproduce or translate descriptions which are less easily accessible.

All the type specimens of these my papers I intend to deposit, for future reference, in the Museum of Comparative Zoölogy in Cambridge, Mass., where my former dipterological collections are also to be found; the few exceptions will be mentioned in their place.

I owe a special tribute of gratitude to Mr. Henry Edwards, of San Francisco, for his manifold assistance, as well as for the contribution of valuable specimens.

Families CULICIDÆ, CHIRONOMIDÆ, PSYCHODIDÆ.

Half a dozen species of *Culex*, two *Anopheles*, and two *Chironomus* are among my collections from California. They all exhibit the characters and coloring peculiar to the species of these genera in other countries. A *Culex* from Southern California is distinguished by very sparsely bearded antennæ of the male and a peculiar structure of the palpi.

PSYCHODA sp.—A single specimen; San Rafael, Cal.

In the absence of any remarkable western forms, I describe two new species from the Atlantic States. The first belongs to the little known genus *Aedes* (*Culicidæ*), of which only one species was known to occur in the United States. The other is a second species of the new genus *Chasmatonotus* (*Chironomidæ*) established by Dr. Loew for a species which I discovered in the White Mountains.

ÆDES FUSCUS n. sp., ♂ ♀.—Brown; thorax clothed with a short, appressed, brownish-golden tomentum; abdomen with whitish-yellow narrow bands at the base of the segments; venter whitish-yellow. Antennæ black; proboscis and legs brownish, with a metallic reflection; femora paler on the under side; pleuræ under the root of the wings with a spot clothed with whitish scales. Long. corp. 3–4^{mm}.

Hab.—Cambridge, Mass., in May.

Obs.—I bred this species from larvæ which I found in a pool together with those of several species of *Culex*. The larvæ and pupæ behaved exactly like those of *Culex*, and only attracted my attention by their smaller size. If I could have known beforehand that they belonged to *Aedes*, I would have compared them more closely with the larvæ of *Culex*. The metamorphosis of *Aedes* has never been observed before.

CHASMATONOTUS BIMACULATUS n. sp., ♂.—Black; wings of the same color and with two large white spots. Length about 1.5^{mm}.

Black; thorax shining; base of the abdomen laterally pale greenish-yellow. Feet black; front coxæ and base of all the femora yellowish; the first tarsal joints are of the same pale yellowish color, except the tip, which is black. Knob of halteres greenish. Wings black; the first white spot is in the shape of a cross-band between the second vein and the anal angle; the second spot is square, and situated on the hind margin, within the fork of the fifth vein.

Hab.—Catskill Mountain House, in July, 1874; numerous male specimens; Quebec (Mr. Bélanger).

The first posterior cell and the cell within the fork of the fifth vein are much longer here than in *C. unimaculatus* Lw., and the latter cell is larger and broader. Hence it happens that although in both species the cross-band-like spot is placed immediately inside of the proximal end of the fork, it occupies the middle of the wing in *C. unimaculatus*, and is much nearer the base in *C. bimaculatus*. The abdomen of the male ends in a comparatively large and conspicuous forceps (the "*hypopygium maris globosum*" in Mr. Loew's description of *C. unimacu-*

latus seems to indicate a different structure?). I found both species in the same situation, walking in numbers on the leaves of low shrubs.

Family CECIDOMYIDÆ.

Of the numerous galls of *Cecidomyia* observed by me in California, I will mention only a few, of which I have kept a written record.

On *Juniperus californicus*, fleshy, subglobular galls on the axis of the small twigs; when full grown, about two-fifths of an inch in diameter, with a round opening at the top, the edge of which is from three- to five-lobed, the gall when ripe thus resembling the fruit of the Medlar (*Mespilus*) in shape; but, before being full grown and open, it is more like a diminutive melon or tomato, being furrowed longitudinally, like these fruits. The furrows are usually six, probably representing six leaves round the axis of the plant. At the base of the gall, round its attachment, there are three sepal-like, small, fleshy, bilobed leaflets. The reddish larva in the cavity of the gall is smooth, and shows no vestige of a breast-bone; in more mature galls, the pupa, glued to the bottom of the cavity, could be distinctly seen through the opening at the top. Very common in March, 1876, about Crafton's Retreat, twelve miles from San Bernardino, Cal.

On *Lupinus albifrons*; folded leaves, forming a pod-shaped swelling; each contained several larvæ, inclosed in a delicate cocoon. Very common about Lone Mountain, San Francisco, in April.

On *Audibertia* sp. (*Compositæ*); swelling on leaves and leaf-stalks, with a neck-shaped prologation, open at the top, the whole having the shape of a round-bellied bottle; sometimes two or three such bottles, alongside of each other, coalescent; inside a longitudinal canal, at the bottom of which I found in several instances a pupa of *Cecidomyia*; wings and thorax blackish; abdomen red; no horny projections anteriorly. A small Hymenopterous parasite often infests this gall. Santa Barbara, end of January, and later in other localities; not rare.

On *Garrya fremonti*, succulent, green swellings on male flowers, contain larvæ and pupæ apparently of a species of *Asphondylia*. On the heights about Yosemite Valley, at an altitude of 7,000 to 8,000 feet, in June.

On *Artemisia californica* (?), accumulation of leaves, produced by the arrested growth of lateral shoots. About Los Angeles, Cal. Inside I found pupæ of *Cecidomyia*, nearly ripe, on the 3d of March.

On *Baccharis pilularis* (syn. *sanguinea*), rounded accumulation of deformed and swollen leaves at the end of twigs; contains larvæ of *Cecidomyia*, from which I bred the fly.

Family MYCETOPHILIDÆ.

Seems abundantly represented in California, although I did not collect very diligently in it. Among my few specimens, I find the following genera:—

PLATYURA sp.—San Rafael, April 12; venation like tab. xix, f. 7a, of the Monograph of the European *Mycetophilidæ* by Winnertz.

PLATYURA sp.—Fossville, Napa County, Cal., May 7. Large red species, with the apex of the wing and a central cloud brown; the anterior branch of the second vein connects it, in the shape of a cross-vein, with the latter part of the first vein.

BOLETINA sp.—Yosemite Valley.

SCIOPHILA, 2 species.

DOCOSIA sp.—Yosemite Valley, June 8; venation exactly like Winnertz's tab. xx, f. 23a.

MYCETOPHILA sp.—San Rafael, Cal., April. Of the group of the European *M. lunata*, and very like it.

EXECHIA sp.—Yosemite Valley.

GNORISTE MEGARRHINA n. sp.—Proboscis nearly as long as the body, filiform. Length of the body, 7^{mm}; of the proboscis 5.5^{mm}; face deep velvet-black, opaque; antennæ brown, second joint somewhat reddish; proboscis brown; vertex black, with a slight gray pollen; thorax brownish-yellow, with three black stripes on the dorsum, the intermediate geminate; halteres pale yellow; legs yellow; tarsi infuscated; wings with a slight yellowish tinge; a light gray shadow along the hind margin, beginning at the apex.

Hab.—Yosemite Valley, June 10.—One specimen.

Although the proboscis of this species is much longer than that of the European *G. apicalis*, they agree in all essential characters, and there is no necessity for establishing a new genus. *G. megarrhina* has the venation of *G. apicalis* (Winnertz, l. c., tab. xx, f. 16); only the proximal end of the fork of the fifth vein is a little nearer to the root of the wing, and the costa is prolonged a little beyond the tip of the second vein.

Family BLEPHAROCERIDÆ.

The new species which I describe is the tenth now known species of this remarkable family,—remarkable for its exceptional characters; for the paucity of the species, scattered through the most distant parts of the world; and for the variety of generic modifications which these species show in preserving at the same time with wonderful uniformity the very striking family characters, some of which are unique in the whole order of *Diptera*. Among those ten species, three belong to the United States; one I found abundantly in a locality near Washington, D. C.; the second was discovered by Lieut. W. L. Carpenter in the Rocky Mountains; the third, described below, comes from Yosemite Valley. A list of the known species of the family, in chronological order of publication, with the locality of each, may find its place here:—

Blepharocera fasciata (Westw.), in Guérin-Méneville, Magaz. de Zool., 1842.—Albania, in Europe.

Liponeura cinerascens Loew, Stett. Entom. Zeit., 1844.—Europe.

Apistomyia elegans Bigot, Ann. Soc. Entom. de France, 1862.—Corsica

Blepharocera capitata Loew, Centur., iv, 1863.—District of Columbia.

Paltostoma superbiens Schiner, Verh. zool.-bot. Ges., 1866.—Colombia, South America.

Liponeura bilobata Loew, Bullet. Soc. Entom. Ital., 1869.—Southern Italy and islands of Greece.

Hammatorhina bella Loew, Bull. Soc. Entom. Ital., 1869.—Ceylon.

Bibiocephala grandis Osten Sacken, in Dr. Hayden's Geol. Rept. for 1873.—Rocky Mountains.

Hapalothrix lugubris Loew, Deutsche Ent. Mon., Berl., 1876, p. 213.—Monte Rosa (Italian side).

Blepharocera yosemite n. sp.

Blepharocera yosemite is closely allied to the known species, both of the genera *Blepharocera* and *Liponeura*. The differences it shows, although important, do not necessitate the immediate formation of a new genus for it, the more so as sooner or later new additions to the family *Blepharoceridæ* will probably require a remodeling of the now adopted genera.

The structural characters of the species are as follows :—

Eyes pubescent, separated by a moderately broad front; upper smaller portion of the eye with large, lower larger portion with small, facets. *Antennæ* 14-jointed, about twice as long as the head, and of equal breadth, that is, not tapering toward the end; first joint very short and small, the second a little larger, the third long, cylindrical, equal to the two following taken together, the fourth and following joints subcylindrical, attenuated at the base. *Legs* long and comparatively strong; a large and stout spur at the end of the hind tibiæ; a much smaller spur alongside of it; unguis with a tooth-like incrassation at the base. *Wings* comparatively larger and broader than in *Blepharocera*; anal lobe very large, projecting. *Venation*: second submarginal cell short and petiolate, the petiole being about equal in length to the interrupted vein between the incomplete second and third posterior cells (in other words, the third vein does not issue near the small cross-vein, but from the second vein, at a distance from the small cross-vein, about equal to the abbreviated vein). Between the base of the fourth posterior cell and the preceding (fourth) longitudinal vein, a cross-vein exists (as it does in *Liponeura bilobata* and in *Bibiocephala*). In other respects, the venation resembles that of *Blepharocera* and *Liponeura*. *Forceps* of the male large, its lobes flattened, as if coriaceous (even in the living insect).

It follows from this enumeration that in the structure of the front the present species is nearer to *Liponeura*, the eyes of *Blepharocera* being subcontiguous; in the structure of the facets of the eyes, it is like *Blepharocera* and unlike *Liponeura*, where the facets are said to be of equal size on both halves of the eye. From both genera it differs in the shortness of the second submarginal cell. It resembles *Liponeura bilobata* in the presence of a cross-vein between the fourth vein and the fork behind it, a cross-vein which is wanting in *L. cinerea* and in *Blepharocera*.

The antennæ have one joint less than those of *Blepharocera* (I counted them on the living specimen), and although proportionally of the same length, they are not subsetaceous, as in the latter genus, and have much more distinctly marked joints.

BLEPHAROCERA YOSEMITE n. sp., ♂.—Body brownish-gray; wings tinged with brown, their distal third hyaline. Length 6–7^{mm}; wing 9^{mm}.

Body brownish; thorax above with a grayish pollen, abdominal incisures slightly whitish, more distinctly so on the sides of the venter; genitals reddish; antennæ brownish, paler at base; legs yellowish-brown; the tips of the femora infuscated; wings tinged with brown, this brown with a distinct bluish opalescence; distal third of the wings hyaline.

Three male specimens caught by me on the wing, on the bridle-path to the foot of the Upper Yosemite Fall, June 6, 1876, about 3 p. m.

Family TIPULIDÆ.

The enumeration which I give contains some thirty-five species from California, belonging to the first six sections of the *Tipulidæ*, commonly united under the name of *Tip. brevivalpi*,—a comparatively small number, considering that, owing to my early studies in this family, I paid more attention to it perhaps than to any other. The paucity of *Erioptera* was especially striking. *Trichocera*, which one would naturally expect during the warm winter days of that climate, did not appear at all; I found a single specimen of a rather peculiar species later in the spring.

Among these thirty-five species, seventeen are identical with species from the Atlantic States, or at least so closely resembling them as to be provisionally classed among the species of doubtful identity. Two of that class of species are at the same time European,—*Symplecta punctipennis* and *Trimicra pilipes*. The very common occurrence of the latter all over California during winter and spring is worthy of notice.

Most of the species peculiar to California belong to genera represented in other parts of the world:—*Dicranomyia* (2 sp., one of which undescribed); *Limnobia* (2 sp.); *Erioptera* (2 sp.); *Elliptera* (1 sp.); *Goniomyia* (1 sp., undescribed); *Limnophila* (4 sp., only one described); *Trichocera* (1 sp.); *Amalopsis* (1 sp.); *Pedicia* (1 sp.); *Eriocera* (1 sp.). Among these, the following deserve to be noticed:—

Elliptera, a genus belonging to the remarkable and intermediate group *Limnobia anomala*, was among the few European genera which have not hitherto been discovered in North America. I found a number of specimens in the Yosemite Valley, which reproduce exactly the generic characters of *Elliptera*, although they belong to a species different from the only European species hitherto described.

Eriocera californica belongs to the *Eriocera* with very long antennæ in the male, of which three species occur in the Atlantic States, one in

Chili, and two fossil species have been found in the Prussian amber. I am not aware of such species having been found in other countries, although *Eriocera* with short antennæ in both sexes are everywhere abundant in the tropics.

Pedicia is represented by a single species, analogous to the Eastern American and the European species, but different from both.

The new genus *Phyllolabis*, with two species, is peculiar to California, and remarkable for the large development of the forceps of the male.

Of the two sections intermediate between the *Tipulidæ brevipalpi* and *longipalpi*, no *Cylindrotomina* have as yet been discovered in the western region. The *Ptychopterina* are represented by two species:—

Ptychoptera lenis n. sp., which belongs to the whole western region from California to Colorado.

Protoplasta vipio n. sp., perhaps the most interesting of all the Californian *Tipulidæ*, closely allied to the Chilian *Tanyderus*, the fossil amber-genus *Macrochile*, and the North American *Protoplasta fitchi*.

Bittacomorpha has not as yet been found in California, but *B. clavipes* occurs in Oregon.

The *Tipulidæ longipalpi*, in contrast to the *brevipalpi*, are very abundantly represented in California, both in the number of species and of specimens. The larvæ probably live on the roots of the rich and abundant Californian grasses. I have abstained from working up this part of my collection, owing to the large number of closely allied species and my insufficient knowledge of the *Tipulidæ* of the Atlantic States.

The gigantic *Holorusia rubiginosa* is a peculiar Californian form. However, Dr. Loew, in establishing the genus, mentions *Holorusiæ* from Java (Centur., iv, 1); elsewhere he describes one from the island Bourbon.

Pachyrrhincæ are much rarer in California than in the Atlantic States.

A species of *Dixa* occurs in California; but I have only a single imperfect specimen (San Geronimo, Marin County, April 19).

Section I.—*Limnobina*.

GERANOMYIA CANADENSIS (Westwood), Osten Sacken, Monogr., iv, p. 80.—Male and female from Los Angeles, February. A common species in the Atlantic States.

DICRANOMYIA BADIA (Walker), Osten Sacken, Monogr., iv, p. 72.—Common in the Atlantic States. San Rafael, Cal., March 31, April 13.

DICRANOMYIA DEFUNCTA Osten Sacken, Monogr., iv, p. 76.—Common in the Atlantic States near springs or water running over dams. Santa Cruz, Cal., May 21, three males in the same situation. I observed the structure of the forceps, peculiar to this species, on the specimens when they were still alive. A single specimen from Webber Lake, July 24, has the wings much less densely spotted, and with a cross-vein in the submarginal cell. The cross-vein, however, may be merely adventitious.

DICRANOMYIA MARMORATA Osten Sacken, Monogr., iv, p. 77.—A Californian species. I found a male and a female near Saucelito, Cal., April 2. In the live insect, I noticed a peculiarity, which I had overlooked in the dry ones, from which I drew my description. The antennæ are distinctly submoniliform, the nearly globular joints being separated by very short pedicels. In my description, the words "related to *humidicola* O. S." better be struck out.

DICRANOMYIA n. sp.—Seems common in Marin County, California, in April. In looking for it on my analytical table (l. c., p. 61,) *D. liberta* and *haretica* would be reached; it is neither of them, but a new species, which I leave to others to describe, as my specimens are not well preserved enough for that purpose. The structure of the male forceps will have to be observed in the live specimens.

LIMNOBIA SCIOPHILA n. sp.—Marginal cross-vein some distance back of the tip of the first longitudinal vein; femora with three brown rings; wings with grayish clouds and intervening subhyaline spaces in all the cells; length 10–11^{mm}.

Rostrum, palpi, and antennæ brown, the latter with long verticils; thoracic dorsum with three brown stripes, the intervening spaces, shoulders, middle of the mesonotum, etc., grayish-pruinose; abdomen brown, incisures paler; genitals yellowish-brown; halteres with brown knobs; femora pale yellow, with three brown rings on the distal half, the last of them very near the tip; tibiæ and tarsi yellowish-brown. Wings with a faint yellowish tinge as a ground-color; grayish clouds of irregular shape occupy all the cells, and become almost confluent on the distal half of the wing, leaving only small spaces of the ground-color at both ends of the cells; in four or five places along the first vein, the clouds are darker, so as to have the appearance of brown spots; the marginal cross-vein is in the middle of the stigma, and some distance back of the tip of the first vein.

Hab.—Marin and Sonoma Counties, California, in the spring; common, especially in dark, deep gulches, with running water at the bottom (Menlo Park, March 25; San Rafael, April, May; Geysers, Sonoma County, May). Three males and four females.

Very closely allied to the European *L. nubeculosa*.

LIMNOBIA CALIFORNICA Osten Sacken, Monogr., iv, p. 96.—California.

Section II.—*Limnobina anomala*.

DICRANOPTYCHA SOBRINA Osten Sacken, Monogr., iv, p. 118.—A species very similar to this eastern one, and perhaps identical with it, occurs quite commonly in Marin and Sonoma Counties, California. The two basal joints of the brown antennæ are yellow and the fringe of hairs on the anterior margin of the wings in the male is not very long and conspicuous; in both respects, these specimens are more like the form which I called *D. sororcula* in my former essay, and which later I gave up as a species, perhaps erroneously. The specific characters in this

genus require a closer study than I have been able to give them in preparing my Monograph. A male specimen from Lake Tahoe, July 19, is much paler in coloring, and may be a different species.

ELLIPTERA CLAUSA n. sp.—This is an interesting discovery, as the genus *Elliptera* (compare Monogr., iv, p. 122, tab. i, f. 10), represented by a single species in Europe, had not been found in America before. The venation is like that represented on the above quoted figure, only the first longitudinal vein is a little shorter, so that the segment of the margin between its tip and the tip of the second vein is much longer than the segment between the second and third veins (and not shorter, as the figure has it); *the discal cell is closed*. But the characteristic mark of *Elliptera*, the close proximity between the first and second veins, exists also in this new species. *Elliptera* has no empodia and no vestige of a marginal cross-vein. The forceps of the male, which I observed in life, resembles that of an ordinary *Limnophila*, and not at all that of a *Dicranomyia*.

Male and female.—Antennæ and palpi black; front grayish-pruinose; thorax grayish-pruinose; three distinct broad brown stripes on the dorsum; halteres brown, their root yellow; abdomen grayish-brown; legs brown; coxæ and root of the femora, especially of the front pair, yellowish; wings subhyaline, slightly tinged with grayish; stigma oval, brown.

Hab.—Yosemite Valley, Cal. I found umerous specimens on the wet mos, in the spray of the Vernal Fall, June 11. I have now four males and two females before me.

Section III.—*Eriopterina*.

ERIOPTERA DULCIS n. sp.—The præfurca ends in the second submarginal cell; discal cell closed; inner end of third posterior cell much nearer to the root of the wing than the inner end of second posterior; wings pale brownish, with a number of white spots, especially along the margin and on the cross-veins; femora with a dark brown ring before the tip. Length about 3^{mm}.

Thorax yellowish, with brown lines on dorsum and pleuræ; abdomen brownish, halteres with a brown knob; wings pale brown, with numerous white spots, one at the extreme proximal end of the basal cells, with a smaller spot, alongside of it, near the costa; a large square spot between the costa and the fourth vein, covering the origin of the præfurca; a similar spot between the costa and the middle of the præfurca; an oblong spot near the end of the præfurca; another one between the end of the auxiliary vein and the second submarginal cell; rounded spots along the whole margin at the end of all veins except the third; often one or two spots in the middle of the posterior branch of the second vein; the distal end of the four posterior cells likewise spotted. Legs pale yellow, a ring before the end of the femora and the tip of the tibiæ dark brown.

Hab.—Lake Tahoe, Sierra Nevada, California, July 19. Six males.

E. dulcis has a striking resemblance to *E. caloptera* Say of the Atlantic States. An obvious difference between them lies in the structure of the discal cell, which in *E. caloptera* is formed by the forking of the anterior, in *E. dulcis* of the posterior, branch of the fourth vein. The distribution of the white spots on the wings is different in both species, as *E. caloptera* has many spots inside of the cells, while *E. dulcis* has none. Besides the brown ring at the tip of the femora, *E. caloptera* has a second one about the middle. The discal cell here is generally closed, while in *E. caloptera* it is more often open. Nevertheless, the homologies between the present species and the group *Mesocyphona*, to which *E. caloptera* belongs, are very striking. They consist in the position of the brown thoracic stripes; in the presence of a brown ring on the femora; as far as I can see, in the structure of the male forceps, which resembles the figure I gave of the forceps of *E. caloptera* (l. c., tab. iv, f. 15); and the course of the last longitudinal vein, which is undulating, and at the same time diverging from the preceding vein, thus holding the middle between the converging arcuated seventh vein of the subgenus *Erioptera* and the straight and diverging one of the subgenus *Acyphona*.

Thus, *E. dulcis* would be well placed in the same subdivision with *E. caloptera*, the subgenus *Mesocyphona*; only the definition of the subgenus should be modified, and less stress laid on the forking of the anterior or posterior branches of the fourth vein. The subdivisions I proposed for the genus *Erioptera* (Monogr., iv, p. 151) were based mainly on the sixteen North American species which I knew at that time. I believe that in the main they will hold good in a more general application, only their definitions will have to be modified in some points, and based upon a closer study of the male forceps.

ERIOPTERA BIPARTITA n. sp.—The præfurca ends in the second submarginal cell; the anterior branch of the fourth vein is forked, and by means of two cross-veins forms a double discal cell; wings spotted with brown along the margin and on the cross-veins and forks. Length 3.5–5^m.

Male and female.—The wings of this species are exactly like those of my *E. graphica* of the Atlantic States (Monogr., iv, Tab. i, f. 18); only the stump of a vein, which in that species, as the figure shows, protrudes inside of the discal cell, is prolonged here, so as to reach the anterior branch of the fourth vein, and to form a fork with it. The two cross-veins in the second and third posterior cells thus inclose two discal cells. The distribution of the brown spots is the same as on the above-quoted figure, with some slight differences: the spot at the root of the præfurca crosses the subcostal cell and reaches the costa; that at the end of the first vein is smaller, and stops short before crossing the first submarginal cell; the seventh vein about its middle has a stump of a vein, projecting into the anal angle, and that is also marked with a brown spot; the fifth vein is checkered with brown spots; thorax yellowish-gray, with an indistinct double brown stripe in the middle; hal-

teres yellowish; abdomen brown; legs yellow, tips of the femora and of the tibiæ slightly infuscated; male forceps with strong horny black appendages.

Hab.—San Rafael, Cal., April, May; San Francisco, June. Two males and a female. In one of the males, the cross-veins in the second and third posterior cells are wanting, so that both discal cells are open.

ERIOPTERA FORCIPULA Osten Sacken, Monogr., iv, p. 163.—I have a male and two females from San Rafael, Cal., March 31, and Lagunitas Creek, Marin County, April 15, which agree very well with the specimens from the Atlantic States. The male has an uncommonly large forceps, of complicated structure; on the comparison of the detail of that structure, impossible in dried specimens, would rest the final identification of the species.

E. forcipula belongs to the subgenus *Molophilus*. I have two other Californian species of the same subgenus, but only a single specimen of each (San Rafael, March 31; Summit Station, Sierra Nevada, July 17).

(?) ERIOPTERA URSINA Osten Sacken, Monogr., iv, p. 164, of the Atlantic States is perhaps identical with the European *E. murina*. These singular, small, black flies form swarms above running waters in shady places. I have observed the same phenomenon on Lagunitas Creek, Marin County, April 14, but have kept only a single, badly preserved specimen.

TRIMICRA PILIPES (Fabricius), a European species, the description of which may be found in Schiner, Fauna Austr., Diptera, ii, p. 536; a more detailed one in Schummel, Beitr. z. Ent., p. 152 (*Limnobia fimbriata*). About the genus *Trimicra*, established by me, see the Monographs, iv, p. 165, tab. ii, f. 1, wing.—This very common Californian species, occurring everywhere through the winter and spring, I hold to be identical with the European species (I have specimens from Angel Island, January 11; Santa Barbara and Los Angeles in February; San Rafael in April; Santa Cruz in May). The specimens differ very remarkably in size, the largest measuring up to 8^{mm}; the smaller specimens are usually females. In identifying these specimens with the European species, I rely upon the descriptions of the latter and my recollection of them; I have no specimens for comparison. *Trimicra anomala* O. S. of the Atlantic States is much more rare, and I have never found it as large as the other. Nevertheless, I think now that this also is the same species. The specimens which I have seen from Mexico and South America also resemble *Trimicra pilipes* very much (compare Monogr., iv, p. 167), and it is not at all improbable that this species, like the following, its close relative, has a very wide distribution.

SYMPLECTA PUNCTIPENNIS, common in Europe and in the Atlantic States, occurs in Colorado and is common in California. I have specimens from Los Angeles and Santa Monica, taken in February; from San Rafael, March 31; Lake Tahoe, July 18. I have observed before (Monogr., iv, p. 171) that *Idioneura macroptera* Philippi from Chili is

probably *S. punctipennis*. On the figure of the wing which I gave (l. c., tab. i, f. 20), the brown spot at the base of the præfurca is nearly invisible; this was an individual peculiarity of the figured specimen; usually it is much larger.

GONIOMYIA sp.—A male specime from Lake Tahoe, July 19, is very like *G. subcinerea*, especially in the venation (Monogr., iv, tab. ii, f. 4), only the legs are darker, the halteres decidedly brown, the pleuræ with a distinct brown stripe, which is wanting in *G. subcinerea*. A female from Saucelito, Marin County, Cal., April 2, is comparatively larger, and has the wings slightly tinged with brownish.

Section IV.—*Limnophilina*.

LIMNOPHILA TENUIPES Say, Osten Sacken, Monogr., iv, p. 210.—I have two females from Lake Tahoe, July 19, which I cannot distinguish from this species.

LIMNOPHILA LUTEIPENNIS Osten Sacken, Monogr., iv, p. 217.—Found abundantly near San Bernardino, Cal., in March. I cannot find any difference between these specimens and eastern ones.

LIMNOPHILA APRILINA Osten Sacken, Monogr., iv, p. 223.—A male from Summit Station, Sierra Nevada, July 17, does not show any perceptible difference from eastern specimens. A male and a female from San Rafael, Marin County, Cal., April 13, have very dark brown and well marked thoracic stripes; the coloration of the wings is much darker, the spots along the anterior margin are larger; that at the end of the first longitudinal vein, for instance, almost coalesces with the brown cloud at the base of the first posterior cell. These specimens may perhaps be considered a different species.

LIMNOPHILA MONTANA Osten Sacken, Monogr., iv, p. 227.—Two males and a female from the Geysers, Sonoma County, California, May 5-7. The specimens have become somewhat greasy, so that the coloring cannot be compared with that of the eastern specimens; the wings are exactly the same. The male forceps shows the peculiar structure of the subgenus *Dactylolabis*, to which the species belongs.

LIMNOPHILA MUNDA Osten Sacken, Monogr., iv, p. 226.—Specimens from San Rafael, Cal., May 14, and Sonoma County, May 5-7, resemble this eastern species very much, but require a closer comparison.

LIMNOPHILA ADUSTA Osten Sacken, Monogr., iv, p. 215.—Two specimens from Webber Lake, Sierra County, seem to belong to this species, or rather group of species.

LIMNOPHILA DAMULA n. sp.—Gray; antennæ black; wings spotted with brown. Length 6-7^{mm}.

Rostrum, antennæ, and palpi black; thorax gray, with faint brown stripes; halteres whitish; abdomen brownish-yellow in the male, nearly brown in the female; ovipositor yellowish; legs yellowish-brown. Venation like that of a *Dactylolabis* (Monogr., iv, tab. ii, f. 7); that is, the first submarginal cell long, rather angular at the proximal end, its

petiole short; the marginal cross-vein is inserted at the end of the first vein a little before the middle of the first submarginal cell; second submarginal cell but a trifle longer than the first posterior cell; five posterior cells. Coloring of the wing whitish-hyaline; a brown spot fills out the proximal end of the first basal cell; another one, inverted T-shaped, at the root of the præfurca; brown clouds at the proximal end of the first submarginal cell, on the central cross-vein and on the great cross-vein; smaller clouds at the base of the second and third posterior cells; stigma pale brown, with a brown cloud on the marginal cross-vein; a pale cloud at the end of the seventh vein; in most specimens, a few brownish dots are scattered in the areas of the cells irregularly here and there. The size and intensity of the spots on the wings vary in different specimens.

Hab.—Crafton, near San Bernardino, Cal., in March, not rare. Two males and two females.

The forceps of the male shows the digitiform appendages peculiar to the subgenus *Dactylolabis* (Monogr., iv, tab. iv, 26); a second forceps-like organ, slender, horny, is visible below them. The ovipositor of the female differs from that of any Tipulid I know of; the horny plate, usually existing at the base of the ovipositor, is so prolonged here as to cover and conceal this organ. The end of this long plate, with parallel sides, is split in the middle, and produced on each side of the cleft, in a small, curved point, diverging from the corresponding point on the other side. This end of the horny plate is yellowish, the basal portion being dark brown. On the under side, the plate is hollow, canaliculate, and contains, some distance before its end, the small ovipositor, which is thus entirely invisible from above.

I have three more species of *Limnophila*, which seem peculiar to California, but only in single specimens. For this reason, I abstain from describing them.

PHYLLOLABIS nov. gen.

Two submarginal cells; four posterior cells; discal cell closed; subcostal cross-vein a very short distance before the tip of the auxiliary vein, which is immediately before the stigma; no marginal cross-vein; first submarginal cell about half as long as the second, its slightly arcuated petiole occupying the length of the other half; the second vein and both of its branches are pubescent; the other veins are somewhat pubescent before their ends; eyes glabrous; antennæ 16-jointed; tibiæ with exceedingly small but distinct spurs at the tip; empodia small but distinct; ungues smooth. The abdominal segment bearing the genitals is unusually swollen in both sexes, bearing in the male a large forceps with horny appendages on the inner, and a long foliaceous whitish appendage on the under side. Belongs to the *Limnophilina* with four posterior cells, although, owing to the unusual structure of the male genitals and the total absence of a marginal cross-vein, its immediate relationship to the other genera of the group is not apparent.

The stature and general appearance are those of a *Limnophila*.

Antennæ, when bent backward, nearly reach the root of the wings; the joints of the scapus have the usual structure; the flagellum is not perceptibly stouter at the base than at the end; the joints have that sub-cylindrical shape, attenuated at the point of insertion and verticil-bearing about the middle, which is quite common among the *Limnophilina*; they gradually decrease in length toward the end and become more oval; verticils short; front moderately broad. *Vertex* but moderately convex.

The *legs* are long and slender, with an almost imperceptible pubescence; the spurs at the end of the tibiæ are very distinctly seen under a magnifying power of 100 to 150. The ungues and empodia are exceedingly small.

The *wings* are of a moderate length and breadth; the venation has been partly described above; the stigma is well defined, oval, placed at the end of the first vein. The præfurca has very little curvature at the base, and is not much longer than the petiole of the fork of the second vein; the second submarginal and first posterior cells are of equal length, their bases being nearly on the same line; the sides of the first posterior are almost parallel; the structure of the discal cell shows that it is formed by the forking of the posterior branch of the fourth vein, connected by a cross-vein with the anterior branch; the great cross-vein is at the bifurcation of that posterior branch, and thus a little beyond the middle of the discal cell.

The genitals of the male are very large and club-shaped, resembling those of a *Tipula* more than those of a *Limnophila*. The following is the description of the forceps of *P. pallida*, as I do not possess the male of the other species:—

The last upper abdominal half-segment is uncommonly large and convex; two large basal pieces of the usual shape, bearing a small, curved, pointed rostriform appendage at the end, and some branched and hairy inner appendages; on the under side of the forceps, and entirely detached from it, is a very characteristic yellowish-white elongated foliaceous appendage, folded lengthwise and bifid at the tip.

The female has the last abdominal segment likewise distinctly swollen, especially when seen from the side.

Stigma pale brownish; antennæ uniformly black *claviger*.

Stigma dark brown; two basal joints of the antennæ pale

brownish; the rest black *encausta*.

PHYLLOLABIS CLAVIGER n. sp.—Head gray, with a shade of brownish on the front; antennæ and palpi black. Thorax gray, with three ill-defined brownish stripes, the intermediate subgeminate; halteres yellowish-white; knob sometimes faintly infuscated. Abdomen grayish-brown; male forceps brown; foliaceous appendages yellowish-white. Legs brown; coxæ and base of femora brownish-yellow. Wings gray-

ish-hyaline; stigma oblong, pale brownish-gray; subcostal cross-vein a little distance back of the tip of the auxiliary vein.

Hab.—Crafton's Retreat, near San Bernardino, Cal., in March. Three males and six females.

The ovipositor of the female has nearly straight, ferruginous valves, smooth on the under side. Length 6–7^{mm}.

PHYLLOLABIS ENCAUSTA n. sp.—Head gray; antennæ brown, two basal joints yellowish; palpi brown. Thorax gray, the dorsum with a brownish-yellow tinge; knob of halteres infuscated. Abdomen brownish-black; in the female, the two last segments are remarkably turgid above and below; upper valves of the ovipositor short, curved, distinctly serrate on the under side. Legs brownish-yellow, tarsi darker toward the end. Wings subhyaline; veins brown, except at base and near the costa, where they are pale yellow; subcostal cross-vein close by the tip of the auxiliary vein. Length 6–7^{mm}.

Hab.—Lagunitas Creek, Marin County, California, April 15–20; San Mateo, Cal., April 9. Four females.

TRICHOCERA TRICHOPTERA n. sp.—Antennæ brown, second joint slightly paler; thorax dull grayish-pollinose, without any distinct stripes; halteres with a brown knob; abdomen brown above, yellowish below; wings subhyaline, immaculate; veins very distinctly pubescent; venation in the main like *Monogr.*, iv, tab. ii, f. 13, but the discal cell smaller; posterior cells 2–4 longer; the cross-vein at the proximal end of the fourth posterior cell is placed obliquely, and thus does not correspond with its posterior end with the great cross-vein (this may, however, be merely adventitious). Feet pale yellowish. Length 3–4^{mm}.

Hab.—Lagunitas Creek, Marin County, California, April 15. One female.

This is the only specimen of the genus *Trichocera* which I came across in California. The species will be easily distinguished by its distinctly pubescent wing-veins.

Section V.—*Anisomerina*.

ERIOCERA CALIFORNICA n. sp.—*Male*.—Antennæ more than twice as long as the body; basal joints reddish; flagellum reddish-brown, beset on its under side with two rows of small spine-like bristles; head reddish above; palpi brown; thorax brownish, with a grayish pollen, especially on the pleuræ; three brown stripes on the dorsum, the intermediate one geminate; a faint brownish stripe on the pleuræ; halteres with a brownish knob; abdomen brown, lateral edges yellowish; genitals reddish; legs reddish; tips of femora and of tarsi brown; wings with a strong brownish-yellow tinge, more saturate in the costal cell; five posterior cells. Length about 15^{mm}.

Hab.—Marin County, California (H. Edwards). Two males.

Belongs to my subgenus *Arrhenica* (Monogr., iv, p. 252), and is closely allied to my *E. spinosa* from New England.

In my Monograph, I omitted to mention that *Megistocera chilensis* Philippi from Chili is very probably not a *Megistocera* at all, but an *Eriocera* with long antennæ. This is the only South American species with long antennæ which I know of as yet, and the circumstance that it belongs to Chili is in keeping with certain other analogies already noticed between the Chilian and the Californian fauna.

ERIOCERA BRACHYCERA n. sp., ♂ ♀.—Antennæ short in both sexes; five posterior cells; thorax brownish-yellow, with four brown stripes; abdomen brown. Length, male, 14^{mm}; female, with ovipositor, 22^{mm}. Antennæ of the male about as long as head and thorax together; basal joints reddish, the remainder brown; the first joint of the flagellum is the longest; the three following but little shorter; the end of the last has the appearance of bearing a seventh minute joint; antennæ of the female shorter than those of the male; the first joint of the flagellum is the longest; the following joints gradually decrease in length and become indistinct; frontal tubercle brownish above, yellowish in front; it bears a tuft of blackish hair. Thorax brownish-yellow, sometimes more grayish above, with four brown stripes; pleuræ brown, with a hoary bloom, which extends over the coxæ. Abdomen brown, but little hairy; valves of the ovipositor but very little curved, long and narrow, ending in a blunt point; halteres reddish, with a brown knob; legs brown; base of femora reddish. Wings strongly tinged with brown; stigma brown, oval; five posterior cells, the second on a long petiole.

Hab.—White Mountains (H. K. Morrison). Two males and a female.

I find now that what I described in the Monogr., iv, p. 253, as the female of *Eriocera spinosa* is the female of the present species.

Section VI.—*Amalopina*.

AMALOPIS CALCAR Osten Sacken, Monogr., iv, p. 268.—A single male, from Webber Lake, Sierra County, July 25, does not show any perceptible difference from the eastern specimens, except that it is somewhat paler in coloring; the male forceps is yellowish and not brownish; the venation is exactly like tab. ii, f. 14, except that both the second submarginal and second posterior cells are petiolate and not sessile (the same is the case with most specimens of *A. calcar*; the one whose wing is figured happened to be somewhat abnormal).

AMALOPIS n. sp.—One female specimen from Crafton, near San Bernardino, Cal., in March. Body brownish; wing immaculate; venation like l. c., tab. ii, f. 14, except that the prefurca is a little shorter, the second posterior cell petiolate. I do not name it, as I have only a single damaged specimen.

PEDICIA OBTUSA n. sp.—I have seen a single specimen of this species in Mr. Henry Edwards's collection in San Francisco. It was taken near Saucelito, Marin County, Cal., in the spring. Not having the specimen

before me, I cannot give a detailed description; but the following statement, prepared from some data kindly furnished by Mr. Edwards in a letter, will render the species recognizable.

It is very much like both *P. rivosa* and *albivitta*, but differs in the abdomen being unicolorous, brown above, without the brown dorsal stripe (consisting of a series of triangles in *P. albivitta*, more continuous in *P. rivosa*) and the whitish lateral borders. The brown design of the wings is nearly the same, but the brown is *not* continued toward the margin, along the last section of the fifth vein; it thus forms an angular stripe along the central cross-veins and the anterior section of the fifth vein; the hyaline space inclosed between this stripe and the brown anterior border is smaller and more curved than in *P. albivitta*.

The interruption of the brown stripe along the fifth vein, before reaching the margin, occasionally takes place in both *P. rivosa* and *albivitta*; at least, I consider *P. contermina* Walker, which shows this peculiarity, as a mere variety of *P. albivitta*.

RHAPHIDOLABIS spec.—A single specimen from Crafton, San Bernardino, Cal., has the wings exactly like Monogr., iv, tab. ii, f. 17. The thorax having become greasy, I am not able to ascertain whether it is *R. tenuipes* or not.

List of TIPULIDÆ BREVIPALPI from Colorado.

Dicranomyia longipennis.—Europe; Atlantic States; Denver, Colo. (Uhler).

Limnobia indigena.—Atlantic States and Colorado (Kelso's Cabin, foot of Gray's Peak, at 11,000 to 12,000 feet altitude, July 6, A. S. Packard).

Empeda n. sp.—Georgetown, Colo., July 8 (A. S. Packard).

Erioptera caloptera.—Atlantic States and Colorado.

Symplecta punctipennis.—Europe and North America; also in Chili. (Boulder City, Colo., June 29, A. S. Packard; Denver, P. R. Uhler.)

Amalopsis n. sp.—Idaho, Boulder, Georgetown, Colo., June, July (A. S. Packard). Very like the undescribed species from Southern California, mentioned above; perhaps identical.

Of Section VII, *Cylindrotomina*, no species has been discovered in California yet, nor in any part of the Western Territories.

Section VIII.—*Ptychoptera*.

PTYCHOPTERA LENIS n. sp.—*Male and female*.—Antennæ black, except the first joint, which is red; base of palpi also reddish; hypostoma reddish, in some specimens darker; front black, shining. Thorax black, subopaque; pleuræ silvery-pruinose; scutellum reddish. Abdomen black, shining; male genitals dark brown; ovipositor reddish. Legs reddish, including coxæ, which are more or less black at the root, and have a more or less distinct black streak about the middle; hind coxæ black, except the tip; femora brown at tip; tibiæ brownish, darker at

tip; tarsi brown, except the base, which is paler. Halteres brownish. Wings with a distinct pale brown tinge, somewhat yellowish along the costa; nearly obsolete clouds, visible with the magnifying-glass only, on the central cross-veins and on the bifurcation of the third vein; venation like *P. rufocincta*. Length, 11-12^{mm}.

Hab.—Yosemite Valley, Cal., June 5; Georgetown, Colo. (8,500 feet altitude), August 12. A male and two females. Seems to resemble the European *P. scutellaris*.

P. metallica Walker from Albany River, Hudson's Bay, may be this species; but Walker states that the venation differs from that of the other *Ptychoptera*, although it does not appear from his explanation in what the difference consists.

BITTACOMORPHA CLAVIPES (Fabr.).—A specimen from Oregon in Mr. H. Edwards's collection in San Francisco; other specimens were collected in Clear Creek Cañon, Colorado, by Mr. J. D. Putnam, of Davenport, Iowa; near Boulder City, Colorado, by A. S. Packard, June 29.*

Genus PROTOPLASTA.

In my Monograph of the North American Tipulidæ (Monographs of North American Diptera, vol. iv, p. 309), I established two groups of the section *Ptychopterina*, the second of which contains three remarkable and closely allied genera,—*Protoplasa* (better *Protoplasta*), from the Eastern United States; *Tanyderus*, from Chili; and *Macrochile*, a fossil form found in the Prussian amber; all of which with but a single species. These three genera and species differ from the *Ptychopterina* of the first group (*Ptychoptera* and *Bittacomorpha*) in the following characters:—A subcostal cross-vein is present; the second submarginal cell is much longer than the first; the number of posterior cells is raised to six, in consequence of the presence of a supernumerary longitudinal vein in the first posterior cell; collare large.

I have discovered a fourth species in California, which possesses the general characters of the *Ptychopterina*, as well as the particular characters of this second group. The characters enumerated below are merely those in which *P. vipio* differs from the generic characters of *Protoplasta* as given l. c., p. 316. In judging of their importance, it must be borne in mind that the original specimens of *P. fitchi*, at the time when I described them, were old specimens, while I made the description of my new species before the specimen had dried. Some of the minor differences may be due to this circumstance.

Eyes finely pubescent; proboscis together with its large fleshy lips a little longer than the head; antennæ 15-jointed, first joint but little longer than the second; joints of the flagellum elongated, very slightly incrassated on their anterior half, with verticils on the incrassa-

* I discover a slip of the pen in my description of this species: Monographs, iv, p. 316, line 2 from top, for *brown*, read *white*.

tion, last joint button-shaped, with a short cylindrical prolongation, which may be taken for a 16th joint. Scutellum projecting. Abdomen of the usual length, ending in the male in a large double-branched forceps. The fourth tarsal joint has a small projection on the under side at the basis (probably a sexual character). Wings narrower than in *P. fitchii*, and anal angle less projecting; venation like l. c., p. 317, f. 7, but the cross-vein in the fifth posterior cell is wanting, and there is no stump of a vein at the origin of the second vein.

P. vipio has the same venation as *Macrochile* Loew (Linn., Entom., v, tab. ii, f. 25), but differs in having 15- and not 19-jointed antennæ. It is also closely allied to *Tanyderus* Philippi (Verh. zool.-bot. Ges., 1865, p. 780). The venation is very like that represented l. c., tab. xxix, f. 57c., only the small cross-vein in the first posterior cell is wanting; the first vein and the branches of the second are more straight, the anal angle more rounded. The neck-like prolongation of the thorax is not quite as long as represented by Philippi. The antennæ of *Tanyderus* are said to be at least 25-jointed.

Dr. Philippi's statement that the abdomen of *Tanyderus* ends in two filaments does not warrant his conclusion that the specimen is a male.

Protoplasta vipio has a forceps, each of the two halves of which resembles the thumb and forefinger of a hand when divaricate; that is, each half has two branches, with a deep and broad sinus between them. This forceps, which I observed and sketched from the fresh specimen, has retained its shape after drying. It seems only probable that both *P. fitchii* and *Tanyderus* have a forceps constructed more or less on the same plan, and that the specimens hitherto described were females.

The sexual characters of *P. fitchii* not being as yet known, and *P. vipio* being known in the male sex only, I prefer to leave them provisionally in the same genus, although in the future a generic separation may become necessary.

PROTOPLASTA VIPIO n. sp.—*Male*.—Body brownish-gray; palpi and antennæ black, a brown spot above each eye and a brownish line in the middle of the front; thorax with three brown stripes, the intermediate double; dorsal segments of the abdomen brownish in the middle, grayish posteriorly and on the sides, sparsely punctured with brownish-black; two larger dots of the same color in the middle of each segment. Legs brown, except the femora, which are reddish-yellow, brown at tip; wings subhyaline, with blackish spots, dots, and cross-bands, a double spot near the root, another spot at the base of the præfurca, an irregular cross-band beginning at the end of the auxiliary vein and ending at the hind margin in the spurious cell; a second interrupted cross-band begins in the region of the stigma and ends on the hind margin in the two last posterior cells; numerous blackish dots in the cells and at the end of the longitudinal veins. Length of the body about 10^{mm}.

Hab.—California (San Mateo Creek, near San Francisco, April 9, 1876). A single male.

Section IX.—*Tipulina*.

Are abundantly represented in California, both in species and specimens. *Pachyrrhina*, however, so numerous in the Atlantic States, seem to be rare.

It would do but little good to describe the numerous species of my collection until the *Tipula* of the Atlantic States are better known. I confine myself, therefore, to a small number of remarkable and easily recognizable species, besides reviewing the Californian species described by Mr. Loew. I add the description of a remarkable *Pachyrrhina* from the Rocky Mountains.

TIPULA PRÆCISA Loew, Centur., x, 2; ♂ ♀.—A common species in Marin and Sonoma Counties in April and May. I have two males from Brooklyn, Alameda County, Cal. (Wm. Holden, M. C. Z.), with abortive wings, which are hardly twice as long as the halteres; in all the other characters, as well as in the structure of the hypopygium, they agree with the males of *T. præcisa*. I suppose this is a case of dimorphism. Mr. H. Edwards mentioned to me a subapterous *Tipula*, which he found in company with the apterous *Bittacus*; it is probably this very species. I found the *Bittacus* abundantly near Petaluma, and ascertain now, by the dates, that the *Tipula* occurred to me on the same day, and probably in the same locality; but I did not find any of the subapterous specimens. I recommend to collectors the verification of the dimorphism which I suspect.

TIPULA PUBERA Loew, Centur., v, 16.—Common in May in Marin County, California (San Rafael, May 26, 27; also received from Mr. H. Edwards and Mr. J. Behrens).

TIPULA FALLAX Loew, Centur., iv, 10.—California. I do not have it.

TIPULA BEATULA n. sp., ♂ ♀.—Wings with longitudinal gray shades in the center of all the cells of the apical portion; thorax behind the suture, including scutellum and metathorax, dark brown, shining, yellow in the middle. Length of male 11–12^{mm}; of the female, including the ovipositor, 15–16^{mm}.

Antennæ but little longer than the head, brown; scapus brownish-yellow; joints of the flagellum 1–7 subcylindrical, elongate, inconspicuously verticillate; tip of the flagellum suddenly attenuate, with two or three joints indistinct in dry specimens; thus the antennæ seems to be only 11- or 12-jointed. Front and vertex grayish-yellow, darker in the middle; rostrum brown above and below; palpi brown. Thorax yellowish-gray, with three brown stripes and two shorter stripes on each side; behind the suture, and in front of the scutellum, the mesonotum is dark brown or black, shining, with a yellow line in the middle; scutellum yellow, shining, with a brown stripe in the middle; metanotum dark brown, shining in the middle, pollinose on the sides, and with a yellow stripe. Knob of halteres brown, with a whitish spot at the tip. Abdomen brownish-yellow; hind margins of the segments and an inter-

rupted dorsal stripe brown. On the venter, the anterior half of the second segment is dark brown, shining; a narrow brown shining cross-band at the base of the three following segments (broader in the female). Terminal club of the abdomen in the male of moderate size, brownish-yellow, with two very small, yellowish, projecting, coriaceous organs above; in the female, the three last joints of the abdomen are shining; the upper valves are almost rounded at tip; the lower ones shorter and pointed. Legs yellowish-brown; tips of femora dark brown. Wings grayish, a gray cloud at the distal end of the first basal cell, other clouds about the middle of the anal cell and at the tip of the seventh vein; longitudinal faint gray shades along the middle of all the cells in the apical portion of the wing, including the axillary; stigma oval, blackish.

Hab.—Marin and Sonoma Counties, in April and May, rather common. Will be easily distinguished by the peculiar coloring of the posterior part of the thorax.

TIPULA SPERNAX n. sp., ♀.—Thorax shining black, smooth, polished; metanctum with a stripe of gray pollen in the middle; wings grayish-hyaline, unicolorous. Length, including ovipositor, about 16^{mm}.

Female.—Head, including rostrum, black, shining; a gray pollen on the front and on the upper part of the rostrum; palpi black; antennæ black, but little longer than the head; joints of the flagellum hardly incrassate at base, with moderate verticils; first joint grayish-pollinose. Thoracic dorsum shining, black, smooth; pleuræ and coxæ grayish-pollinose, a yellowish stripe between the root of the wings and the collare; the space between the root of the wings and the scutellum and metanotum is likewise yellowish; metanotum black, with a stripe of gray pollen in the middle, its sides yellowish; halteres yellowish-brown; abdomen black, shining, slightly grayish-pruinose toward the tip; each segment with a narrow yellow border posteriorly and yellow lateral margins; legs dark brown; femora, except the tip, reddish. Valves of the ovipositor yellowish-ferruginous, the upper ones very narrow, almost linear; tip slightly incrassate, brown. Wings uniformly grayish-hyaline—stigma brown, a whitish spot at its proximal end; veins brown, except those of the root, which is yellow, with a dark brown spot immediately above the insertion.

Hab.—Webber Lake, Sierra Nevada, July 26. A single female.

A very remarkable species, allied to *Pachyrrhina*. Without having the male, it is difficult to ascertain its relationship.

PACHYRRHINA ALTISSIMA n. sp., ♂ ♀.—Altogether black, including legs and halteres; wings brownish, with a small brown stigma. Length, ♂ 12–13^{mm}; ♀ 15–16^{mm}.

Male.—Antennæ about as long as head and thorax together, nodose, verticillate; thorax somewhat shining, slightly grayish-pollinose; abdomen moderately shining, with velvet-black, opaque cross-bands on the segments 2–4; second posterior cell sessile or subsessile; appendages of hypopygium dark brown or black.

Female.—Antennæ but little longer than the head; joints of flagellum slightly incrassate at base; the whole body more opaque than that of the male; hence the velvety cross-bands on abdomen less apparent; ovipositor ferruginous-brown (valves divaricate in the dry specimens).

Hab.—Rocky Mountains, at great altitudes; male specimens were found July 15, 1875, on Taos Peak, New Mexico, above timber-line (W. L. Carpenter); females on Pike's Peak, July 14, 1875, at 13,000 feet altitude (A. S. Packard). Three males and as many females.

PACHYRRHINA FERRUGINEA Fabr.—A very common eastern species. I have a male and a female from California (San Mateo) and two males from Denver, Colo. (P. R. Uhler), which have no black or brown triangles on the abdomen. It seems, nevertheless, to be the same species.

HOLORUSIA RUBIGINOSA Loew, Centur., iv, 1.—Not rare in Marin and Sonoma Counties in May.

CTENOPIHORA ANGUSTIPENNIS Loew, Centur., x, 3.—Not rare among the red-woods in the Coast Range. The larva probably lives in the stumps of *Sequoia sempervirens*. (Lagunitas Creek, Marin County, April 15; also numerous specimens from Mr. H. Edwards.)

Family BIBIONIDÆ.

BIBIO HIRTUS Loew, Centur., iv, 2; ♂ ♀.—Marin and Sonoma Counties, California, in April, common; Yosemite Valley, June 1-12. Mr. Loew's description implies that this species is very variable, and indeed I have male specimens, from the same localities, which look like a different species; they are almost destitute of whitish hairs, showing only a few of them on the sides of the abdomen; the size of the specimens is also variable.

BIBIO NERVOSUS Loew, Centur., iv, 4; ♀.—California. I did not come across this species.

BIBIO sp., ♂ ♀.—(Saucelito, April 2; San Geronimo, Marin County, April 19.) A red-legged species, like the preceding, but different.

DILOPHUS sp., ♂ ♀.—Marin and Sonoma, in April, common.

Family XYLOPHAGIDÆ.

RACHICERUS HONESTUS n. sp.—Antennæ 22-23-jointed, moniliform, subpectinate; thorax brownish-yellow, with two brown stripes; abdomen dark brown; wings tinged with brownish. Length 5.5^{mm}.

Male.—Head and antennæ black; palpi yellow; front above the antennæ with a silvery cross-band; antennæ 22-jointed, if the last joint, which is double, is counted for one; they are moniliform and subpectinate on both sides, the projections on the lower side being a little longer than those on the upper. Thorax brownish-yellow, with two broad brown stripes, which begin a little behind the humerus and do not touch the anterior margin; pleuræ brown. Abdomen uniformly dark brown, with a delicate grayish-yellow pubescence. Legs, including the

coxæ, yellow. Knob of the halteres brownish on the under side. Wings with a uniform slightly brownish tinge.

Hab.—San Rafael, Cal., May 29. One specimen.

The antennæ of *R. honestus* (♂) seem to be like those of *R. ruficollis* (♂) Hal., of which I regret not to have a specimen for comparison; only instead of having 34–35 joints, they have 22–23. The eyes are notched on the inner side, as described in Walker, List, etc., v, p. 104. The coloring of the body of *R. honestus* is exactly like that of a specimen from Illinois, which I have, and believe to be a mere variety of *R. obscuripennis* Lw.

The North American *Rachiceri* at present known may be grouped thus:—

Antennæ not pectinate:

ruficollis Hal.—Atlantic States.

honestus n. sp.—California.

Antennæ pectinate in the male, not pectinate in the female:

varipes Loew.—Cuba.

Antennæ pectinate in both sexes:

obscuripennis Loew.—Illinois.

nigripalpus Loew.—Mexico.

Family STRATIOMYIDÆ.

CHLOROMYIA VIRIDIS (syn. *Sargus viridis* Say).—A number of specimens taken between San Rafael and Saucelito, Marin County, Cal., April 2, agree with the specimens from the Atlantic States. The same occurs in Colorado (P. R. Uhler).

The name *Chrysomyia* Macq., 1834, cannot be maintained for the genus to which *Sargus viridis* belongs, as there is an earlier *Chrysomyia* Rob. Desv., 1830, among the *Muscidæ*. I reinstate, therefore, the name *Chloromyia*, introduced by Mr. Dnncan (Magaz. Zool. and Bot., 1837).

OXYCERA CROTCHI n. sp., ♀.—Abdomen with three lateral yellow spots on each side and an apical triangular one, all connected by a narrow yellow margin; femora black, with yellow tip; tibiæ and tarsi yellow. Length 8^{mm}.

Female.—Face and front yellow, with a broad black stripe in the middle; posterior orbits yellow; vertex, cheeks under the eyes, and occiput black. Antennæ: basal joints black (the rest wanting). Thorax black, opaque; a yellow stripe from the humerus to the antescutellar callus is interrupted a little beyond the middle, a pair of narrower yellow stripes on the dorsum slightly expanded in front and not reaching beyond the transverse suture; scutellum yellow, the base black; pleuræ with a large yellow spot in front of the wings, and a smaller oblong one under it; the black opaque abdomen has a subtriangular yellow spot on each side of the second segment, a larger, semi-elliptical spot on each side of the third segment, a somewhat similar, but smaller, pair of spots on the fourth segment, a large triangular spot on the last

segment; all these spots are connected by the narrow, yellow, abdominal margin; ventral segments yellow in the middle, brownish-black on the sides. Femora black, with yellow tips; tibiæ and tarsi yellow; joints 3 and 4 of front tarsi darker. Wings tinged with yellowish anteriorly, with grayish posteriorly; stouter veins and stigma reddish yellow.

Hab.—California (G. R. Crotch). A single specimen.

STRATIOMYIA BARBATA Loew, Centur., vi, 9.

STRATIOMYIA INSIGNIS Loew, Centur., x, 7.

STRATIOMYIA MACULOSA Loew, Centur., vii, 19.

STRATIOMYIA MELASTOMA Loew, Centur., vi, 10.

ODONTOMYIA ARCUATA Loew, Centur., x, 4.

ODONTOMYIA MEGACEPHALA Loew, Centur., vi, 20.

CLITELLARIA LATA Loew, Centur., x, 9.

Of these species, I possess *S. maculosa*, ♀ (San Rafael, in April and May, not rare); *S. insignis*, ♂, which, the difference of the coloring of the face notwithstanding, I hold to be the male of *maculosa*; and *S. melastoma* (Summit Station, Sierra Nevada, July 4, H. Edwards).

I have furthermore three *Stratiomyiæ* and one *Odontomyia* from the Sierra Nevada (Webber Lake, in July), which I abstain from describing.

CLITELLARIA RUSTICA n. sp., ♂ ♀.—(Altogether black, with a short grayish-yellow pubescence; knob of halteres white; wings tinged with dark gray. Length, male, about 6^{mm}; female, 7–8^{mm}.)

Black, but little shining, rather evenly clothed with a grayish-yellow, short, semi-recumbent pubescence; the disk of the abdomen above glabrous. Antennæ black; eyes densely pubescent; legs black, beset with a dense, short, grayish pubescence; upper side of tarsi glabrous, deep black. Spines of the scutellum brownish. Wings with a distinct dark gray shade; stigma pale brown; anal cell closed some distance from the margin.

Hab.—The Geysers, Sonoma County, California, May 5–7, common; also in San Geronimo, Marin County, April 19. A male from Webber Lake, Sierra County, July 22, is only 4.5^{mm} long. Three males and six females.

NEMOTELUS sp.—Specimens from the environs of San Francisco (W. Holden) agree with the description of *N. canadensis* Loew, but the edge of the abdomen does not show any trace of yellow.

Family TABANIDÆ.*

California (and with it, probably, the whole western region) is not very rich in *Tabanidæ*, especially when compared to the Atlantic States. Both species and specimens seem to be much less numerous. From the valleys of the Coast Range, in the environs of San Francisco, I possess only four *Tabani*, one *Chrysops*, one *Pangonia*. A *Silvius* is common,

* About the *Tabanidæ* from the Atlantic States, compare my Prodrôme of the *Tabanidæ* of the United States in the Memoirs of the Boston Soc. N. H., vol. ii.

especially in the foot-hills of the Sierra Nevada; the same species occurs in Colorado. From the high Sierra I brought three *Tabani* and two *Chrysops*. Besides these species, I describe a *Chrysops* common in the Colorado region and Utah. For comparison's sake, I will state that at least sixty species of *Tabanus* and twenty-five *Chrysops* occur east of the Mississippi. None of these species has as yet been found in California. Dr. Philippi's essay on the fauna of Chili enumerates twenty-two *Pangoniae* (including *Mycteromyia*), thirty-five *Tabani*, but only two *Chrysops*. The occurrence of *Silvius* in the western region is remarkable, as it is one of the numerous points of analogy between its fauna and that of Europe. A *Silvius isabellinus*, said to be from the Atlantic States, has been described by Wiedemann, but it has never been found since, and if it exists it must be a very rare species. In Central Europe, a single *Silvius* occurs; another one is an alpine species of apparently local occurrence, described by Mr. Loew.

Chrysops fulvaster, from Colorado and Utah, has a fenestrated spot in the discal cell, like several European species, mostly belonging to the Mediterranean fauna. Not a single one of the twenty-five *Chrysops* from the Atlantic States has this peculiarity.

Chrysops noctifer, from the Sierra Nevada, seems to resemble most closely two species from Lapland, one of which, according to Dr. Loew, also occurs in Sitka.

PANGONIA.

PANGONIA HERA n. sp.—Proboscis short, hardly projecting beyond the palpi; body uniformly blackish-gray; wings grayish-brown; eyes pubescent, first posterior cell open. Length 13–14^{mm}.

Female.—Antennæ black; two basal joints grayish; face and front dull yellowish-gray, the former with pale yellowish-white hairs, the latter (at least in my specimen) with a black, shining, denuded space in the middle; the proboscis hardly reaches beyond the short and stout gray palpi; lips large, developed; eyes pubescent, in life unicolorous, green; ocelli distinct. The black ground-color of the thorax and of the abdomen is partly concealed under a dust-colored, dingy-gray pollen; both are clothed with pale yellowish-white hairs. Wings tinged with a dingy brownish-gray; some lighter shades are visible in an oblique light, especially along the rounded part of the hind border and in the second basal cell; first posterior cell open; a long stump of a vein at the base of the fork of the third vein.

Hab.—San Francisco, Cal., caught in the street twice, by Mr. Henry Edwards, in July. I have a single female.

PANGONIA INCISA (syn. *Pangonia incisuralis* Say, Journ. Acad. Phila., iii, p. 31; Amer. Ent., plate xxxiv; *Pangonia incisa* Wiedemann, Auss. Zw., i, p. 90).—Colorado Springs, Colo., in August (P. R. Uhler); Arkansas (Say). The descriptions are easily recognizable.

SILVIUS.

SILVIUS GIGANTULUS (syn. *Chrysops gigantulus* Loew, Centur., x, 12; *Silvius trifolium* Osten Sacken, Prodr. of Tabanidæ, i, 395).—My description was drawn from alcoholic specimens, and requires some emendations.

The three-fold spot at the base of the abdomen is sometimes quite distinct, in other cases very faint. A longitudinal stripe in the middle of the abdomen, formed by an appressed golden-yellow pubescence, is very distinct in most, but not in all specimens. The black spot on the venter is often wanting. Front tarsi black, faintly reddish at base. One of the specimens (Colorado) has no denuded spots on the face; the ocellar area likewise is not denuded; the legs are altogether reddish, except the infuscated ends of the tarsi.

Hab.—California, especially in the Sierra Nevada and along its foothills (Mariposa County, June 3, not rare; Yosemite Valley, June 13; also about Webber Lake, Sierra County, July 26); Washington Territory; Vancouver Island (J. R. Crotch); Southern Colorado (W. L. Carpenter).

The living insect has bright yellowish-green eyes, with numerous irregularly scattered black dots; this agrees with Meigen's and Loew's description of the eyes of the other species of the genus.

In my former description, line 2, for *regular* spots, read *angular*.

That Mr. Loew took this species for a *Chrysops* is, I suppose, nothing but an oversight on his part.

TABANUS.

Of the seven species of *Tabanus* from California which I possess, three belong to the high Sierra, and four were found in the valleys of the Coast Range. Four of these species belong to the subgenus *Therioplectes*, one is apparently an *Atylotus*, and the remaining two are true *Tabani*.

All descriptions of species of the difficult group of *Therioplectes* must be necessarily imperfect as long as they are based on female specimens only. I have done my best to render them clear, and have taken note of the coloration of the eyes of the living specimens. As far as my knowledge goes at present, these two subgenera may be defined as follows:—

Therioplectes.—Eyes pubescent, with three or four purple cross-bands and intervening green intervals; ocelligerous tubercle more or less distinct; head of the male not differing much in size and shape from that of the female; the difference in size between the large and small facets on the eyes of the male is but very moderate, and the dividing line between them indistinct. (Species Nos. 1-4.)

Atylotus.—Eyes pubescent, with a single narrow purple cross-band in the middle, or unicolorous (?); no vestige of an ocellar tubercle; frontal callosity either entirely wanting or imperfect (in the Californian *T. insuetus* it is narrow and does not reach the eyes on either side, which is

not the case with an ordinary *Tabanus*). Head rather large, very convex anteriorly and concave posteriorly. In the male, the difference in size between the large and small facets is considerable, the line of division between them distinct; palpi (♀) stout at base; third joint of the antennæ rather broad, with a comparatively short, stout, annulate portion; upper branch of the third vein knee-shaped at base, with a tendency to emit a stump of a vein; first posterior cell broadly open. (Species No. 5 provisionally placed here until the male is found).

Tabanus, in the broader sense, species Nos. 6 and 7.

1. *TABANUS PROCYON* n. sp.—Is a *Therioplectes*; eyes densely pubescent, even in the female; in life, they have four green stripes on dark purple ground, the upper stripe not sharply limited on the upper side.

Female.—Altogether black; subcallus black, shining, rather swollen; third antennal joint rather narrow. Length 13^{mm}.

Front broad, opaque, slightly grayish, clothed with black pile; callosity large, broader than long, convex; subcallus denuded, shining, somewhat swollen; cheeks black, shining, with long brownish hair; antennæ black, third joint long and narrow, its upper corner hardly projecting; ocellar tubercle distinct; palpi black, stout at base; thorax black, with long black pile, especially on the pleuræ; abdomen black, moderately shining; the two last segments with some whitish hairs; legs black. Wings:—costal cell tinged with brown; bifurcation of the third vein, cross-vein at the base of second posterior cell, also the central cross-veins, more or less distinctly clouded with brownish.

Hab.—Marin and Sonoma Counties, California, April, May. Two females.

Is somewhat like the European *T. micans*, but can be at once distinguished by the deep black color of the pile on pleuræ and chest.

2. *TABANUS SONOMENSIS* n. sp.—A *Therioplectes* of the group of *T. epistates* (syn. *T. socius* of my Prodrôme) and of the European *T. tropicus*.

Female.—Grayish-black; sides of the abdomen red; abdominal incisions fringed with yellowish hairs, which also form faint triangles in the middle of the segments; wings with a small but distinct brown cloud on the fork of the third vein. Length 13–15^{mm}.

Antennæ black, sometimes faintly reddish on the second joint and at the base of the third; the latter is not broad, its upper angle either moderately or very little projecting. Front moderately broad, clothed with brownish-gray pollen, and beset with black, erect pile; callosity large, square, sometimes with a linear prolongation above; subcallus not denuded; cheeks whitish, with yellowish-white hair; palpi stout at base, yellowish-white, beset with short black hairs; eyes pubescent; ocellar tubercle distinct. Thorax grayish-black, the usual gray lines very faint; antalar tubercle reddish; pleuræ thickly clothed with hairs of a dingy gray. Sides of the abdominal segments 1 to 4 rufous, thus leaving between them a black stripe, expanding anteriorly; the remaining segments black;

hind margins of all the segments fringed with yellowish hairs, which also form faint triangles in the middle of the segments; in very well preserved specimens, faint lateral spots, formed by yellow hairs, on segments 2 and 3, are perceptible. Venter reddish, blackish at the base and toward the end. Femora blackish-gray, beset with grayish pile; front tibiæ red at base, their distal half and tarsi black; four posterior tibiæ and first joint of tarsi red, beset with black pile, which, on the hind tibiæ, forms a distinct fringe. Wings with a faint grayish tinge; costal cell and stigma yellowish-brown; a faint brownish cloud across the central cross-veins; a small cloud on the fork of the third vein; the latter often appendiculate.

Hab.—Marin and Sonoma Counties, California, April 27 to May 9, common. Eleven females.

Not unlike my *T. epistates*, but easily distinguished by the black antennæ, darker thorax, distinct cloud on the fork of the third vein, more conspicuous fringes of yellow hair on abdominal segments, etc.

3. *TABANUS PHÆNOPS* n. sp.—A *Theriopectes* of the same group with *T. sonomensis*.

Female—Grayish-black; sides of the abdomen red; wings hyaline, no distinct brown cloud on the bifurcation of the third vein; antennæ black. Length 13–14^{mm}.

Front gray, a little converging; ocellar tubercle distinct; callosity nearly square, with a spindle-shaped prolongation above; antennæ black; third joint rather narrow, its upper angle very little projecting; thorax grayish-black, with the usual lines very faintly marked; the antealear callosity variable, reddish or dark. The black stripe inclosed between the reddish sides of the abdomen is generally rather broad, and somewhat expanded at the posterior margins of segments 2 and 3, so as to appear jagged; the red on the sides of segments 2, 3, and 4 is clothed with a scarce and very minute golden-yellow pubescence, in the shape of faint, oblique spots; it also forms a fringe on the incisures.

T. phænops is very like *T. sonomensis*, but it is usually a little smaller, the front is narrower, the bifurcation of the third vein is not clouded; in most, but not in all, specimens, the red on the sides of the abdomen is less extended, leaving a broader black stripe in the middle, which is expanded at the abdominal incisures, and therefore appears jagged. In shape, the abdomen is more elongated, with more parallel sides. In life, this species is easily distinguished by the color of its eyes, which are of a very bright green, with comparatively narrow purple cross-bands, much narrower than the green intervals between them; no purple in the upper and lower corners of the eye (at least, in the specimens observed).

Hab.—Webber Lake, Sierra County, California, July 27. Four females. Two specimens from Fort Bridger, Wyo., August 4, seem also to belong here.

4. *TABANUS RHOMBICUS* (*Tabanus rhombicus* Osten Sacken, Prodrôme, etc., ii, 472).—A number of specimens from Webber Lake, Sierra Nevada, July 21–27, closely resemble my *Tabanus (Theriopectes) rhombicus* from the Colorado Mountains. These specimens show two or even three distinct forms, which I will characterize, in order to draw the attention of collectors to them. I have five specimens of each of these groups, all females.

1. The lateral triangles on the second and third segments of the abdomen are rectangular,—that is, their inner side is perpendicular to the hind margin of the segment, or nearly so; the prolongation of the outer angle toward the lateral margin forms a broad border on the hind margin; the intermediate triangles are well defined, equilateral, their apex not prolonged in a line reaching to the next segment; anteorar callosity black; subcostal cell distinctly tinged with brownish; subcallus denuded; none of the specimens has a stump of a vein on the fork of the third vein. Length 12–13.5^{mm}.

2. The lateral triangles on the abdominal segments from 2 to 5 are oblique,—in fact, more streaks than triangles; their prolongation toward the lateral margin is a narrow whitish border of the hind margin; the intermediate triangles (rubbed off in most specimens) show a tendency to a linear prolongation of the apex toward the next segment; anteorar callosity faintly reddish; subcostal cell nearly hyaline; subcallus either not or only partially denuded; stump of a vein present in most, not in all, specimens. Length 14–15^{mm}.

Intermediate between these two groups of specimens, there is a third, which combines the abdominal markings and the faintly reddish anteorar callosity of the second group, with the infuscated costal cell, the perfectly denuded subcallus, the absence of the stump, and the smaller size of the first. My specimens of this group have the sides of the abdomen very distinctly reddish.

All the specimens were taken indoors, on a window, promiscuously, together with *T. phanops* and *T. insuetus*. I took note of the eyes as having “alternate green and dark purple stripes of about equal breadth”. The specimen bearing this label belongs to the intermediate group. Another specimen of the same group and one of the first group are marked as having the green stripes broader.

My specimens from Colorado are nearer to the first form, without reproducing it exactly. The abdomen seems narrower, the abdominal spots less pure whitish. A specimen from Twin Lakes, Colorado, is certainly identical with the second form, and its subcallus is not at all denuded, and it has a distinct stump on the forked vein.

The uncertainty whether the typical *T. rhombicus* from Colorado is the same as the *Tabani* of the first form, the existence of the intermediate group, and the total absence of male specimens, are so many causes why it would be premature to describe the second form as a separate species.

5. *TABANUS INSUETUS* n. sp.—Belongs apparently to the subgenus *Atylotus*. Eyes pubescent, although in the female specimens the pubescence is often hardly perceptible; in life, pale olive-green, with a single very narrow brown stripe in the middle (distinct even in dry specimens); no vestige of an ocellar tubercle; frontal callosity rather small, variable in size, narrower than the front; third antennal joint rather broad and short, with a short and stout annulate portion; palpi stout at base; first posterior cell broadly open; base of upper branch of third vein knee-shaped, in many specimens with a stump of a vein. All these characters would justify the location of the species in that sub-genus; the discovery of the as yet unknown male will have to decide it.

Female.—Face and front yellowish-gray; cheeks with pale hairs; front with short black hairs; a fringe of such hairs on the upper edge of the occiput. Front broad (in most specimens; much narrower in others); frontal callosity narrower than the front, rather small, and variable in shape; usually another black, shining spot above it. Palpi short, stout at base, pale yellowish or yellowish-white, with black pile. Antennæ pale brownish-red; annulate portion of third joint sometimes, but not always, black or brown. The black ground-color of the thorax is partly concealed under a gray pollen; vestiges of longitudinal gray lines are visible anteriorly; a pale golden, sometimes whitish, appressed, rather scarce, pubescence, and black, erect pile clothe the dorsum. Pleuræ gray, with pale gray hairs. Abdomen in well-preserved specimens with three rows of yellowish-gray spots, formed by an appressed pubescence; the triangles of the intermediate row large, occupying the whole breadth of the segment; the spots of the lateral rows are oblique, prolonged laterally along the hind border of the segments (well-preserved specimens seem rarely to occur; in the worn specimens, the abdomen appears as grayish-black, somewhat reddish on the sides of the first two segments, and with but vestiges of the appressed yellowish-white pubescence and of the abdominal spots). Venter uniformly yellowish-gray. Feet variable in coloring, pale reddish-yellow, with blackish (seldom pale) femora and tips of tibiæ; tarsi blackish, the two posterior pairs paler at base. Costal cell and stigma more or less tinged with brownish-yellow; upper branch of third vein often, but not always, with a stump of a vein. Length 12–13^{mm}.

Hab.—Webber Lake, Sierra County, July 21. Twelve females.

6. *TABANUS ÆGROTUS* n. sp.—*Female*.—Altogether brownish-black; wings immaculate; third antennal joint very broad at base. Length 19–20^{mm}.

Front, face, and cheeks clothed with a dense brown pollen, hiding the ground-color; front moderately broad; frontal callosity subobsolete, flat, not shining, prolonged above in an opaque line; cheeks with brown hairs; palpi dark brown; antennæ black, third joint very broad, expanded, and rounded on the under side, and with a projecting upper

angle; annulate portion rather abruptly attenuated, as long as the body of the joint. Thorax brownish-black; pleuræ and pectus black, with long black pile. Abdomen black, moderately shining. Legs black. Wings slightly tinged with gray; costal cell and stigma brownish; first posterior cell hardly coarctate.

Hab.—California (H. Edwards). A single female.

In its general appearance and coloring the species is not unlike *T. nigrescens*, from which it is easily distinguished by the absence of brown spots on the wings and other characters. It probably belongs in the same group, especially if the shape of the head of the as yet unknown male and the coloring of the eyes are like the same characters in *T. nigrescens* and *punctifer*.

7. *TABANUS PUNCIIFER* (*Tabanus punctifer* Osten Sacken, Prodrôme, etc., ii, 453, 29).

Hab.—Colorado, Utah; Sonora, California; not rare in the valleys of the Coast Range in June and July.

CHRYSOPS.

The female specimens of the species described below may be tabulated as follows:—

Apex of the wing beyond the cross-band more or less infuscated; first basal cell altogether, or to a considerable extent, infuscated:

Second basal cell infuscated on its proximal third or beyond:

Prevailing color of the body black; palpi black.....1. *noctifer*.

Prevailing color of the body brownish-yellow; palpi reddish.....2. *fulvaster*.

Second basal cell hyaline:

The black facial callosities small, not converging anteriorly, separated by a broad, ferruginous interval.....3. *proclivis*.

The black facial callosities large, converging anteriorly, separated by a narrow ferruginous interval.....4. *surdus*.

1. *CHRYSOPS NOCTIFER* n. sp.—*Female*.—Cheeks and the converging facial and the large frontal callosities black, shining; between them, the usual yellowish-gray pollen; antennæ black, reddish at base. Thorax^o black, shining, with vestiges of grayish pollen, forming a faint, broad, geminate stripe anteriorly; scattered whitish pile on the dorsum, more dense above the roots of the wings and on the pleuræ. Abdomen black; sides of segments 1 and 2 red, this color occupying about one-half of the breadth of the dorsum; a faint, appressed, whitish pubescence on the red; similar whitish hairs on the hind margins of the segments (in very well preserved specimens these hairs form very faint triangles on segments 2 and 3). Legs black; four hind tarsi brownish at base. Wings:—costal cell, two-

thirds of first, more than one-half of second basal cell dark brown; the dark brown cross-band does not reach the posterior margin, and does not fill out the third, fourth, and fifth posterior cells; at the proximal end of the fifth posterior cell, near the cross-vein, the brown often but not always shows a small hyaline space; apical spot small, pale grayish-brown, occupying the extreme end of the marginal and first submarginal, and encroaching but very little on the second submarginal cell; the hyaline triangle reaches the first longitudinal vein (if there is any connection between the apical spot and the cross-band, it is a very faint one). Length 9-10^{mm}.

Hab.—Webber Lake, Sierra County, California, July 20-27. Four females.

The eyes of this species in life are like figure 2 of my Prodrôme (p. 369), the two central black spots being sometimes disconnected.

This species is closely allied to *C. nigripes* Loew, and still more to *C. lapponicus* Loew, but seems to be different from both, as in those species the apical spot seems to be confluent with the cross-band (if I understand Dr. Loew's expression, "der schmale Spitzenfleck . . . steht mit der Schwärzung des Vorderrandes in vollständigster Verbindung"—Verh. zool.-bot. Ges., 1858, p. 623). *C. nigripes* occurs not only in Lapland, but, according to Loew, also in Sitka.

2. CHRYSOPS FULVASTER n. sp.—*Female*.—Facial tubercles either entirely red or red mixed with black; frontal tubercle comparatively small, pale red, with a black upper margin more or less extended; palpi pale reddish. Thorax clothed with a yellowish-brown pollen, four stripes, leaving blackish intervals between them. Abdomen:—two basal segments yellowish, the first with a transverse black spot under the scutellum, the second with two black spots, separated by a yellow interval in the middle; the following segments black, with yellow posterior margins, and a more or less distinct yellow longitudinal line in the middle. Legs rufous, more or less black on the joints; front tarsi and the tips of the other tarsi black. Wings somewhat pale brown, almost grayish along the hind margin; a hyaline space occupies the end of the first basal cell, the larger portion of the second basal, the whole anal cell except its distal end, and the proximal half of the anal angle; a crescent-shaped subhyaline space separates the brown cross-band from the more grayish apex of the wing; the inside of the discal cell is paler brown, a spot in the fourth posterior cell subhyaline. Length 6-7^{mm}.

Male.—Black, except the face; palpi black; narrow lateral margins of abdominal segments 1 and 2 and hind margins of the other segments yellow; fulvous pollen in stripes on pleure and above the root of the wings; fulvous pile on these stripes. Prevailing color of front legs black; of the two hind pairs reddish. Wings uniformly tinged with black; a crescent shaped subhyaline space separates the usual

cross-band from the apical portion of the wing; another subhyaline elongated spot at the distal end of both basal cells. Length 6^{mm}.

Hab.—Denver, Colo., August 5 (P. R. Uhler); Utah (J. D. Putnam). This seems to be the common species in those regions. The coloring of the body is variable, but the design on the wings will be easily recognized. Five females and one male. It is not possible to identify *C. fulvaster* with *C. quadrivittatus* Say, although it is rather singular that the latter should never have turned up as yet in any of the western collections.

3. *CHRYSOPS PROCLIVIS* n. sp.—*Female*.—Facial tubercles black on the outside of the dividing furrow only, thus leaving a broad ferruginous interval between them; cheeks black, shining; the intervals between cheeks, facial tubercles, eyes, rostral tubercle, and antennæ are filled out with stripes of pale fulvous pollen. Antennæ black; underside of first joint reddish (sometimes the red is more extended). Thorax black, moderately shining, clothed with yellowish pile; a stripe of gray pollen each side between the scutellum and the humerus is more densely overgrown with yellow pile; the same pile on the pleuræ. Abdomen black; the sides of segments 1 and 2 yellow, leaving an elongated black square in the middle, slightly coarctate on the hind margin of segment 1, and dovetailed on the hind margin of segment 2, by the insertion of a yellow triangle; near the same hind margin, on each side, there is a more or less developed black dot; segment 3 is black, with a yellow hind margin and three more or less distinct longitudinal lines, breaking up the black in four portions; segment 4 black, with a yellowish hind margin, sometimes expanded into a triangle in the middle; the following segments black, with narrow yellow margins; all the yellow portions, including the hind margins, are beset with short yellow hairs. Venter likewise variegated with black and yellow. Front legs black; base of tibiæ reddish; on the posterior pairs, the prevailing color is red, with more or less black on the joints and at the base of the femora. Wings:—costal cell and first basal cell brown, the latter with a small hyaline space at the distal end crossed by a brown line; second basal, anal cell, anal angle, and fifth posterior cell hyaline; the cross-band reaches the hind margin and fills out the fourth posterior cell; apical spot narrow, encroaching but very little on the second submarginal cell; the hyaline triangle enters the marginal cell, but is separated by a brown shade from the costa; distal margin of cross-band slightly protruding toward the base of the second submarginal cell. Length 8-9^{mm}.

Hab.—Marin County, California. Four females.

As usual in species of this kind of coloration, the extent of the yellow on the abdomen is somewhat variable.

4. *CHRYSOPS SURDUS* n. sp.—*Female*.—Very like *C. proclivis*, but differs in being smaller; the facial callosities are black and shining on both sides of the dividing furrow; being prolonged anteriorly, they coalesce above the mouth; the ferruginous space between them is a narrow stripe, interrupted anteriorly. The thoracic dorsum anteriorly shows two distinct gray longitudinal lines, reaching to about the middle of the thorax; the pile on the pleuræ is of a paler yellow. On abdominal segments 1 and 2, the elongated black square is more distinctly coarctate on the hind margin of the first segment; on segment 3 there is a yellow dividing line in the middle, but the lateral yellow marks in most cases do not exist. The prevailing color of all the legs is black, with only a little reddish at the base of the four posterior tibiæ and tarsi. The design on the wings does not show any important difference. Length 7–8^{mm}.

Hab.—Webber Lake, Sierra County, California, July 21. Four females.

The eyes of this species have the normal coloration (like the figure 1 in my Prodrôme).

Family LEPTIDÆ.

As far as the small number of known *Leptidæ* from California enables me to judge, this family exhibits, on the Pacific slope, a more European than Eastern American character.

The striking forms of golden-haired *Chrysopila*, the principal feature of the fauna of the Atlantic States, are replaced here by small and insignificant species.

The genus *Triptotricha*, however, hitherto peculiar to North America, seems equally well represented in the Atlantic and Pacific States.

The considerable number of Californian species of *Symphoromyia* and the abundance of specimens are remarkable.

TRIPTOTRICHA LAUTA Loew, Centur., x, 15.—California.

TRIPTOTRICHA DISCOLOR Loew, Berl. Ent. Zeitschr., 1874, p. 379.—California.

I have neither of these species. A specimen which I found near Lake Tahoe, Sierra Nevada, July 19, seems to be different from both.

LEPTIS COSTATA Loew, Centur., ii, 4.—Not rare in Marin and Sonoma Counties, California. The front and hind legs of my five specimens are not as dark as described; but the coloring of the legs seems to be very variable.

LEPTIS INCISA Loew, Centur., x, 16.—The female alone is described; the male has usually much darker femora; the coloring of these, however, is very variable in both sexes. One of my females has a pale reddish scutellum; another has it black at base, reddish toward the tip. Not rare in Marin County in April.

CHRYSOPILA HUMILIS Loew, Berl. Ent. Zeitschr., 1874, p. 379.—*Male*.—"Atra, opaca, tota pilis lutescentibus vestita; tibiæ testaceæ,

apicem versus fuscæ; tarsi toti fusci; alæ saturate cinereæ, stigmatè fusco. Long. corp. 2 lin.; long. al. $1\frac{1}{2}$ lin." (About 4.4 and 4.2^{mm}.)

"Black, opaque; antennæ, palpi and knob of halteres of the same color. The erect pubescence of the whole body, and likewise that of the palpi and coxæ pale luteous-yellow, only that of the frontal tubercle a little darker, so that it looks almost black when held against the light. Femora black, at the tip pale luteous-yellowish; their short tomentum of an impure whitish. The luteous-yellowish tibiæ become gradually brown towards the tip, and the feet are tinged with brown, except sometimes at the base of the first joint. Wings with an intense grayish tinge; the stigma dark brown, of a medium breadth and length; the wing-veins blackish-brown.

"*Hab.*—San Francisco (H. Edwards)."

A species of which I found several males near Los Angeles in March differs from this description in having the pubescence of the body golden-yellow, rather than luteous; that of the femora likewise golden-yellow; that of the palpi decidedly black; the stigma is brown, but not dark brown.

A specimen from Webber Lake, California, July 24, has longer and less brownish wings, but a darker stigma; first antennal joint with long bristles, which do not exist in the specimens from Los Angeles; palpi very long; pleuræ grayish; pubescence of the abdomen whitish.

I cannot identify either of these species with the above description.

ATHERIX VARICORNIS Loew, Centur., x, 13.—*Female.*—I do not know this species.

SYMPHOROMYIA sp.—Half a dozen species which I took in Marin and Sonoma Counties in April and May, and about Webber Lake in July, all have the anal cell open, and therefore belong to the genus *Symphoromyia* Frauenfeld (*Ptiolina* Schiner, not Zetterstedt). California seems to be much richer in this group than Europe or the Atlantic States of North America. But as these species resemble each other very closely, and as both sexes often differ in coloring, I deem it more prudent not to attempt to describe them.

The female of one of these species which I observed near Webber Lake stings quite painfully, and draws blood like a *Tabanus*. I am not aware of the fact having ever been noticed before concerning any species of *Leptidæ*.

Family NEMESTRINIDÆ.

Hirnoneura brevirostris Macquart, Dipt. Exot., suppl., i, p. 101, tab. 20, f. 1, from Yucatan, is the only species of this family hitherto recorded as occurring north of the Isthmus of Panama. I describe a species from Texas, of which I have a single specimen, the only Nemestrinid from North America I have ever seen. This scarcity is the more remarkable, as the regions of Central Asia, which, in other respects, show many faunal analogies with the western plains and California, are very rich in

species of that family. Many species occur in the countries round the Mediterranean. Dr. Philippi enumerates not less than twenty-one species from Chili (!).

HIRMONEURA CLAUSA n. sp.—Body clothed with pale yellowish-gray hair; antennæ and feet reddish; eyes bare; second submarginal and second posterior cells closed and petiolate at the distal end. Long. corp. 9–10^{mm}.

Face densely covered with pale yellowish hair, through which a short, reddish proboscis is hardly visible; antennæ reddish; front clothed with the same pale yellowish hair; vertex black, with a tuft of black hair; behind it, on the occiput, a tuft of yellow hair. Eyes bare. Thorax clothed with the same pale yellowish hair, especially dense on the pleuræ and pectus; on the dorsum, the black ground-color is visible; the posterior corners, as well as the hind margin of the scutellum, are reddish-brown. Abdomen black, clothed with the same pale yellowish hair. Halteres reddish. Legs brownish-red; femora clothed with pale yellowish, erect pile, especially on their proximal half. Wings hyaline; the veins near the costa reddish-brown; the second submarginal cell is closed, eye-like, long-petiolate at the distal end; the second posterior cell (that is, the cell which is separated from the second submarginal by a single cell, the first posterior, which opens at the apex of the wing) is also closed, with a petiole at the distal end half as long as the petiole of the second submarginal; the third posterior cell is closed (as usual in this genus).

Hab.—Dallas, Texas (Boll). A single specimen, apparently a female.

The venation of this species is like that of *H. brevisrostris* Macquart (Dipt. Exot., suppl., i, tab. 20, f. 1), except that the second posterior cell is closed, and the petiole of the second submarginal is longer than represented on the figure.

Family BOMBYLIDÆ.

The *Bombylidæ* are perhaps the most characteristic and one of the most abundantly represented families of *Diptera* in the western region, including California. Nevertheless, the results obtained by me in working up this family are not at all in proportion to the number of species collected. I have been very much hampered, on the one hand, by the unsatisfactory condition of the systematic distribution of the *Bombylidæ* in general; on the other, by the insufficiency of my eastern material and the impossibility of identifying the large number of existing descriptions of eastern species.

For fear of increasing the difficulties of the future student, I have confined myself to the description only of the more striking forms; and, at the same time, in order to facilitate his task, I have taken advantage of this opportunity for reviewing all that has been hitherto done for North American *Bombylidæ*. A list of all the described species from

North America north of Mexico, distributed as far as possible among the genera where they belong, will be found on the following pages.*

An analytical table of all the genera hitherto found in the United States is also given.

From the very circumstance that the *Bombylidae* are one of the most numerously represented families of *Diptera* in the Western Territories, it follows that it would be premature now to attempt any generalization about their geographical distribution. The following remarks, based upon the existing data, are therefore only provisional.

Among the group of *Anthracina*, the genera *Anthrax*, *Exoprosopa*, and *Argyramæba* are abundantly represented both in the Atlantic and Pacific States, but probably more so in the latter. The new genus *Dipalta*, with a single species, occurs in Colorado and in California as well as in Georgia.

The North American species of the group *Lomatina*, which I have seen, have the general appearance of *Anthrax*, but, at the same time, a very short præfurca, with the small cross-vein far beyond its end, and the eyes contiguous in the male. They differ from the *Bombylina* in the globular shape of the head, the very large size of the frontal triangle of the male, and often in the *Anthrax*-like antennæ, more or less distant from each other at the base. The genus *Oncodocera*, with *O. leucoprocta* from the Atlantic States, belongs here. I have introduced the new genus *Triodites*, with one species from California and Utah. I possess a species from Colorado, which will require the formation of a new genus; I do not describe it at present. *Anisotamia eximia* Macq. (= *Anthrax valida* Wied.) from Mexico is related to *Oncodocera*. From Mr. Loew's statements about *Aphæbantus* and *Leptochilus*, both new genera, with a single species from Texas, I judge that they likewise belong to this group. The *Stygia elongata* Say (*Lomatia elongata* Wied.) is evidently not a *Lomatia*, and perhaps not a Bombylid at all. I have never seen it.

The *Toxophorina* are represented as yet only by one *Toxophora* from California and by several from the Atlantic States. A single *Systropus* occurs in the Atlantic States.

The *Bombylina* are represented by the genera *Bombylius*, *Systæchus*, and *Sparnopolius*. From *Systæchus* I have separated the genus *Anastæchus* which also occurs in Europe. *Pantarbes* nov. gen., with a single species from California, is not unlike *Mulio*. *Lordotus* Lw., with one species, occurs in Colorado, Wyoming, and Texas, as well as in California. *Comastes* nov. gen., with one species from Texas, is a very original and interesting form. *Ploas* is represented by seven species from California,

* In identifying species from the United States, the descriptions of species from the West Indies and Mexico must not be quite neglected, as some of these species may have a wide northerly range. Lists of these species will be found in my Catalogue of the Described Diptera of North America, Smithsonian Institution, 1858. The species published since will be found in Loew's "Centuries", in Jaenicke's "Exotische Diptern", and in Bellardi's "Saggio".

one from New Mexico, and one from the Southern States. *Geron* occurs everywhere. Two *Phthiria* are known from the Atlantic States, one more from Colorado, and three from California.

The most interesting addition to the North American fauna in this family is *Epibates*, a new genus, the male sex in which is distinguished by a muricate surface of the thoracic dorsum. I have not less than seven species in it, four from the Pacific coast, two from the Atlantic States, and one uncertain.

As a general result, I will state that the large genera of this family occurring in the United States are universal or nearly universal genera.

The genera peculiar to the fauna, with the exception of *Epibates*, are all as yet monotypical. The genera which do not belong to either of these two categories are:—*Ploas*, which, besides North America, occurs, as far as I know, only in the fauna of the Mediterranean and Central Asia. It is singular that it has not been recorded from South America. *Systropus* counts several species in Mexico and South America, also at the Cape, and in Australia. *Toxophora* occurs in Algiers, Syria, the Cape, Brazil, and Java. *Phthiria* is found in the Mediterranean region and in Central Asia, at the Cape, also in Brazil and Chili.

A fact worth noticing is the common occurrence of some species of *Bombylidae* in both hemispheres, or, if the specific identity is contested, at least the great resemblance between some species in Europe and America.

The European *Bombylius major* seems to be the same as the most common species in California. *B. fratellus*, from the Atlantic States, is very little different from it. *Systæchus vulgaris* and *Anastæchus barbatus* are remarkably like the European species of the same genera. *Anthrax doreadion* n. sp. (= the true *A. capucina* F.) is the same, or nearly the same, as the species known as *A. capucina* in Europe.

Of all families of *Diptera orthorhapha*, hardly any have been so imperfectly studied in their organization as the *Bombylidae*. By gradual additions, the number of genera has reached very near seventy, and nevertheless the discrimination of the essential characters on which to base a classification may be said not to have been even begun. Dr. Schiner (Novara, p. 115) proposed a subdivision of the family in four groups,—the *Anthracina*, *Lomatina*, *Toxophorina*, and *Bombylina*. But, as he did not characterize these groups, this subdivision can have but very little value. It would seem self-evident that any attempt at a subdivision must be preceded by a thorough study of the outward organization of these insects; nevertheless, this has never been done yet. The thick fur, the hairs and scales, which cover the whole body, or certain parts of it, render such a study difficult, unless that covering is removed; and many an important character may have been overlooked, owing to the neglect of undergoing that trouble. As an instance of such an oversight, I will mention the remarkable epizeral hooks which exist in most of the genera of the *Anthracina* above the root of the

wings; as far as I am aware, their very existence has never been mentioned anywhere.

Under such circumstances, and especially in the absence of collections containing some of the foreign generic forms, the task of establishing the indispensable new genera becomes a very difficult one. I have spared no trouble in reading the descriptions of the existing general and hope, as far as lay in my power, to have avoided redescribing old genera under a new name.

The following table contains all the genera of *Bombylidæ* hitherto found in North America north of Mexico. The genera hitherto recorded as occurring in Mexico, and not found yet in the United States, are:—

Adelidea Macq., Dipt. Exot., ii, 1, p. 84, for *A. flava* Jaenicke, from Mexico. According to Schiner (Novara), this genus is the same as *Sobarus* Loew, Beitr., iii.

Anisotamia Macq., Dipt. Exot., ii, 1, p. 81, for *A. eximia* (= *Anthrax valida* Wied.), is closely related to *Oncodocera*. Whether it is a true a genus established by Macquart for certain African species, remains *Anisotamia*, to be proved.

Pœcilognathus Jaenicke is simply a *Phthiria*.

In using this table, it must be borne in mind that I have not seen *Aphoebantus* Lw. and *Leptochilus* Lw., and have placed them according to the data of the descriptions; and that I do not know the male sex of *Comastes*.

Analytical table of the genera of BOMBYLIDÆ, occurring in North America north of Mexico.

- 1 (10). The bifurcation of the second and third veins takes place opposite, or nearly opposite, the small cross-vein; the second vein forms a knee at its origin from the præfurca; the third vein is in a straight line with the præfurca :
- 2 (5). Three submarginal cells, the anterior branch of the third vein being connected with the second vein by a recurrent cross-vein :
- 3 (4). Antennæ with a more or less long style at the end of the third joint *Exoprosopa* Macq.
- 4 (3). Antennæ without any distinct style at the end, *Dipalta* nov. gen.
- 5 (2). Two submarginal cells :
- 6 (7). Third antennal joint with a distinct pencil of hairs at the tip; pulvilli distinct *Argyramœba* Schiner.
- 7 (6). Third antennal joint without pencil of hairs at the tip :
- 8 (9). Pulvilli distinct *Hemipenthes* Loew, Centur.
- 9 (8). No distinct pulvilli *Anthrax* Scopoli.
- 10 (1). The bifurcation of the second and third veins takes place some distance before the small cross-vein, at an acute angle; the second vein does not form a knee at its origin from the præfurca :

- 11 (18). Body *Anthrax*-like; frontal triangle in the male unusually large; frontal space in the female of a corresponding size:
- 12 (13). Antennæ approximated at base; third antennal joint gradually attenuated..... *Oncodocera* Macq.
- 13 (12). Antennæ remote at base; third joint subglobular at base, suddenly contracted, and then linear, styliiform:
- 14 (17). Pulvilli distinct:
- 15 (16). Second submarginal cell appendiculate,
Aphæbantus Loew, Cent.
- 16 (15). Second submarginal cell not appendiculate, *Triodites* nov. gen.
- 17 (14). Pulvilli none..... *Leptochilus* Loew, Cent.
- 18 (11). Body not *Anthrax*-like; frontal triangle in the male small:
- 19 (22). Body (antennæ, thorax, abdomen) clothed with more scales than hairs, gibbose, the abdomen hanging down; antennæ long, first joint unusually long:
- 20 (21). Four posterior cells..... *Lepidophora* Westw.
- 21 (20). Three posterior cells..... *Toxophora* Meig.
- 22 (19). Body clothed with hairs, or else nearly glabrous:
- 23 (44). Four posterior cells:
- 24 (33). First posterior cell closed:
- 25 (32). Two submarginal cells:
- 26 (29). First basal cell longer than the second:
- 27 (28). Front and epistoma in the profile form a gently inclined plane; the latter with long and dense, bushy pile; head narrower than the body..... *Bombylius* Lin.
- 28 (29). Front and epistoma in the profile nearly vertical, without bushy pile; head large, as broad as the body; thorax large, more bulky than the abdomen..... *Comastes* n. gen.
- 29 (26). Both basal cells of equal length:
- 30 (31). Under side of the head moderately pilose, and hence its different parts (including the base of the antennæ, the oral edge, etc.) easily perceptible..... *Systæchus* Loew, Beitr.
- 31 (30). Under side of the head densely pilose, the root of the antennæ, epistoma, mouth, etc., being completely hidden,
Anastocchus n. gen.
- 32 (25). Three submarginal cells..... *Pantarbes* n. gen.
- 33 (24). First posterior cell open:
- 34 (41). Two submarginal cells:
- 35 (36). Both basal cells of equal length..... *Sparnopolius* Loew, Beitr.
- 36 (35). First basal cell longer than the second:
- 37 (38). Third antennal joint not truncate at the tip.... *Epibates* n. gen.
- 38 (37). Third antennal joint flattened, truncate at the tip:
- 39 (40). Proboscis short..... *Paracosmus* (*Allocotus* Lw.).
- 40 (39). Proboscis very long..... *Phthiria* Meig.
- 41 (34). Three submarginal cells:
- 42 (43). Proboscis long; abdomen convex..... *Lordotus* Loew, Cent.

- 43 (42). Proboscis short; abdomen flattened.....*Ploas* Latr.
 44 (23). Three posterior cells; anal cell closed:
 45 (46). Proboscis much longer than the antennæ; small, *Bombylius*-like,
 pubescent insects.....*Geron* Meig.
 46 (45). Proboscis shorter than the antennæ; long, *Sphex*-like, almost
 glabrous insects; abdomen with the four basal joints very
 narrow.....*Systropus* Wied.

EXOPROSOPA.

I have tried to construct an analytical table for all the described species from the United States. In using it, it must be borne in mind that *E. gazophylax* Lw., *bifurca* L., and *agassizi* Lw., I know only from the descriptions. All the species except *E. gazophylax* have three posterior cells.

- 1 (2). Style of the third antennal joint not more than one-fourth the length of that joint..... { 1. *fasciata* Macq.
 2. *sima* n. sp.
 2 (1). Style of the third antennal joint very long, from one-third to one-half as long as the joint, or more:
 3 (14). The expanded end of the marginal cell is not altogether hyaline (more or less filled out with brown):
 4 (9). The marginal cell is altogether brown (except a small subhyaline spot in its proximal third):
 5 (6). Four submarginal cells.....3. *gazophylax* Lw.
 6 (5). Three submarginal cells:
 7 (8). Proximal half of the wings altogether brown....4. *decora* Lw.
 8 (7). Proximal half of the wings brown, but with a hyaline cross-band.....5. *dorcadion* n. sp.
 9 (4). The marginal cell contains one or more hyaline spots:
 10 (13). The marginal cell contains one hyaline spot before its expanded distal end, cutting off a brown spot which fills out that end:
 11 (12). Both brown cross-bands fully reach the posterior margin,
 5. *dorcadion* var.
 12 (11). Neither of the two cross-bands reaches the posterior margin,
 7. *fascipennis* Say.
 13 (10). The marginal cell contains three large hyaline spots, alternating with brown ones.....6. *caliptera* Say.
 14 (3). The expanded end of the marginal cell is altogether hyaline:
 15 (20). Whole marginal cell brown, except its expanded end:
 16 (17). Prevailing color of the wings brown, except the apex and a large spot in the discal cell, which are hyaline,
 8. *emarginata* Macq.
 17 (16). Prevailing color of the wings hyaline:
 18 (19). Cross-veins at the base of the third and fourth posterior cells strongly infuscated.....9. *titubans* n. sp.
 19 (18). Cross-veins, etc., not infuscated.....10. *dodrans* n. sp.

- 20 (15). Proximal half of the marginal cell hyaline :
- 21 (24). Proximal half of the first posterior cell brownish; its latter portion hyaline :
- 22 (23). Cross-veins at the base of posterior cells 1, 3, and 4 clouded with brown } 11. *doris* n. sp.
 } 12. *agassizi* Lw.
- 23 (22). Cross-veins, etc., not clouded.....13. *bifurca* Lw.
- 24 (21). Proximal half of the first posterior cell hyaline, followed by a dark brown space and then again hyaline..14. *eremita* n. sp.

1. EXOPROSOPA FASCIATA Macquart, Dipt. Exot., ii, 1, p. 51, 38; tab. xvii, f. 6.—*E. longirostris* Macquart, Dipt. Exot., suppl., 4, p. 108, probably, and *Mulio americana* v. d. Wulp certainly, are synonyms of this species. I also suspect that *E. rubiginosa* Macq. is nothing but a rubbed-off specimen of this species. *E. sordida* Loew, Centur., viii, 21, differs in having the anterior part of the wings darker brown, the posterior less infuscated; the base of the third and fourth posterior cells is strongly infuscated. As the habitat is Matamoras, Tamaulipas, it will probably occur in Texas.

2. EXOPROSOPA SIMA n. sp., ♀.—Very like *E. fasciata*, but differs in having a shorter proboscis, which does not project beyond the oral margin, or projects very little; the whole body is more blackish; antennæ deep black; relation of the third joint to its style like 4: 1; base of second and the fourth abdominal segments beset with a white, scale-like, appressed tomentum, forming cross-bands; the sides of the third segment and the whole seventh have a similar tomentum; the pile on the sixth segment slightly yellowish; legs black; the pile on the thorax anteriorly, on the pleuræ, and above the root of the wings is pale yellowish-white or whitish-yellow, rather than fulvous; wings like those of *E. fasciata* but of a more blackish-brown rather than reddish-brown color. Length 14–15^{mm}.

Hab.—Humboldt Station, Central Pacific Railroad, Nevada. Three specimens, which I caught flying in the hot sunshine on the top of an arid hill (July 29).

3. EXOPROSOPA GAZOPHYLAX Loew, Centur., viii, 18.—California. I do not know this species, which will be easily distinguishable by its four submarginal cells.

4. EXOPROSOPA DECORA Loew, Centur., viii, 19.—Illinois, Iowa, Wisconsin, Colorado plains, Georgia.

5. EXOPROSOPA DORCADION n. sp.—The coloration of the wings is nearly the same as in *E. caliptera*. The principal difference consists in the second hyaline cross-band stopping short at the second vein, instead of reaching the first; the interval between these two veins is filled out with brown, thus connecting the two brown cross-bands, which are bifid posteriorly; the hyaline spot, which in *E. caliptera* exists in the marginal cell above the inner end of the second submarginal, in most cases, does not exist here; the triangular hyaline spot near the base of

the marginal cell, which in *E. caliptera* forms the anterior bifurcation of the broad brown cross-band, is much smaller here, often subobsolete.

The thorax has a fringe of reddish-brown pile anteriorly, and the usual black bristles, a stripe of white recumbent pile between the root of the wings and the scutellum, some white hairs in front of the latter; the disk of the thoracic dorsum is beset with reddish scales, mixed with white ones, the latter forming two indistinct longitudinal stripes. The abdomen has a cross-band of white scales on the anterior half of the second segment and a tuft of white pile at each end of this band; a small spot with white scales on the anterior margin of the third segment in the middle, and larger white spots on the posterior angles of the same segment, and two whitish scaly spots on segments 4, 5, and 6, forming two longitudinal rows, converging posteriorly; a fringe of long black pile along the sides of the abdomen, beginning with the latter part of the second segment. The ground-color of the abdomen when denuded appears as black, with red sides, the red forming indentations into the black on the hind margins of the segments. The proboscis hardly protrudes beyond the oral margin. Length 11–13^{mm}.

Hab.—Seems to have a wide distribution in the Northern States, in Colorado, and in the Sierra Nevada, California. I have specimens from Summit Station, Central Pacific Railroad, California (July 17); Webber Lake, Sierra Nevada, California (July 26); Shasta district, California (H. Edwards); Washington Territory (the same); Georgetown, Colorado (August 12); Twin Lake Creek, Colorado (W. L. Carpenter); White Mountains, New Hampshire (H. K. Morrison); Maine.

I said in the description that the hyaline spot in the marginal cell above the proximal end of the second submarginal *in most cases* does not exist here. There is a small spot of that kind in one of the specimens from Webber Lake; a larger one in the specimen from the White Mountains; in two specimens from Denver, Colo. (Uhler), the spot occupies the whole breadth of the marginal cell, so as to cut off the brown in its enlarged portion. I think, nevertheless, that these specimens belong to *E. dorcadion*, as their tolerably well preserved thorax and abdomen agree with the normal specimens. The corresponding hyaline spot in *E. caliptera* is not placed exactly in the same position; it is *before* the expansion of the marginal cell, while in *E. dorcadion* it is *within* that expansion.

Observation.—*E. dorcadion* is remarkably like the European *E. capucina*. As far as I can judge from the comparison of a single specimen of the latter, the wings are exactly the same, but there seems to be a difference in the distribution of the white scales on the abdomen. This resemblance has given rise to a confusion which may provoke a discussion about the true specific name of *E. dorcadion*. There is no doubt that this species is the true *Anthrax capucina* of Fabricius, marked "habitat in America boreali" (see Syst. Antl., p. 123, 23). Wiedemann, observing the resemblance of Fabricius's types to the European species,

concluded too hastily that the *habitat* assigned to them by Fabricius was erroneous,* and transferred the name to the European species; all the European authors have followed his example since. The zealots of priority will probably insist upon changing the name of the European species, now adopted in all the works on European *Diptera*; in my opinion, it is much more in accordance with the true interest of science to preserve a name which has been so long in use, and merely to strike out the quotation from Fabricius. Furthermore, it may turn out in the end that *E. dorcadion* is the same species as the European *E. capucina*, in which case there will be no occasion for a discussion.

6. EXOPROSOPA CALIPTERA Say, Journ. Acad. Phil., iii, 46 (Compl. Writings, ii, 62).—To Say's very clear description, I will add a statement about the silvery spots on the abdomen, taken from two well preserved specimens in my possession. A silvery cross-band on the second segment occupies two-thirds of the breadth of the segment, and is deeply emarginate in the middle; a silvery spot on the posterior corners of the third segment, and a *silvery longitudinal streak in the middle of each of the segments 4, 5, and 6*. The latter character is important, as it does not exist in *E. dorcadion*, otherwise so closely allied. I caught this species near Cheyenne, Wyo., August 21, and also received a specimen from Morino Valley, New Mexico, collected by Lieut. W. L. Carpenter, July 1.

Observation.—There is an *Anthrax caloptera* Pallas (see Wiedem., Zool. Magaz., i, 2, 12, and Meigen, Syst. Besch., ii, 173), which Wiedemann considered the same as *A. capucina* Fab., and therefore put among the synonyms. As the name will probably never be revived, Say's name may be retained.

Walker's *Anthrax californiæ* agrees better with this species than with *E. dorcadion*.

7. EXOPROSOPA FASCIPENNIS Say is well known. *Anthrax noctula* Wiedemann (Auss. Zw., ii, 635, 45) and *Exopr. coniceps* Macquart (4e suppl., 108) are its synonyms. *Exopr. phila delphica* is, I suspect, only a smaller variety, which occasionally occurs.

8. EXOPROSOPA EMARGINATA Macquart, Dipt. Exot., ii, 1, 51.—Virginia, Georgia, not rare.

9. EXOPROSOPA TITUBANS n. sp.—Head grayish black; antennæ black; style of the third antennal joint nearly as long as the joint; face beset with a golden-yellow scaly tomentum; oral margin reddish; front with some golden scaly hairs and black pile; posterior orbit with short, appressed, white hairs; proboscis not protruding. Thorax black, with dingy-yellowish pile; scutellum reddish, with yellow pile. Abdomen black in the middle, reddish on the sides; anterior half of the second and the fourth and sixth segments with a cross-band of white scales; the latter half of the second and the other segments beset with yellow-

* The passage from Wiedemann's Zool. Mag., i, 2, 12, is quoted by Meigen, Syst. Besch., ii, 173.

ish scales (somewhat rubbed off in my specimens); some black pile in the posterior corners of the segments, beginning with the second. Venter reddish, sparsely beset with yellowish scales. Legs black; femora beset with fulvous scales. Wings hyaline, brown anteriorly, which color is bounded by the fourth vein before the small cross-vein and by an oblique line running to the end of the first vein after it; cross-veins at the base of the third and fourth posterior cells with broad brown clouds. Length 12-13^{mm}.

Hab.—Denver, Colo. (P. R. Uhler); one female. A second specimen, also from Denver (by the same), is a little larger; the proboscis is protruding a little beyond the oral margin; the brown of the wings is darker and encroaches considerably on the second basal, and also a little on the anal cells; the posterior femora are more densely clothed with fulvous scales; the two last posterior cells are longer. I am in doubt whether to consider this a distinct species or not. The wings of this species must be very like those of *E. sordida* Loew; but the latter must have a longer proboscis, and the antennæ, I suppose, must be like those of *E. fasciata*, to whom Dr. Loew compares it,—that is, the third joint must be three or four times longer than its style, and not nearly equal to it in length.

10. *EXOPROSOPA DODRANS* n. sp.—The brown of the anterior part of the wing is bounded by the basal cross-veins, by the fourth vein as far as the small cross-vein, beyond which the boundary-line runs obliquely toward the end of the first vein; the second basal cell at its proximal end is considerably encroached upon by the brown; the first posterior and first submarginal cells likewise; the remainder of the wing is hyaline, without any spots or clouds, except an indistinct one on the cross-vein at the base of the fourth posterior cell. Head black, clothed with golden-yellow short pile; oral margin reddish; antennæ black; first joint red; third joint conical, with a style half as long as the joint; proboscis projecting about half the length of the head beyond the oral margin. Thorax grayish-black, with yellowish pile, more whitish above the root of the wings; scutellum reddish, black at base; abdomen black, with very little red on the sides; second segment with the usual white cross-band on its anterior half; the other segments beset with yellow and white scales; sides with yellowish hair at the base and black hair on the segments beyond the second; venter reddish, with white scales on the first four, and with yellow ones on the following segments. Halteres brownish at the base of the knob; its tip yellowish. Legs densely beset with fulvous scales, which cover the ground-color; tarsi black. Length 12^{mm}.

E. dodrans is, in many respects, very like *E. titubans*; it is, however, a little smaller; the brown on the wings is of a very uniform tinge, with no reddish nor subhyaline spots in it. In *E. titubans*, the brown is more reddish, the costal cell more yellowish, and the proximal end of the submarginal cell has a paler, almost subhyaline, spot in it; the clouds on

the cross-veins at the base of the third and fourth posterior cells are very distinct here, while in *E. dodrans* there is a hardly perceptible infuscation on the cross-vein at the base of the fourth cell only. In *E. dodrans*, the distance between the bases of the third and fourth posterior cells is a little greater than in *E. titubans*; finally, in the latter, the antennal style is comparatively longer.

Hab.—Colorado Springs (P. R. Uhler); two specimens (somewhat rubbed off on the abdomen). One of them has, on both wings, an adventitious stump of a vein inside of the discal cell.

11. *EXOPROSOPA DORIS* n. sp.—Base of the wings as far as the basal cross-veins brownish; costal cell yellowish; first basal cell, except its proximal end, which is pale yellow, and first posterior cell, except its distal end, brown; the middle portion of the marginal and first submarginal cells brown, which thus forms an incomplete, irregular, and ill-defined cross-band, expanded anteriorly as far as the end of the first vein, attenuated posteriorly, and ending in the brown of the first posterior cell; the distal boundary of this cross-band is in zigzag, one of the projections touching the proximal end of the second submarginal cell; the proximal boundary is evanescent; a round, brown spot on the proximal end of the second posterior cell; an irregular, ill-defined, narrow, oblique, brown band runs from the small cross-vein across the discal cell, covers the proximal end of the third posterior cell and the posterior cross-vein, cuts in two the anal cell, and ends in the axillary without touching the posterior margin; small clouds on the bifurcation of the second and third veins and on the proximal end of the discal cell. Epistoma yellow, clothed with yellow scales; cheeks pale yellow, with a silvery covering of scales; front and vertex black, with golden-yellow scales; posterior orbits silvery; proboscis not projecting beyond the oral margin; antennæ black; first joint short, reddish; the third conical, with a style half as long as the joint. Thorax with yellow pile; white pile above the root of the wings and in front of the reddish scutellum; silvery-white pile on the chest and pleuræ; abdomen densely clothed with yellow scales, except at the base of the second and on the fourth segments, where there are cross-bands of white scales; seventh segment likewise beset with white scales; venter reddish-yellow, with snow-white scales on the first four segments and yellowish scales on the following segments, with an admixture of black ones on the fifth segment. Femora red, clothed with fulvous scales; tibiæ reddish, darker on their front side; the front pair black at tip; the hind pair is black, thickly clothed on the inner side with fulvous scales; tarsi black. Halteres with a yellow knob. Length 7–8^{mm}.

Hab.—Humboldt Station, Central Pacific Railroad, Nevada (July 29). A single very well preserved specimen.

A second specimen, from Oregon (H. Edwards), is considerably larger (from 12^{mm} to 13^{mm}); the coloring of the body is exactly the same; the distribution of the brown spots on the wings is, in the main, the same, but

they are all less extended and weakened in intensity of color; the whole first basal and the proximal end of the first posterior cell are not brown, but yellowish, which color is interrupted by a brown cloud on the small cross-vein, and ends in a brown cloud in the middle of the first posterior cell; the brown band across the middle of the marginal and first submarginal cells is narrower; that running obliquely from the discal to the axillary cell is likewise narrow, almost dissolved in its component spots. I am inclined to believe, nevertheless, that it is the same species.

12. *EXOPROSOPA AGASSIZI* Loew, Centur., viii, 24.—California. Must be somewhat like *E. doris*; nevertheless, a different species.

13. *EXOPROSOPA BIFURCA* Loew, Centur., viii, 23.—California. I do not know it.

14. *EXOPROSOPA EREMITA* n. sp.—Wings brown at base, the brown encroaching a little beyond the basal cross-veins, and with two broad brown cross-bands; the first is limited anteriorly by the præfurca and ends in the distal half of the axillary cell, where a very narrow hyaline space separates its end from the margin of the wing; the second starts from the anterior margin in the region of the stigma, and, attenuated posteriorly, stops short before crossing the third posterior cell; the yellowish-brown costal cell forms the only connection between those three regions of brown, the hyaline intervals between which are almost broader than the brown cross-bands; apex of the wing and posterior margin likewise hyaline. Front and vertex black, beset with yellowish pile; epistoma brownish-red; antennae black, third joint conical, with a style about one-third as long as the joint. Proboscis hardly projecting. Thorax grayish-black, beset with yellowish pile; antescutellar callosities brownish; scutellum reddish-brown, black at base. Ground-color of the abdomen black, with red sides; second segment with a white cross-band at the base; white spots on each side of the third, and interrupted cross-bands on the fourth and fifth; sixth segment also whitish; yellow pile on the sides of the abdomen, at the base, and black pile beyond the end of the second segment. Venter red, with traces of a covering of white scales on segments 2-4. Legs dark reddish-brown, with black pile. Length 16^{mm}.

Hab.—Shasta district, California (H. Edwards). A single specimen. Its epistoma and abdomen were somewhat denuded.

DIPALTA nov. gen.

Differs from *Exoprosopa* in the course of the second vein, which is strongly contorted, in the shape of a recumbent S, near its point of contact with the cross-vein, which separates the first submarginal cell from the second.

A still more important difference lies in the structure of the antennæ, the third joint of which does not bear the terminal style, so apparent in *Exoprosopa*, and is more like that of the genus *Anthrax*. Examined

attentively, that joint shows, on its incrassate, basal part, a more or less distinct transverse suture, which also exists in *Anthrax*, and may indicate that the third joint is very much shortened here and coalescent with the style, their suture being very near the base of the joint. The joint is onion-shaped at the base, with a slender, gently tapering, almost linear, prolongation, ending in a point. I do not see any bristle at the end. The body is more slender than in *Exoprosopa*, and the hairy covering of a more uniform color.

Anthrax paradoxa Jaenicke (Exot. Dipt., 31, tab. ii, 16) probably belongs here. The course of the second vein is the same in that species; only the cross-vein in *D. serpentina* is inserted in the middle of the sinus, and not at its base. In the specimen from Georgia, to be mentioned below, the cross-vein is placed very nearly as it is in Jaenicke's figure.

Diplocampta Schiner (Novara, 119, tab. ii, f. 9) from Chili resembles *Dipalta* in the curvature of the second vein; nevertheless, it is evidently different; the abdomen is not longer than the thorax, and narrower, being gradually attenuated posteriorly; the structure of the antennæ is different; the species is small ($1\frac{1}{2}$ to 2 lines long), with nearly hyaline wings; the position of the cross-vein between the second and third veins is different.

Dipalta, in Greek, means *twice bent*.

1. *DIPALTA SERPENTINA* n. sp., ♂ ♀.—Body black, densely and rather uniformly clothed with a short, appressed, pale yellow tomentum; longer pile on the pleuræ and on the anterior margin of the thorax. Wings subhyaline, with a pale brownish-yellow tinge, the base and two irregular cross-bands brown. These cross-bands are formed by the confluence of large, round, brown spots on the cross-veins and bifurcations; the first cross-band has a hyaline spot anteriorly in the proximal half of the marginal cell; posteriorly it is attenuated; the second cross-band contains a hyaline spot at its posterior end in the first and second posterior cells; the apex of the wing is hyaline, the end of the second vein clouded with brown; a much smaller cloud on the third vein; a stump of a vein projects into the marginal cell a short distance before the cross-vein; beyond the cross-vein, the second vein is very deeply bisinuate. Legs densely clothed with fulvous scales, except on the tarsi, which are black. Antennæ, first two joints very short, reddish, sometimes darker; third joint black. Halteres yellow, slightly brownish at the base of the knob. Proboscis not projecting beyond the oral border. Length 10–11^{mm}.

Hab.—Mount Shasta district, California (H. Edwards); Clear Creek Cañon (Uhler); Colorado Mountains (W. L. Carpenter). Three specimens.

Observation.—I have a specimen from Georgia (H. K. Morrison) which probably belongs here. The hairy covering of the body is of a very saturate fulvous; the markings of the wings are of a darker brown; the different position of the cross-vein has been alluded to above.

ANTHRAX.

In this genus, I abstain almost entirely from describing the numerous new species which I have from California and the Colorado region. Such a work should be done in connection with a critical examination of the previously described species from the Atlantic States, and my material from those States is entirely insufficient for that purpose. I subjoin a list of all the described species from North America north of Mexico. The rough grouping which I have attempted will facilitate, I hope, the task of identification.

A. *Wings hyaline; costal cell but little darker:*

albipectus Macq., 3e suppl., 34.—North America.

* *alternata* Say, Compl. Wr., ii, 61.—Middle States.

? SYN.—*consanguinea* Macq., D. E., ii, 1, 69.

* *connexa* Macq., 5e suppl., 76.—Baltimore.

gracilis Macq., D. E., ii, 1, 76.—Philadelphia.

hypomelas Macq., D. E., ii, 1, 76.—North America.

* *lateralis* Say, Compl. Wr., ii, 59.—Middle States.

mucorea Lw., Centur., viii, 43.—Nebraska.

* *scrobiculata* Lw., Centur., viii, 39.—Illinois.

stenozona Lw., Centur., viii, 40.—Illinois.

molitor Lw., Centur., viii, 42.—California.

B. *Wings hyaline; costal cell dark brown:*

* *fulviana* Say, Compl. Wr., i, p. 253.—Northwestern Territory (Say).

* *nigricauda* Lw., Centur., viii, 38.—Massachusetts; White Mountains.

C. *Wings with the proximal half dark brown or black (like FULVOHIRTA, SINUOSA):*

albovittata Macq., 4e suppl., 113.—N. A. (?)

* *celer* Wied., i, 310.—Kentucky.

edititia Say, Compl. Wr., ii, 353.—No locality given.

floridana Macq., D. E., 4e suppl., 112.—Florida.

* *fulvohirta* Wied., i, 308.—Atlantic States.

SYN.—*conifacies* Macq., 4e suppl.

separata Wk., Dipt. Saund., 177.

(?) *incisa* Walker, Dipt. Saund., 187.—North America.

(?) *cedens* Walker, Dipt. Saund., 190.—United States.

palliata Lw., Centur., viii, 32.—Illinois.

parvicornis Lw., Centur., viii, 36.—Illinois.

sagata Lw., Centur., viii, 34.—Matamoras.

* *sinuosa* Wied., i, 301.—United States.

SYN.—*concisa* Macq., D. E., ii, 1, 68.

nycthemera Macq., D. E., ii, 1, 67.

(?) *assimilis* Macq., suppl., i, 114.

vestita Walker, List, ii, 258.—Nova Scotia.

curta Lw., Centur., viii, 35.—California.

diagonalis Lw., Centur., viii, 33.—California.

D. *Species resembling* ANTHRAX HALCYON Say:

- * *ceyx* Lw., Centur., viii, 30.—Virginia.
- demogorgon* Wk., List, ii, 265.—Florida.
- * *flaviceps* Lw., Centur., viii, 29.—Tamaulipas.
- * *halcyon* Say, Compl. Wr., i, 252.—Northwestern United States.
- fuliginosa* Lw., Centur., viii, 31.—California.
- * *alpha* n. sp.—California; Cheyenne, Wyo.

E. *Species resembling* ANTHRAX TEGMINIPENNIS Say:

- * *lucifer* Fab., Wied., i, 294.—West Indies; Texas.
- SYN.—*fumiflamma* Walk., D. S., 184.
- * *tegminipennis* Say, Compl. Wr., i, 253.—Northwestern Territory, (Say).
- fuscipennis* Macq., H. Nat., i, 410. (Very doubtful species.)

F. *Peculiar species not coming within the former groups*:

- pertusa* Lw., Centur., viii, 28.—Pecos River, Western Texas. (Wings bifasciate with brown.)
- proboscidea* Lw., Centur., viii, 27.—Sonora. (Very long proboscis.)

ANTHRAX SINUOSA Wiedemann, Auss. Zw., i, 301, 64.—I have specimens of this widespread species from Sonoma County, California (July 5), Vancouver Island (H. Edwards), Clear Creek Cañon, Colorado (P. R. Uhler), Manitou, Colo. (August 17), Morino Valley, New Mexico (W. L. Carpenter). The Californian specimens have the short, scale-like hairs covering the thorax and the abdomen of a more intense color, red instead of fulvous. In all the western specimens, the brown in the first posterior cell reaches the bifurcation of the third vein, sometimes even beyond. The brown spot at the distal end of the first submarginal cell is a little larger, so as to encroach a mere trifle on the second submarginal. This species has small but very distinct pulvilli, and thus holds the middle between *Anthrax* and *Hemipenthes*.

ANTHRAX HALCYON Say.—Easily distinguished by its third posterior cell being in most specimens bisected by a cross-vein. It has a wide distribution in the Northwest and West; it is not rare round Manitou and Colorado Springs, Colorado, in July and August. I also have it from Morino Valley, New Mexico, July 1 (W. L. Carpenter).

ANTHRAX FULIGINOSA Loew.—Among my specimens from the West, longing to the group of *A. halcyon*, there are several species; three at least occur in California. I am not sure whether *A. fuliginosa* is among them.

The following species, which seems to occur on the plains of Wyoming as well as in the Sierra Nevada, is easily distinguishable from all the described species:

ANTHRAX ALPHA n. sp., ♂ ♀.—Coloring of the wings very like that of *A. halcyon*; second submarginal cell bisected by a cross-vein; in the third posterior, a long stump of a vein. Length 12–14^{mm}.

Front, face, and cheeks beset, the former with short black, the two

latter with scarce yellow pile; vertex black; proboscis not projecting; antennæ black, first joint reddish, with black pile. Thorax grayish-black, clothed with pile, which is pale fulvous above and white on the pectus and the lower part of the pleuræ. Scutellum reddish, black at base; ground-color of the abdomen is grayish-black; in rubbed-off specimens, only a little red is perceptible on the sides of the second and third segments; in well preserved specimens, the ground-color is entirely concealed under a dense, appressed tomentum, which is whitish-gray on the anterior and brownish-fulvous on the posterior half of the segments; an ill defined blackish spot in the middle of each segment; the sides of the first two segments are beset with yellowish-white pile; the sides of the following segments, beginning with the end of the second, with black, mixed with fulvous pile, the black forming tufts on the hind margins of the segments; the same black pile is scattered over the surface of the abdomen, above the tomentum. Venter: segments 2-4 reddish, more or less black at the base; the following segments black, with a reddish posterior margin. Legs red, with a golden-yellow tomentum and black spines; front femora black at base; tips of tibiæ and all the tarsi black. Wings tinged with blackish-brown; in the apical half, the following spaces are grayish-hyaline: a spot in the expanded end of the marginal cell, the end of the first submarginal and nearly the whole second submarginal, a streak in the end of the first posterior cell, the three other posterior cells, and the latter half of the discal cell; the veins traversing these subhyaline places are clouded with brown. The cross-vein bisecting the second submarginal cell is placed in its narrow part, so as to form with the adjacent veins the figure A.

Hab.—Cheyenne, Wyo., where I found it to be quite common, August 21, 1876. Five specimens.

Six specimens which I took near Webber Lake, Sierra Nevada (July 25), agree in all respects with those from Cheyenne; but they are a little smaller, the coloring is a little darker, both on the wings and on the body; the pile on the chest and pleuræ is less white; the tomentum on the abdomen above is the same, but the fulvous prevails over the gray, and the black spots in the middle of each segment are larger; on the second segment, along the hind margin, the black forms a cross-band, attenuated on each side, and not reaching the lateral margin; the same is repeated on each following segment, the black spot rapidly diminishing in extent. The venter is reddish, without any black at the base of the segments. The portion of the anterior branch of the third vein beyond the supernumerary cross-vein is very distinctly clouded with brown in these specimens, while it is not clouded at all, or only imperceptibly, in the specimens from Cheyenne. I hold this to be merely a local variety of *A. alpha*.

ANTHRAX LUCIFER F.—Hitherto known only from the West Indies. I have several specimens from Dallas, Tex. (Boll), which seem to belong here.

I have one or two other well marked species, belonging to the same group; one, from Fort Bridger, Wyo., is somewhat like *A. lucifer*, but certainly different; the other, from South Park, Colorado, and Twin Lake Creek, Colorado (W. L. Carpenter), is more like an *A. tegminipennis*, but with a more hyaline latter half of the wings.

HEMIPENTHES.

This genus was established by Loew (Centur., viii, 44) for the European *Anthrax morio*, and for a species from British North America, of which he described the female as *H. seminigra*. He does not say what prevented him from identifying it with *Anthrax morioides* Say, which is certainly a *Hemipenthes*. A well preserved male specimen from Montreal agrees well with Say's and Wiedemann's descriptions; the knob of the halteres, however, is dark on one side, whitish-yellow on the other. It does not have the strongly coarctate first posterior cell, which distinguishes *H. seminigra*, according to Mr. Loew's description. A number of specimens from Spanish Peaks, Colorado, possess this character, and therefore belong, I suppose, to *H. seminigra*.

I have, moreover, a number of specimens from different parts of California (Yosemite and Webber Lake), which may likewise belong here. The *Hemipenthes* occurring commonly in Marin County, California, in May, seems to be a different species. The wings are more uniformly black, and the pile and tomentum on the abdomen are different.

ARGYRAMÆBA.

Contains a variety of forms, which have, as common characters, a pencil of hairs at the end of the third antennal joint, and distinct, rather large pulvilli. With a very insufficient material, I have attempted a rough grouping of all the described species from the United States, in which I have used some characters hitherto neglected. In using this table, it must be remembered that I know only those species which are marked with an asterisk (*), and that data about the others are drawn from the descriptions. I have omitted *Anthrax costata* Say (Compl. Wr., i, 254), which may possibly be an *Argyramæba*.

I. Large species; third posterior cell bisected by a cross-vein:

* *simson* Fab., Wied., i, 259 (syn. *scripta* Say, Compl. Wr., ii, 59).—Atlantic States.

delila Loew, Centur., viii, 45.—California.

II. The male has the last abdominal segments clothed with silvery scales; the other segments in both sexes altogether black:

(a) Wings black; posterior margin hyaline; the limit of the black well defined:

(b) The black of the anterior margin of the wing reaches the end of the first submarginal cell; wings remarkably narrowed toward their root, cuneiform; axillary cell exceedingly narrow, linear; alula obsolete; the pencil-bearing style of the antenna is as long as the styliiform portion of the third joint:

**argyropyga* Wied., i, 313 (syn. *contigua* Lw., Cent., viii, 50, *female*).—Virginia; Georgia.

(bb) The black on the anterior margin of the wing does not cover the end of the marginal cell; wings broad, with a fully-developed, broad axillary cell and alula; the pencil-bearing style of the antenna is short, about one-quarter of the length of the very long styliiform portion of the third joint:

**analis* Say, Compl. Wr., ii, 60 (syn. *georgica* Macq.).—Atlantic States.

(aa) Wings black, this color being gradually evanescent posteriorly; they are long and comparatively narrow; the stout basal portion of the third antennal joint is somewhat gradually attenuated, conical, with a short pencil-bearing style.

**cephus* Fabr., Wied., i, 297.—Southern States.

III. Hind margins of abdominal segments (especially the second and third) more or less beset with white or whitish scales, forming spots or cross-bands:

(a) Basal portion of the wings more or less black; black spots at the proximal end of the second submarginal, the third posterior, sometimes also the second posterior cells:

(b) A hyaline space across the proximal end of the marginal and the distal end of the first basal cells:

(c) A brown spot at the proximal end of the second posterior cell:

**limatulus* Say, Compl. Wr., ii, 354.—Indiana (Say).

(cc) No brown spot, etc.:

**albofasciata* Macq., D. E., ii, 1, 67.—Georgia.

(bb) No hyaline space across, etc.:

(d) Distal half of the wings hyaline:

**antecedens* Walker, Dipt. Saund., 193.—United States.

(dd) Distal half of the wings distinctly grayish:

**obsoleta* Loew, Centur., viii, 47.—Missouri; Georgia.

(aa) Basal portion of the wings black, with numerous black spots in the hyaline portion:

**pluto* Wied., i, 261.—Kentucky (Wied.).

stellans Loew, Centur., viii, 46.—Oregon.

(aaa) Basal portion of the wing more or less dark; no black spots at the proximal end of the second submarginal, second and third posterior cells:

bastardi Macq., D. E., ii, 1, p. 60.—North America.

pauper Loew, Centur., viii, 48.—Illinois.

**fur* n. sp.—Texas.

IV. Group in which the costal cell is checkered, hyaline, and black:

**ædipus* Fab., Wied., i, p. 262 (syn. *irrorata* Say and Macq.).

Schiner (Fauna Austr., Dipt., i, 52) says that the larvæ of *Argyramoeba* live parasitically in pupæ of *Lepidoptera*. That this is far from being universally the case is proved by the fact that *A. cephus* and *A. fur* were bred from the nest of a Mud-wasp in Texas, forming tubes of clay five or six inches long, pasted together like organ-pipes. The nests were found near Dallas, Tex., by Mr. Boll, and are now in the Museum of Comparative Zoölogy in Cambridge, Mass. The pupæ bored their way directly through the clay, and the exuviae remained in the hole. The Hymenopteron which builds these nests is very probably a *Pelopygus*; the larva of the fly probably devours the larvæ of the wasp.

I observed *A. ædipus* in the Sierra Nevada persistently flying round a hole in a pine log, probably containing the nest of some Hymenopteron.

Argyramoeba leucogaster Meig. was bred from the nest of a *Cemonus*, living in deformed reeds. The article of Mr. Frauenfeld on the subject is well worth reading (Verh. zool.-bot. Gesellsch., 1864, 688).

A. subnotata Meig. was bred by the same author from a nest of *Chalicodoma muraria* Lin. (Verh. zool.-bot. Ges., 1861, 173).

A. sinuata was bred by Mr. Laboulbène from the nest of a Hymenopteron, probably *Megachile muraria* (see Ann. de la Soc. Entom. de France, 1857, 781).

1. ARGYRAMOEBÆ CEDIPUS Wied. (syn. *irrorata* Say, Macq.).—Seems to have a very wide distribution all over North America, even quite far in the northwest of the British possessions; according to Schiner, also in South America. I brought a couple of specimens from Webber Lake, Sierra County, California. A specimen from the Shasta district was given to me by Mr. H. Edwards. A specimen which I took in Sonoma County, July 4, is larger, and the black dots in the latter part of the wing are much more scarce.

2. ARGYRAMOEBÆ LIMATULUS Say.—I retain under this name a group of specimens from the Geysers, Sonoma County, California (May 5-7); Fort Bridger, Wyoming (August 7); Fair Play, Colorado; Spanish Peaks, Colorado; Sangre de Cristo Mountains, New Mexico (the latter collected by Lieut. W. L. Carpenter). The extent of the black on the wings in these specimens is very variable, even in those taken on the same day and in one locality; in many, there is very little black left except the dark clouds on the cross-veins. Whether these specimens really belong to the *A. limatulus* I am not prepared to affirm. Say's orig

inal specimens were from Indiana. I have no specimens from that region, except a well preserved male from Detroit, Michigan, which, besides the white scales, has some fulvous scales forming cross-bands on the abdominal segments. Such scales not being mentioned by Say, I am in doubt whether this specimen is his *limatulus* or not.

3. ARGYRAMÆBA PLUTO Wied.—The basal half of the wing is more or less like the darker-colored specimens of *A. limatulus*; the hyaline portion has nine or ten small black spots, one at the extreme end of the first vein in the shape of a small cloud, two on the concave end of the second vein, two on the anterior branch of the third vein, the one at its origin being large; a spot, sometimes double, on the cross-vein at the base of the second posterior cell, often coalescent with a small spot on the vein separating this cell from the third posterior; a spot on the curvature of the cross-vein at the base of the third posterior cell; another at the proximal end of that cell; one a little before the tip of the fifth vein. The large spot on the cross-vein at the base of the fourth posterior cell is usually coalescent with the black on the anterior half of the wing. A long stump of a vein on the geniculate base of the second vein; two stumps on the sinuosities of the anterior branch of the third vein, one on each side; a small stump on the cross-vein at the base of the third vein. Body deep black; face and front with short, erect, black pile, mixed with some white ones, especially around the mouth. Abdomen with tufts of black pile on each of the first segment and some white hairs along its hind margin; small patches of white scales on the sides and the hind margin of the third and fourth segments; the end of the abdomen in the male densely beset with white scales.

This description applies to specimens about 11^{mm} long, which I have from Canada (F. X. Bélanger), Pennsylvania (E. T. Cresson), and Waco, Texas (Belfrage). But I have two other specimens, from Illinois (Le Baron) and Texas (M. C. Z.), in which the black spots on the distal half of the wings are so much enlarged that they coalesce and form an irregular, broad cross-band, bifurcate at both ends; only three brown dots on the apex of the wing are not confluent with this cross-band. A specimen from Georgia (H. K. Morrison) holds the middle between these two forms, its spots being larger than in the first form, and less coalescent than in the second. This last specimen, as well as that from Illinois, measures only 8-9^{mm}. I have little doubt now that all these specimens belong to *A. pluto*.

5. ARGYRAMÆBA FUR n. sp., ♂ ♀.—Face and front pollinose with yellowish-gray, and clothed with short black pile; on the front, some very minute pale yellow hairs are mixed with the gray ones; the gray occiput is more or less clothed on the orbits with hair of this latter description. The dull grayish-black ground-color of the thorax and scutellum is in part covered with a short, yellow, appressed tomentum; a large tuft of yellowish-white pile between the humerus and the root of the wings, extending to the upper part of the pleuræ; a frill of whitish

hairs, mixed with black ones, on the anterior margin of the thorax, opposite the occiput; the edge of the scutellum with a yellowish-white tomentum and a row of stiff black bristles. Ground-color of the abdomen black; first segment on each side with a tuft of yellowish-white pile and a sparse fringe of them along the hind margin; second segment black, with a faint streak of microscopic fulvous tomentum in the middle; the following segments are densely clothed with a recumbent, short, yellowish tomentum, more whitish on the hind margins of the segments; in the middle of each segment, the tomentum, being less dense, leaves a dark spot, which, in connection with similar spots on the next segments, forms an ill-defined longitudinal dark stripe; rows of black erect pile on each segment above the yellow pubescence; the black pile is more dense on the sides and at the end of the body; the sides of the two last segments are clothed with whitish, scale-like pile; the same whitish scales form subtriangular spots on the hind corners of the third and fourth segments, connected with the fringes of whitish hairs on the hind margins of the segments. Femora black; four front tibiæ and tarsi dark brown; the front femora are sparsely beset on the anterior side with whitish-gray scales. Halteres yellow, the knob with a brown spot. Wings grayish-hyaline; their root, the costal cells, the two basal cells, and the proximal ends of the anal and axillary cells pale reddish-brown; a transverse darker brown cloud on the small cross-vein, and the bifurcation of the second and third veins; another darker cloud, coalescent with the brown of the base of the wings, lies between the origin of the præfurca and the cross-vein at the base of the fourth posterior cell. The stump of a vein on the anterior branch of the third vein is small, sometimes obsolete; that on the curvature of the second vein is moderately long; there is none in the second posterior cell. Length 10–11^{mm}.

Hab.—Dallas, Texas (Boll). Three specimens. The description was drawn from a well-preserved female.

As mentioned in the introductory paragraph to this genus, the larva of this species lives in the nest of a Mud-wasp (*Pelopaeus?*), and this alone induced me to describe it. I did not dare to identify it with *Anthrax bastardi* Macq., and still less with *Anthrax costata* Say.

TRIODITES nov. gen.

Belongs in the number of genera which forms the passage between the *Anthracina* and *Bombylina*. It has the appearance of an elongated *Anthrax*; the antennæ are distant at the base, and resemble those of that genus. But the eyes of the male are contiguous for a short distance, high up, on the vertex, and the bifurcation of the second and third veins takes place long before the small cross-vein, the præfurca being very short. *Triodites*, like *Oncodocera* and other genera of the same group, has, in the male, a very large frontal triangle, and, in the female a correspondingly large frontal space.

Head subglobular; *occiput* but slightly tumid; *oral opening* oval, slightly oblique; *front* projecting very little in the profile; epistoma retreating below the antennæ, comparatively long (longer than in *Anthrax*) and broad, nearly flat; cheeks exceedingly narrow, linear, the eyes being nearly in contact with the mouth; *eyes* very large, occupying the whole side of the head, and descending on the under side to the very edge of the mouth; they are (as in *Anthrax*) somewhat reniform, with a linear impression, starting from the sinus of the occipital orbit and interrupted about the middle; in the male, the eyes come in contact for a short distance in front of the small ocellar triangle; in the female, they are separated by an interval, which is not greater than the interval between the roots of the antennæ; *frontal triangle*, in the male, very large, nearly flat; the pubescence on front and epistoma is short, denser on the latter than on the former.

Antennæ, in a profile-view of the head, are inserted about its middle; the two basal joints are exceedingly short, concealed in the pubescence; the third joint, broad at base, becomes suddenly contracted, long, linear, styliform, truncate at the end, the truncature bearing a minute joint, with a bristle at the end.

Thorax rounded, clothed with a very delicate, even, silky, erect, and moderately long pubescence; only a single delicate bristle is perceptible on each side in front of the wings, and a few on the antescutellar tubercle (they are of the same color with the pubescence); *scutellum* rather broad.

Abdomen, in the male, narrower than the thorax, and not much longer, cylindrical, the seventh segment being only a little narrower; in the female, the abdomen is a little longer than the thorax, and nearly as broad, gradually attenuated posteriorly. The segments do not differ much in length, the second being but a little longer; in the female, the seventh, at the end, bears a dense circle of appressed hairs, their ends converging, and closing the anal opening.

Legs moderately long, clothed with scales, and beset with spines; *pulvilli* distinct.

Wings of moderate length and breadth, narrower than in most species of *Anthrax*; venation like that of an *Anthrax*, except that the bifurcation of the second and third veins takes place very early, at the same distance from the root of the wing as the proximal end of the discal cell; the præfurca is but one-half longer than the great cross-vein; the small cross-vein is about the middle of the discal cell; the curvature of the second vein at the end and of the anterior branch of the third vein are very much like those of an ordinary *Anthrax* (*A. alternata* or *sinuosa*); costal enlargement small; a distinct, apparently coriaceous, epimeral hook, as in *Anthrax*.

Triodites, in Greek, means a *street-lounger*.

TRIODITES MUS n. sp., ♂ ♀.—Uniformly clothed with whitish-gray pile; face with white pile; wings hyaline. Length 8–9^{mm}.

Male.—Frontal triangle black, with short, erect, black pile; face with a dense covering of short snow-white pile; antennæ black; occiput black, with appressed white hairs along the orbits; thorax grayish-black, with a dense covering of delicate, downy, whitish-gray pile, which in an oblique light looks altogether white; the few bristles on the antescutellar callosities and on the scutellum are whitish, almost colorless; abdomen black, with the same covering of grayish-white pile, which is longer here on the sides. Halteres whitish; knob brownish. Legs black, densely clothed with white scales; spines on femora and tibiæ whitish-yellow. Wings, including the costal cell, of a pure hyaline; veins, except at the root, black; costal and first longitudinal brown.

Female.—Like the male, but the front is slightly brownish pruinose, and has, besides the erect, black pile, some short, recumbent, yellowish hairs. The hind margins of the abdominal segments are beset with some short, appressed, whitish hairs, forming cross-bands.

Hab.—I have a single male, which I took near the Salt Lake, Utah, August 1. One of the females is from Sonoma County, California, July 6; the other from the Shasta district (H. Edwards, July, 1875).

ONCODOCERA.

ONCODOCERA LEUCOPROCTA Wiedemann, i, 330 (*Mulio*); male (syn. *Oncodocera dimidiata* Macq., D. E., ii, 1, 84, female).—Middle and Southern States; Illinois; Wisconsin.

LEPTOCHILUS MODESTUS Loew, Centur., x, 40.—Texas. } I do not know
APHÆBANTUS CERVINUS Loew, Centur., x, 39.—Texas. } these species

BOMBYLIUS.

The species from the Atlantic States may be grouped as follows:—

1. Anterior half of the wings brown, with a well-defined, sinuous, posterior limit of that color:

fratellus Wied., i, 583.

SYN.—*vicinus* Macq., ii, 1, 98.

albipectus Macq., 5e suppl., 82.

aqualis Harris (*nec* Fabr.), 3d edit., 604.

major Kirby, Fauna Bor.-Am., 312.

2. Wings brown at base, and with brown spots on the posterior half:

pulchellus Loew, Centur., iv, 47.

pygmaeus Fab., Wied., i, 351.

3. The brown of the basal half of the wings is gradually evanescent posteriorly:

atriceps Loew, Centur., iv, 49.

mexicanus Wied., i, 338.

SYN.—*fulvibasis* Macq., 5e suppl.

philadelphicus Macq., ii, 1, 99. } Synonymy on the authority of Mr.
Loew, in litt.

varius Fab., Wied., i, 335.

validus Loew, Centur., iv, 48.

The Californian species which I have before me may be tabulated as follows:

1. Anterior half of the wings brown, which color has a well-defined posterior border1. *major* Linn.
2. Anterior part of the wings brown; the posterior, or hyaline region, with six or seven brown spots.....2. *albicapillus* Loew.
3. Basal portion of the wings more or less brown, which color is gradually evanescent posteriorly:

Frontal triangle (in the male) with a conspicuous covering of silvery white, shining; recumbent pile....3. *metopium* n. sp.

Frontal triangle (of the male) with blackish or golden-yellow, never conspicuous, pile:

Face and cheeks with a dense beard of pale yellowish, shining; comparatively long hair, entirely concealing the color of the face under it4. *aurifer* n. sp.

Face and cheeks with a sparse beard of mostly black pile, not dense enough to conceal the color of the face and cheeks under it; proboscis very long:

Smaller species, with a fringe of golden pile round the mouth5. *cachinnans* n. sp.

Larger species, with only black pile round the mouth,

6. *lancifer* n. sp.

1. *BOMBYLIUS MAJOR* LINN.—Dr. Loew identified with this European species specimens of the most common Californian *Bombylius*. I have about two dozen specimens, principally from Marin County, which vary in size from 7^{mm} to nearly 12^{mm}. The color is likewise variable in the more or less brown or yellowish shade of the fur, in the greater or lesser distinctness of the tufts of black pile on the sides of the abdomen, etc. In a number of specimens, there is no vestige of white fur on the chest and the mentum. Three specimens have the femora black and the tarsi dark brown. The females, of which I have five, show on the front part of the thorax the blackish spot, which distinguishes the southern variety of the European *B. major* (see Loew, Neue Beitr., iii, 14). Whether some of these varieties do not constitute different species, I do not pretend to decide. At the same time, I confess not to know in what the difference between *B. major* and *B. fratellus* of the Eastern States consists. Wiedemann (Auss. Zw., i, p. 583) merely mentions the absence of the tufts of black pile on the abdomen; but I have seen specimens with such tufts. Macquart (Dipt. Exot., ii, 1, 98; *B. vicinus*) says that *B. fratellus* (his *B. vicinus*) resembles *B. major*, but that its fur on the abdomen is fulvous instead of yellow; that is all. Loew (l. c.) adopts *fratellus* as a separate species, but does not throw any light on the subject of its difference from *B. major*; he merely observes that apparently several species occur under that name in collections. As long, therefore, as it is not settled whether *fratellus* on one side and the Californian *major* on the other represent

one or several species, it is useless to try to discover a difference between them. I will only mention that Californian specimens frequently occur which are larger and of a deeper brownish-fulvous than any I have seen from the Atlantic States.

2. *BOMBYLIUS ALBICAPILLUS* Loew, Centur., x, 42.—Not rare in Marin and Sonoma Counties in April and May; a specimen from Yosemite Valley (June 13) has a whitish instead of yellowish fur.

3. *BOMBYLIUS METOPIUM* n. sp., ♂.—Frontal triangle with a conspicuous covering of long, silvery-white, recumbent hair, entirely concealing the ground-color; face clothed with brownish-gray pollen, and sparsely beset with long brownish-black pile; a fringe of fulvous pile along the oral margin; long white pile on the under side of the head; occiput with pale yellowish pile; occipital triangle black, with a few black hairs; antennæ black, with black hairs on the first two joints; third joint but little expanded in its proximal part, about once and a half the length of the two first taken together; proboscis of moderate length, about twice as long as the head. The fur on the body is pale yellowish, with some whitish reflections above the root of the wings; a stripe of dark hairs between the latter and the shoulders; chest with white pile; on the abdomen, rows of black hairs are visible on the posterior margins of the segments; on both sides of the second and the following segments, they are more dense. Stem of halteres brownish; knob yellow. Femora black, beset with yellowish scales; tibiæ and tarsi brownish-red, darker toward the tips. Wings brown at base and along the anterior margin, including the two basal, the marginal, and the proximal half of the first submarginal cells; on the inner surface of these cells, however, the brown is more diluted; cross-veins at the base of the first and fourth posterior cells, as well as the bifurcation of the second and third veins, are clouded with dark brown; the cross-vein at the base of the second posterior cell is about as long as the small cross-vein. Length 8–9^{mm}.

Hab.—Lagunitas Creek, Marin County, California, April 19. Although I have but a single specimen, I do not hesitate to describe this species, easily recognizable by the silvery tuft on the front of the male.

4. *BOMBYLIUS AURIFER* n. sp., ♂ ♀.—*Male.*—Epistoma with a dense mystax of pale golden-yellow hair, covering the edge of the mouth, but not quite reaching the lower corner of the eye; some few black hairs in the upper part of this mystax near the orbit; front clothed with shorter hairs of the same color (but by far not as long and conspicuous as the snow-white pile on the front of *B. metopium*). Proboscis a little more than twice the length of the head. The two first antennal joints with black pile; the third about once and a quarter the length of the two first, rather broad, its greatest expansion beyond its middle; rather suddenly attenuated at the tip. Under side of the head with whitish pile; on the occiput, it is more yellowish-white. The fur of the body rather uniformly pale yellow; a small tuft of black pile on each

side of the third segment; the fur on the chest more whitish; ground-color of the thorax deep black. Halteres yellow. Legs black; base of tibiæ brown; femora and tibiæ beset with whitish-yellow scales. Proximal part of the wings tinged with pale reddish-brown as far as the tip of the first vein and the anterior and posterior cross-veins; the brown gradually evanescent about this limit; the remainder of the wing grayish-hyaline.

Female.—Like the male in all respects, except that the fur is much more whitish, including that of the mystax. The front is clothed with some scattered, erect, whitish pile, and a very dense, recumbent, pale whitish-yellow, shining tomentum, completely covering the ground-color, except on the vertical triangle and a line in the center of the front; some black hairs above the mystax, but none on the front and vertex; the brown on the wings less dark and extended; the ground-color of the femora and of a part of the tibiæ concealed under a thick covering of whitish scales.

Length about 6.5^{mm}.

Hab.—Webber Lake, Sierra Nevada, California, July 25. A male and a female. Will be easily recognized by the dense hairy clothing of the face and the shape of the antennæ. The paler fur of the female specimen I hold to be varietal and not sexual.

5. *BOMBYLIUS CACHINNANS* n. sp., ♀ ♂.—Body black, densely clothed with a dull yellowish fur; epistoma brownish-yellow in the female, darker in the male, and covered with grayish pollen; the longer hairs upon it are black; the shorter pile round the edge of the mouth is golden-yellow. Frontal triangle in the male grayish-pollinose, and with black pile; in the female, the opaque grayish-black front is beset with a recumbent reddish-golden short tomentum, the ocellar tubercle and surrounding being free from it; some scattered black erect hairs are visible on the sides of the front and on the vertex; proboscis nearly as long as the body; antennæ with black pile on the basal joints; the third joint is rather narrow in the male and somewhat broader in the female, and of equal breadth for more than half of its length, beyond which it is narrower. The fur on thorax and abdomen is of a nearly uniform color; on the hind margins of the segments of the latter, some sparse black hairs may be perceived, which appear as indistinct tufts on the sides of the second and of the following segments. Wings grayish-hyaline, tinged with pale brown or reddish-brown at the base and in the costal cell; in the female, the brown does not fill out the distal half of the first basal nor the second basal cell; in the male, the brown is darker, and gradually evanescent posteriorly, but it extends over nearly the whole wing. Legs yellowish-red; tarsi, except their base, black; in the male, the base of the femora is black; the knees have black dots on the front side. Length of male 6.5^{mm}; of female 7–8^{mm}.

Hab.—Sonoma County, California, April 27–May 9. Two females and one male.

6. *BOMBYLIUS LANCIFER* n. sp., ♂ ♀.—Body black, densely clothed with yellow fur; tufts of brown pile in the posterior corners of the thorax, and two tufts of black pile on each side of the abdomen connected by rows of black pile over the back; a stripe of dark brown pile between the humerus and the root of the wing; on the chest, the hair is paler; on the mentum, white. Epistoma yellowish-brown, shining above, grayish-pollinose on the sides, beset with black pile; frontal triangle in the male grayish-pollinose, beset with black pile; the whole front and vertex in the female grayish-pollinose, beset with some recumbent golden-yellow tomentum and longer black pile. Proboscis long, as long as the body, perhaps a little longer. Third joint of the antennæ moderately broad, with parallel sides, on its last third tapering toward the tip. Legs red, thinly clothed with whitish scales, and beset with black spines; tarsi brown, reddish at base; knees dark brown, especially on their anterior side. Wings blackish-brown on their basal half; strongly tinged with grayish on the rest of the surface. Length 10^{mm}.

Hab.—San Francisco, Cal. (H. Edwards); Yosemite Valley (June 9). One male and two females. The fur is intact in the male only; that of the female, which I took in Yosemite Valley, is more whitish. In general appearance, *B. lancifer* is not unlike *B. varius* of the Atlantic States; but the latter has a much shorter proboscis, a distinctly lanceolate third antennal joint, black pile on the chest, wings less grayish on their distal portion, etc.

ANASTŒCHUS nov. gen.

Closely allied to *Systæchus*, but easily distinguished from the North American species of that genus by the following characters:—

Head comparatively larger, and front of the female broader.

Face, cheeks, and lower part of the front are beset with erect pile, which forms a dense broad brush, entirely concealing from view the outlines of the mouth and cheeks, as well as the basal joints of the antennæ. When the pile is removed, the face shows a structure entirely different from that of *Systæchus*; in the profile, the mouth, instead of projecting forward, has its sides, the cheeks, on the same plane with the eyes, and even somewhat withdrawn behind them; the epistoma, or face above the mouth, projects very little, and descends almost directly below the antennæ.

Eyes, in the male, separated by an interval on the vertex, which is not coarctate in front of the ocelli; a distinct oblique line separates the upper and larger facets from the lower and smaller ones (in *Systæchus*, the narrow interval between the eyes on the vertex is strongly coarctate in front of the ocelli; the passage between the two kinds of facets is gradual and imperceptible); in the female, the interval between the eyes is about one-half broader than the horizontal diameter of the eye.

Antennæ of the same structure as in *Systæchus*, but the third joint, beyond the usual ring-like expansion at the extreme base, is, for a cer-

tain distance, more distinctly attenuated, the dilatation being removed farther toward the middle; the slender distal half is more elongated.

Venation like that of *Systæchus*, but the relation between the cross-vein at the base of the second posterior cell to that at the base of the third is like 1 to 2 or 3 here, while it is like 1 to 5 or 6 in *Systæchus*; this causes the proximal end of the third posterior cell to be less long and pointed in *Anastæchus*, and renders the discal cell a little broader; the usual enlargement of the costa at the base, besides the usual pile, bears a fringe of bristles.

General outline of the body more elongated than in *Systæchus*; the hairs on the end of the body longer, tuft-like.

This genus answers Dr. Loew's first and smaller division of *Systæchus* (Neue Beitr., iii, 35). The structural differences are of an importance which not only justifies but requires the formation of a new genus.

Anastæchus means "separated", in contradistinction from *Systæchus*, "belonging together".

ANASTÆCHUS BARBATUS n. sp., ♂ ♀.—Densely clothed with grayish-yellow pile, mixed with some black pile at the end of the abdomen (especially in the male); beard white, with some black hairs above; wings grayish-hyaline, more or less brownish at the base. Length 5-7^{mm} (exclusive of the length of the pile).

Ground-color of the body grayish-black, densely clothed with long pale grayish-yellow pile (much less yellow than that of *Systæchus vulgaris*). Head with a dense beard of white pile, slightly yellowish round the base of the antennæ; above it, on the front, a tuft of long black hairs, descending on each side along the eyes to about the middle of the inner orbit in the male, much less in the female. Antennæ black. Chest with white pile. On the abdomen, besides the prevailing yellowish pile, darker hairs are visible in rows, on the posterior margins of the segments; they are black, and especially visible on the last two or three segments, so that in most of the male specimens they impart a blackish tinge to the pile around the tip of the abdomen; the extent and number of these black hairs is, however, very variable, and in most female specimens they disappear altogether. Knob of halteres yellow. Femora, except the tips, black, but densely clothed with white scales; tip of femora, tibiæ, and tarsi reddish-yellow; the usual spines of the same color; end of tarsi brown; in the female, the yellow on the femora is more extended. Wings grayish-hyaline, with a more or less extended shade of brown at base, which is almost obsolete in the female; costa at the root with short yellowish-white and longer black pile, the latter forming a kind of comb; wing-veins black, those at the root and near the costa often pale brownish.

Hab.—Cheyenne, Wyo., where I found it commonly on the 21st of August, 1876. Five males and as many females; the latter smaller. Besides these, I have three specimens from the Twin Lakes, Colorado (9,300 feet altitude, collected by Lieut. W. L. Carpenter), which I cannot distinguish from the others, although they measure 10^{mm}.

Two male specimens from California (one of them from the Shasta district, H. Edwards) belong apparently to the same species, and are nearly of the size of the larger ones from Cheyenne.

Finally, a female from Nantucket, Mass. (caught over sandy soil, middle of September, by Mr. S. H. Scudder), is larger than the females from Cheyenne, measuring nearly 10^{mm}; the proboscis is a little shorter and there is more yellowish pile in the beard around the antennæ; in other respects, the agreement is perfect.

A. barbatus is therefore either a species with a very wide distribution, or else there are several closely allied species, which, with the material before me, I am unable to distinguish. The European species of this group (*A. nitidulus*, etc.) are also remarkably like *A. barbatus*.

SYSTÆCHUS.

A difficult genus on account of the great resemblance of the species and the apparent scarcity of distinctive characters of an absolute and more than comparative value. *Systæchus* is very common in the West, but occurs also in the Southern States. I have seen only one specimen from the Northeastern and Middle States, which I took near Alexandria Bay, Saint Lawrence River.

1. SYSTÆCHUS VULGARIS Loew, Centur., iv, 52 (Nebraska; Dr. Hayden). A common species in Colorado, about Denver, Manitou, etc., July, August (P. R. Uhler and myself); also in Utah (a male from Salt Lake City, July 21, by A. S. Packard). The fulvous hairs on the face are often more abundant than Dr. Loew's wording implies; in the female, they extend to the front, especially along the eyes.

A female specimen which I caught near Alexandria Bay, N. Y., on Saint Lawrence River, is smaller, but does not, in other respects, differ from *S. vulgaris*.

I have two males and two females from Illinois (Le Baron) and Denison, Crawford County, Iowa (Allen; July, 1867), which, instead of the usual pale yellow color of *S. vulgaris*, are of a decidedly reddish-yellow, almost rufous; in outline, they seem to me broader than *S. vulgaris*, and may belong to a different species.

2. SYSTÆCHUS SOLITUS Walker, List, etc., ii, 288 (*Bombylius*).—Florida. As suspected by Dr. Loew (Centur., iv, 52), this is a *Systæchus*. I have a specimen from Capron, Fla. (Messrs. Hubbard and Schwarz, in April), which answers the description. It differs from *S. vulgaris* in having the tarsi and the ends of front and hind tibiæ black; the spines on femora and tibiæ are of the same color. I do not discover any other difference.

3. SYSTÆCHUS CANDIDULUS Loew, Centur., iv, 51 (Wisconsin).—Besides the whitish pile covering the whole body, this species is easily distinguished by its longer proboscis and more hyaline wings, with paler veins; the pile on the face and front is black without admixture, and

only a slight grayish or whitish pollen is visible under it on the face. I have specimens from Illinois and Kansas.

4. *SYSTÆCHUS OREAS* n. sp.—Differs from *S. vulgaris* in the third antennal joint being a little broader, the mystax more mixed with fulvous pile, the proboscis longer, the legs darker, the wings more grayish, the covering of pile more dense and of a paler shade of yellow, the ground-color less dark (when denuded), without reddish on the scutellum; on the average, the size is somewhat larger.

Male.—The blackish-gray ground-color of the body is entirely concealed (in intact specimens) under a thick covering of pale yellow pile, giving the body an elongated-oval shape, slightly broader about the middle of the abdomen; face and front clothed with a recumbent fulvous tomentum and erect black pile; mystax mixed of both; some black pile on the vertex; antennæ black, third joint considerably expanded on its proximal half; legs black; femora densely covered with the usual appressed whitish hairs, which conceal the ground-color; tibiæ reddish, but clothed with the same whitish pubescence; the latter part of the tibiæ is black, and on the inner side this color extends farther upward than externally; tarsi deep black. Wings with a decidedly grayish tinge, brownish-yellow at the base and in the costal and first basal cells. Length about 10^{mm} (including the length of the pile at both ends of the body, but excluding the antennæ).

Female.—I have a single somewhat damaged specimen, which evidently belongs here, although it is smaller, and the femora and tibiæ, except the tip, are yellowish-red. Length about 8^{mm}.

Hab.—Webber Lake, Sierra County, California, July 22–26. Three males and one female. None of my specimens show any reddish on the scutellum.

PANTARBES nov. gen.

Belongs to the *Bombylina*, with a closed first posterior cell, but differs abundantly from *Bombylius*, *Systæchus*, and *Anastæchus* in having three submarginal cells; the front very broad in both sexes; the antennæ remarkably distant at base, and with a much more developed, 2-jointed, terminal style; the ends of the second vein and of the anterior branch of the third strongly curved and bent forward (as in *Ploas* and *Lordotus*).

In the thickness of its beard, entirely concealing the outlines of the mouth, it resembles *Anastæchus*, but it surpasses it in the breadth of the head; its mouth is much smaller. The proboscis is shorter here than in any of the above-named genera, and not attenuated toward the tip.

Its closest relative, however, is perhaps *Mulio* (as understood by Meigen, Eur. Zweifl., ii, tab. xvii, f. 26–28), with which it shares the shape of the head, the distant eyes in both sexes, the distant antennæ, and the general appearance of the body. But *Mulio* has the first pos-

terior cell open, no pulvilli, the first antennal joint much shorter, for an antennal style a mere bristle, the beard less long, etc. Comparatively, the head of *Pantarbes* is larger and broader, the body is stouter, the præfurca shorter.

Head large, considerably broader than the thorax; vertex in the male equal in breadth to about two-thirds of the greatest horizontal diameter of the eye, still broader in the female; the front immediately above the antennæ is about three times as broad as the vertex (in the male), the eyes being placed obliquely; front and face descend nearly perpendicularly toward the oral margin, the antennæ, therefore, inserted at a much lower level than the vertex. The lower part of the front, the face, the base of the antennæ, and the oral opening are entirely concealed from view by a dense tuft-like crop of hair, occupying the whole anterior part of the head, and similar to that of *Anastæchus*. Those parts of the head can only be examined after the removal of this hair.

Ocelli placed on a hardly perceptible flat prominence of the vertex; the lateral ones large, and at a distance from each other, which, in the male, is at least by one-half larger than the interval between each of them and the nearest orbit of the eye; in the female, the latter interval is a little larger than the distance between the ocelli.

Antennæ inserted at a distance from each other which is but little shorter than the breadth of the vertex in the male; first joint (concealed in the facial tuft of hair) nearly cylindrical; second joint short, not longer than broad; the third a little longer than the two first taken together, slender, beginning by a short basal expansion, then attenuated for about one-third of its length, and then again very slightly expanded, with but a small attenuation toward the end; at the tip, a minute, stout, cylindrical, 2-jointed style, with a microscopic bristle on top; the style when viewed from above the vertex is somewhat at an angle to the rest of the antenna.

Eyes glabrous; the passage from the larger facets above to the smaller ones below in the male is gradual; in dry specimens, at least, the line of separation is not visible.

Oral opening comparatively small, its upper edge reaching but little above the lower corners of the eyes.

Proboscis prorected forward, comparatively short, projecting but little beyond the tip of the antennæ, not tapering toward the end.

Thorax of moderate size, not gibbose, nearly on a level with the head.

Scutellum small in comparison with those of *Bombylius* and *Systæchus*.

Abdomen a little longer than thorax and scutellum together, as broad as the thorax at the base, and gradually tapering toward the tip.

Legs, especially the femora, comparatively strong; first tarsal joint a little shorter than the four others taken together; *ungues* curved; *pulvilli* distinct and long.

Venation of the wings: first posterior cell closed; its petiole as long as in an ordinary *Bombylius*; second vein gently arched before the cross-

vein, connecting it with the third (but not as strongly curved as in *Lordotus*); beyond this cross-vein, its curvature is stronger than in *Lordotus*, so that the expanded distal end of the marginal cell bulges out beyond the end of the first submarginal cell; three submarginal cells formed by a cross-vein connecting the second vein with the anterior branch of the third very near its base; the first of the two exterior submarginal cells almost crescent-shaped, in consequence of the curvature of the veins forming it; small cross-vein about the middle of the discal cell, and hence the first basal cell much larger than the second; the bifurcation of the second and third vein takes place a little before the middle of the distance between their common root and the small cross-vein; these two veins become at once distinctly divaricate (and not approximate and parallel for a considerable distance, as in *Bombylius* and *Systoechus*); the rest of the venation as in those two genera,—that is, anal cell open, etc.

Pantarbes, in Greek, means *full of fear*.

PANTARBES CAPITO n. sp., ♂ ♀.—Body grayish-black, densely clothed with whitish-gray pile; beard white; wings grayish-hyaline, the anterior half for about three-quarters of the length infuscated. Length 6–10^{mm}.

Front and lower part of the head and occiput densely clothed with snow-white pile; upper part of front with a fringe of long black hairs, which extend some distance downward along the orbits of the eyes; vertex likewise with a bunch of black hairs. Antennæ: first and second joints yellowish; the third black. Halteres yellow. Femora black, densely beset with white scale-like hairs, and some longer pile; tibiæ and tarsi reddish, the latter black toward the tip. The brown color of the wings extends from the root to the end of the first longitudinal vein, and a little beyond the small cross-vein; it gradually fades away posteriorly; anal and axillary cells hyaline.

Hab.—Sonoma County, California, April 27 to May 9; not rare. Nine males and one female. The latter is, of all the specimens, the smallest; its wings are less infuscated at the base; the beard round the antennæ is somewhat yellowish. In flying, this species frequently alighted on the soil.

COMASTES nov. gen.

Venation, antennæ, and proboscis of a *Bombylius*, but general outline of the body and the character of the fur of pile upon it entirely different. Head larger; thorax much longer; abdomen, on the contrary, smaller; the outline of the body more parallel, less ovate; scutellum much larger; hind legs longer. The hair on the epistoma is less long and bushy, more recumbent, which gives the large, broad head, especially when seen from above, a totally different appearance. The fur on the thorax is dense, but shorter than in *Bombylius*, more like that of an *Eristalis*; that on the abdomen is as long, but less erect and less evenly distributed than in *Bombylius*.

I have only a single specimen, which, from the breadth of the front, I judge to be a female.

Head transverse, inserted as in *Bombylius*, a little lower than the thorax; as broad as the latter in its broadest part (even a little broader, if the fur be removed); the interval between the eyes, in the female, broad, very little narrower on the vertex than near the mouth; three large ocelli on a flat protuberance; eyes reniform; mouth oval, rather large; epistoma moderately projecting in the profile in front of the eyes; cheeks not projecting and head not descending below the eyes; occiput but little swollen, densely clothed with down.

Proboscis long, three-quarters of the length of the body, and stouter than in a *Bombylius* of equal size; palpi elongated, second joint short.

Antennæ approximated at base; first joint elongated, cylindrical; second not much longer than broad; the third one-third longer than the two first taken together, narrow, linear on its first half, gradually tapering on the second, truncate at the tip, upon which is inserted a short 2-jointed style. I do not perceive any terminal bristle in my specimen. The whole length of the antenna is about equal to the distance between the ocelli and the mouth.

Thorax rather long, square, with nearly parallel sides, moderately convex, densely clothed with short erect pile above and with longer hairs on the pleuræ; scutellum comparatively larger than in *Bombylius*, almost semicircular, moderately convex.

Abdomen short, much smaller in bulk than the thorax, turned down at the end, unevenly clothed with long pile arranged in semi-erect rows and tufts, which begin at the posterior end of the second segment; venter hollow.

Legs like those of *Bombylius*, only the hind pair comparatively longer; pulvilli much shorter than the ungues.

Wings and *venation* as in *Bombylius*; the contact of the second submarginal cell with the first posterior is very short, almost punctiform; the same is the case with the second posterior and the discal cell; small cross-vein about the middle of the discal.

Comastes, in Greek, means *a reveler*. (I am aware of the existence of *Comaster* Agassiz, *Echinod.*, but both the termination and the derivation of that word are different.)

COMASTES ROBUSTUS n. sp., ♀.—Ground-color of the head grayish-white, yellowish round the mouth, densely clothed with pale yellowish-white pile, more yellow on the front; a tuft of black pile on the ocellar tubercle. Antennæ black; first joint grayish-pruinose. Palpi reddish, second joint brownish. Proboscis black. The dense pile on the vertex is yellowish above, whitish below. The grayish-black ground-color of the thorax is almost concealed on the dorsum by a dense, short, erect clothing of fulvous pile; on the pleuræ, a tuft of whitish-yellow hair; that on the chest almost white. Scutellum reddish, with fulvous pile and some black bristles along the edge. Abdomen blackish-gray; second

segment with a short, appressed tomentum, forming a yellowish-white cross-band; the remaining segments, beginning with the posterior margin of the second, are covered with long, semi-erect, black pile, across which, in the middle of the abdomen, there is a triangular figure formed by similar pile, but white; the apex of the white triangle rests on the hind margin of the second segment; the oblique stripes of white pile, forming the sides of the triangle, run downward toward the venter; the inner side of the triangle is filled, partly with black, partly with white pile, the latter chiefly occupying the end of the abdomen; the venter is clothed anteriorly with white, posteriorly with black pile. Legs reddish; tarsi darker; hind tibiæ and tarsi reddish-brown. Knob of halteres yellow. Wings grayish-hyaline; base as far as the basal cross-veins brownish; costal cell pale yellowish. Length 11-12^{mm}.

Hab.—Waco, Texas (Belfrage). A single female. The specimen is in Mr. E. Burgess's collection in Boston.

LORDOTUS.

LORDOTUS GIBBUS Loew, Centur., iv, 53.—Dr. Loew described a female from Matamoras. I have a dozen specimens from Denver, Colo. (Uhler, August 18), Cheyenne, Wyo. (myself, August 21), and California (San Francisco and Shasta district, H. Edwards). The color of the antennæ is variable. In all the specimens from California (six females), the two basal joints are red. One of the specimens from Denver has the second joint red toward the tip only, as described by Dr. Loew. In the other specimens from Denver, and also in those which I took near Cheyenne, the antennæ are altogether black, although the basal joints are grayish-pollinose. Well preserved specimens show two grayish stripes on the thorax. The brownish-red color at the base of the wings and in the costal cell is often extended to the first basal and submarginal cells. A gray cloud is often visible on the cross-vein at the base of the fourth posterior cell. The costa in all my specimens is reddish, and not black, as described by Dr. Loew.

I have only a single male, taken near Cheyenne, Wyo. The eyes are closely contiguous on a rather long line, down to very near the base of the antennæ. The difference between the upper larger facets and the lower smaller ones is well marked, although the line of division between them is not very sharp (in the female, the facets are uniform); frontal triangle very small, glabrous. On the last abdominal segments, beginning with the fifth, many black hairs are mixed with the yellow ones, especially on the sides. The femora, except the last quarter, are black; the tarsi altogether black. The body is smaller and much more slender than that of the female.

As one of the specimens from Denver has been communicated to Dr. Loew, there can be no doubt about the specific identity.

LORDOTUS(?) PLANUS n. sp.—I place provisionally in this genus a Californian species, of which I have only a single male specimen, and

for which the erection of a new genus will perhaps be necessary. It has the characters of *Lordotus*, except the general shape of the body, which is much less gibbose. The venation is exactly like that of *Lordotus*, including the remarkable sweep of the second vein. The second joint of the antennæ is comparatively shorter, as it is but little longer than broad.

Male.—Thorax clothed with yellowish-gray, abdomen with whitish pile; legs and antennæ black, the former densely clothed with an appressed white scale-like tomentum. Length 7–8^{mm}.

Antennæ black, the first two joints beset with black pile, especially long on the under side; cheeks and face with grayish pile, with an admixture of black hairs in the mystax; the small frontal triangle clothed with whitish pollen; occiput with pale yellowish-gray pile. The grayish-black ground-color of the body is concealed under a dense covering of dull yellowish-gray pile on the thorax and of white pile on the abdomen. Knob of halteres yellowish-white. Wings subhyaline; veins brown, those nearer to the base and to the costa yellowish-brown; a darker spot on the first vein, at the junction of the cross-vein at the proximal end of the first basal cell; a similar spot, with a vestige of a cloud, on the præfurca; vestiges of clouds on the large and small cross-veins.

Hab.—Marin County, California (H. Edwards). A single male.

SPARNOPOLIUS.

1. SPARNOPOLIUS COLORADENSIS Grote, Proc. Entom. Soc. Phil., vi, p. 445.—Mr. Grote describes the female; the male stands in the same relation to it as the male of *S. fulvus* to its female; it is more slender in shape, and paler yellow; less fulvous in the coloring of its pile; the hairs on the antennal scapus are black. In the female, those hairs are variable in color, in some specimens black, in others mixed with bright fulvous ones; in others again the fulvous pile prevails. I have a number of specimens collected about Colorado Springs by Mr. Uhler.

2. SPARNOPOLIUS BREVICORNIS Loew, Centur., x, 43.—Waco, Texas; female. I have specimens of both sexes from the same locality. This species is exceedingly like the preceding; antennæ and proboscis, in my specimens at least, are shorter; the costal cell a little more yellowish; the fur a little less dense, especially in the female. I do not perceive any other differences.

3. SPARNOPOLIUS CUMATILIS Grote, Proc. Entom. Soc. Phil., vi, p. 445.—Colorado; female. I have never seen this species.

4. SPARNOPOLIUS FULVUS Wied., i, 347 (syn. *Bombylius Lherminieri* Macq., D. E., ii, 1, 103; *Bombylius brevirostris* Macq., l. c.).—A well-known species from the Atlantic States.

PLOAS.

The Californian species which I have may be tabulated thus:

Halteres with a yellow knob:

Wing-veins clouded with dark brown, but the inside of most of the cells hyaline.....1. *fenestrata* n. sp.

Wings brown at base, which color gradually fades into grayish posteriorly:

Thorax and proximal half of the abdomen clothed with yellowish-rufous pile above and below.....2. *rufula* n. sp.

Whole body clothed with black pile, mixed with yellowish-gray:

Large species.....3. *nigripennis* Lw.

Small species.....4. *atrata* Lw.

Halteres with a brown knob:

Abdomen metallic bluish-green:

Abdomen opaque anteriorly and in the middle, its sides and apex being shining bluish-green; pile on thorax and on the upper side of abdomen rufous.....5. *obesula* Lw.

Abdomen shining greenish-blue; pile on thorax and proximal half of the abdomen above pale yellow; on the distal half and below black.....6. *amabilis* n. sp.

Abdomen black.....7. n. sp. indescr.

None of the species described below has any marked impression on the scutellum, and all have three submarginal cells.

Ploas limbata Loew, Centur., viii, 51, from New Mexico, I do not know.

1. PLOAS FENESTRATA n. sp., ♂ ♀.—Wings dark brown along the anterior margin; all the veins (except the seventh) and cross-veins broadly clouded with brown. Hyaline spaces in the following cells: the two outer submarginal and the distal half of the inner submarginal; the end of the first posterior; the three other posterior; the discal; the whole axillary; nearly the whole anal (except at both ends). A hyaline spot in the distal half of the second basal cell. Head and thorax beset with long black and shorter pale yellowish-gray pile, the latter thicker and longer on the occiput, the chest, and the pleuræ. Antennæ black, with a very stout first joint and an unusually elongated subcylindrical second joint more than half as long as the first. Thoracic dorsum black, opaque; scutellum, when denuded, shining. Abdomen black, opaque; on the hind margin of each segment, a cross-band of whitish-gray recumbent pubescence, which expands in the middle so as to coalesce with the preceding cross-band; in the middle of each cross-band, on the hind margin of each segment, there is a more or less triangular spot of brownish-fulvous hair; these spots gradually diminish on each subsequent segment; the whole abdomen is beset, besides, with black, erect pile. Legs black in intact specimens, with a dense covering of brownish-ful-

vous scales, more whitish on the anterior part of the femora. Halteres reddish-yellow. Length 10–11^{mm}.

Hab.—Crafton, near San Bernardino, Cal., in March; San Rafael, Cal., and Sonoma County, in April and May. Much less common than *P. nigripennis*. Three males and one female.

This species, in several respects, is peculiar. The marginal cell is unusually short, reaching very little beyond the tip of the first vein, and not expanded at the end, as in all the other species. The consequence is that the submarginal cells have a shape different from the usual one: the first outer submarginal cell is larger, the inner submarginal broader toward the end. The structure of the antennæ is peculiar in the shape of the second joint, which is about as long as the third. The rather slender abdomen has none of the dense fringe of pile along the lateral edges, which distinguishes most of the following species.

2. *PLOAS RUFULA* n. sp., ♂.—Second antennal joint less than half the length of the first; two basal joints beset with long black pile; the under side of the head, occiput, thorax above and on the sides, and the abdomen beset with rufous pile; conspicuous tufts of black pile on the sides of the three penultimate abdominal segments; ground-color of the abdomen black, opaque on the two first segments; the other segments are shining greenish-black, with a small black opaque triangle in the middle and a narrow opaque cross-band at the base. Halteres reddish-yellow; legs black, beset with fulvous scales and pile, principally on the femora; spines on the tibiæ black; wings grayish, infuscated at base and along the fore border as far as the end of the first vein and including the first basal cell; the brown gradually evanescent; small cross-vein with a deep brown cloud; posterior cross-vein with a weaker one. Length 11–12^{mm}.

Hab.—San Geronimo, Marin County, Cal., April 19. Two males. In one of them, the cross-vein separating the second outer submarginal cell from the inner one is wanting on both wings.

3. *PLOAS NIGRIPENNIS* Loew, Centur., x, 45.—This is the most common Californian *Ploas*. I have numerous specimens of both sexes from Crafton, near San Bernardino, in March; Marin and Sonoma Counties, in April and May; Yosemite Valley, in June; Webber Lake, Sierra Nevada, in July. Dr. Loew describes the female. In the male, the opaque spaces in the middle of the third and following abdominal segments are much broader.

4. *PLOAS ATRATULA* Loew, Centur., x, 44.—I refer to this species, with a doubt, two female specimens taken by me near the Geysers, Sonoma County, California, in May.

5. *PLOAS OBESULA* Loew, Centur., x, 46.—California. Two male specimens, received from Mr. H. Edwards, without indication of the precise locality, I unhesitatingly refer to this species.

6. *PLOAS AMABILIS* n. sp., ♂ ♀.—Head black, beset with black pile, except on the occiput, where it is yellow; the front of the female, be-

sides the long black pile, in some specimens shows some shorter, yellow hairs. The whole under side of the body as well as the three last abdominal segments above are beset with deep black pile, which forms a dense fringe on the edge of those segments, especially long, and consisting of a row of tufts in the male. The upper side of the thorax, as well as the whole anterior half of the dorsal side of the abdomen, is clothed with pale yellow (straw-colored) pile. The ground-color of the thorax is black; that of the abdomen greenish-blue, shining, except the first segment, which is opaque, blackish; wings grayish-hyaline, brown at base and along the anterior margin as far as the end of the first vein, the brown gradually evanescent posteriorly; halteres black; leg black. Length 9–10^{mm}.

Hab.—Yosemite Valley, California, where I caught two females and one male of this pretty species, June 5–15.

7. *PLOAS* n. sp., ♀.—I have a single specimen from Yosemite Valley, June 14, measuring 5–6^{mm} without the antennæ; knob of halteres black, except the base, which, like the stem, is yellow; first joint of the antennæ unusually long and stout, the second cylindrical, about one-third as long as the first. The specimen being denuded is unfit for a description. The body is uniformly black; tufts of yellow pile are left on the sides of the thorax. I mention this species in order to call the attention of collectors to it.

PARACOSMUS

(nomen novum, vice *Allocotus* Loew).

PARACOSMUS EDWARDSI Loew, Centur., x, 48 (*Allocotus*).—The name given by Mr. Loew to this new genus being pre-occupied (*Allocotus* Mayr, Hemipt., 1864; *Allocota* Metchulski, Coleopt., 1859), I have changed it to *Paracosmus* (meaning, in Greek, *disorderly*).

Loew describes the female. In the male, the eyes are not contiguous on the front, which is but little narrower than that of the female. The eyes have uniform facets above and below. The hypopygium is rather large for the family, consisting of subhemispherical lower piece and a forceps-like organ above, with broad valves.

I found this curious insect in both sexes, flying in the sun over the sands round Lone Mountain, San Francisco, June 29.

PHTHIRIA.

I do not possess *P. punctipennis* Walker (List, iii, 294) from Georgia. *P. sulphurea* seems to have a wide distribution, from New Jersey to Colorado and Texas. The other species seem to be more exclusively western or Californian.

1. *PHTHIRIA SULPHUREA* Loew, Centur., iii, 18 (New Jersey, female).—I have specimens from Waco, Texas (Belfrage, communicated by Mr. Burgess), Colorado Springs (Uhler), and Illinois (Le Baron), which ap-

parently belong here. The antennæ are yellow, therefore paler than the description makes them; the sheath of the proboscis is variable in its coloring, being sometimes entirely black, sometimes yellow, except the lips, which remain black; the costa is yellowish-brown (and not black, as the description has it). The specimens from Illinois are smaller, and have no stump of a vein in the discal cell. These discrepancies notwithstanding, I could not take my specimens for a different species before comparing them with the types of the description. *P. sulphurea* is figured in Mr. Glover's Manuscript Notes, etc. (Diptera, tab. v, f. 1). The male of this species has the abdominal segments tinged with brownish at the base, the hind margins remaining sulphur-yellow.

2. *PHTHIRIA SCOLOPAX* n. sp.—Drab-colored; thorax with faint yellow lines; legs yellow, tips of tarsi black; wings large, all the cross-veins strongly, all the ends of longitudinal veins and the distal half of the costa more faintly, clouded with brown; proximal ends of the second submarginal and of the third posterior cells square, and both provided on the outside with a long stump of a vein. Length 6-7^{mm} (without the proboscis).

Head yellowish; cheeks, except the orbits, dark brown or reddish-brown, shining, with a yellow cross-line in the middle; ocellar triangle in the male dark brown, grayish-pruinose; frontal triangle yellow in the middle, reddish-brown on the sides, which color is separated by a yellow line from the brown of the cheeks; in the female, the interval between the eyes is yellowish-brown, with a dark brown spot on the vertex, upon which are the ocelli; the orbits of the eyes are sulphur-yellow. Palpi long and slender, dark brown. Antennæ yellowish-brown, last joint more brown, nearly three times the length of the two first taken together, its sides nearly parallel, its tip distinctly emarginate. Proboscis nearly as long as the body in the male, somewhat shorter in the female. Thorax opaque yellowish-gray, beset with an appressed golden tomentum; on the dorsum, two pale yellow longitudinal lines, and a third, much more delicate one, between; lateral margins of the dorsum and antescutellar callosities likewise yellowish; scutellum with a yellow line in the middle, and often with a brown spot on the tip. Halteres yellow, with a brown spot on the knob. Abdomen brownish-yellow. Legs yellow, tarsi, except the base, dark brown. Wings rather large and broad; the proximal ends of the second submarginal and of the third posterior cells are square; each emits on the outside a long stump of a vein, projecting, the one into the first submarginal, the other into the discal cells; the cross-veins at the base of the second submarginal and of the four posterior cells are clouded with dark brown, which clouds extend along the above-mentioned stumps; a large cloud at the bifurcation of the second and third veins; the costal margin, especially beyond the end of the auxiliary vein, and the ends of all the longitudinal veins, are also clouded. In most specimens, there is a curved stump of a vein with a cloud upon it, on the second vein, opposite the small cross-vein, and inside of the first submarginal cell.

Hab.—Manitou, Colo., August 18. One male and three females. A note which I took when the specimens were alive describes the eyes as greenish-purple, with a bluish-purple cross-band across the middle; in the male, the facets *above* the cross-band are the larger; in the female, those *below*.

P. scolopax is very like the figure of *Poecilognathus thlipsomyzoides* Jaenicke (Neue, exotische Diptern, tab. i, f. 11); and although it appears from the description that it is a different species, it is equally evident that both are most closely related. I do not see any sufficient ground for separating this species from *Phthiria*; at any rate, it is singular that Mr. Jaenicke, in his definition of his new genus *Poecilognathus*, does not even mention *Phthiria*. He says the venation is that of *Thlipsomyza*; but that genus has the first posterior cell closed, while *Poecilognathus*, according to the figure, has it open.

3. PHTHIRIA EGERMINANS Loew, Centur., x, 47.—California.

4. PHTHIRIA NOTATA Loew, Centur., iii, 19.—California.

I have not seen these two species.

5. PHTHIRIA HUMILIS n. sp., ♂.—Grayish-black; sparsely beset with pale grayish-yellow pile on the thorax, and with white pile on the abdomen and the under side of the head; legs and antennæ black; wings hyaline. Length 4–5^{mm}.

The grayish-black ground-color of the epistoma, cheeks, and front is clothed with a grayish pollen, more yellowish-gray on the occiput; oral margin and chin beset with white pile, silvery in a certain light; occiput with yellowish pile; antennæ black. The grayish-black ground-color of the thorax is but very little concealed above by a covering of pale grayish-yellow downy pile, more dense anteriorly; pleuræ opaque, almost glabrous; abdomen sparsely beset with long, erect, whitish pile, more dense on the sides; halteres brownish-yellow; legs black; femora with some whitish pile; wings hyaline; posterior costal cell (interval between the auxiliary and first vein) yellowish in its latter half; veins dark brown, except near the root.

Hab.—Los Guilucos, Sonoma County, Cal., July 4. A single male.

In life, the smaller facets on the lower part of the eye were of a darker color than those above.

This species can be, without difficulty, referred to *Phthiria*, although in its coloring and its pubescent body it differs from the other American species of the genus. The flattened antennæ, truncate at the end, the long proboscis, and the venation, are those of *Phthiria*. But the second submarginal cell and third posterior bear no stumps of veins on their outside, as they do in *P. sulphurea* and *scolopax*.

GERON.

The described North American species are:—

holosericeus Walker, List, ii, 295.—Georgia.

senilis Fab., Wied., i, 357.—West Indies (Wied.); Texas (Macq.).

calvus Loew, Centur., iv, 54.—New York.

macropterus Loew, Centur., ix, 76.—New York.

subauratus Loew, Centur., iv, 55; also ix, 77, nota.—Pennsylvania.

vitripennis Loew, Centur., ix, 77.—Middle States.

albidipennis Loew, Centur., ix, 78.—California.

SYSTROPUS.

Only a single species has been discovered in the United States, *S. macer* Loew (Cent., iv, 56). It occurs in all the Atlantic States. I have seen it from Kansas. I do not know whether it goes farther west or not.

S. macer has been bred from the cocoon of a *Limacodes*, the larvæ of which are allied to those of *L. pitheciium* (see Walsh, in the Proc. Bost. Soc. N. H., vol. ix, 300, Febr., 1864). The fly, kindly communicated to me by Mr. Walsh after the publication of the article, is not a *Conops*, as he thought at the time, but *Systropus macer*. Quite recently, Mr. Westwood bred a species of *Systropus* from a South African cocoon, resembling that of *Limacodes* (Trans. Entom. Soc. London, 1876, 575).

LEPIDOPHORA.

LEPIDOPHORA ÆGERÛFORMIS Westw.—Occurs from Georgia to Kansas.

LEPIDOPHORA APPENDICULATA Macquart, suppl., i, 118.—Texas.

A third species, *L. (Toxophora) lepidocera* Wied., without locality, is mentioned by Macquart, l. c., as possibly the female of his species.

TOXOPHORA.

Two North American *Toxophora* have been described, *T. amphitea* Walk. and *T. leucopyga* Wied.; two have been figured, but not described, *T. fulva* Gray and *T. americana* Guérin.

T. leucopyga Wied., i, 361 (without *patria*), was referred by Macquart (ii, 1, 117) to a species from the Carolinas; this species has only two submarginal cells, and no stump of a vein in the second posterior; the third vein (and not the second) is furcate; both Wiedemann's (tab. v, f. 3) and Macquart's (l. c., tab. xiii, f. 1) figures agree in this.

T. americana Guérin is not described; the figure shows four complete posterior cells, and an abdomen with interrupted cross-bands, but no longitudinal stripe, as in both species described below.

T. fulva Gray, in Griffith's Anim. Kingd., Insects, tab. 126, f. 5, from Georgia (Walker, List, etc., ii, 298), is described (l. c., 779) thus: "fulvous, with a black mark on the thorax and black lines across the abdomen". The figure agrees with this statement (it can hardly be called a description).

The metamorphosis of *Toxophora* was hitherto unknown. Mr. Townsend Glover in Washington, D. C., observed a *Toxophora*, the larva of which inhabits the well-known globular clay nest of the Wasp, *Eumenes*

fraterna, "feeding either upon the caterpillar stored up in the nest, or upon the young larvæ themselves" (see Glover, Manuscript Notes from my Journal, etc., Diptera, p. 81, sub voce *Eumenes*). As far as I remember the specimen of *Toxophora*, which Mr. Glover kindly showed me many years ago, it was the species described below as *T. amphitea*.

The species described below may be tabulated as follows:

Second vein with a fork at the end, the posterior branch of which is connected by a cross-vein with the third vein:

The cross-vein between the discal and second posterior cells is S-shaped, and bears no stump of a vein 1. *virgata* n. sp.

The cross-vein between the discal and second posterior cells is angular, and bears a long stump of a vein } 2. *amphitea* Walk.
 } 3. n. sp. indescr. (Calif.).

Third vein with a fork at the end; no cross-vein between the second and third veins 4. *fulva* Gray.

T. amphitea and *virgata* have nearly the same venation; in both, it is the *second* vein, instead of the third, which is furcate; the posterior branch of the fork is connected by a perpendicular cross-vein with the third vein. This description applies, of course, to the venation as it appears to the eye; theoretically, it is the third vein, as usual, which is forked, the anterior fork being knee-shaped, and forming a square at the base, the anterior corner of which is connected by a *recurrent* cross-vein with the second vein, and thus produces the appearance of that vein being forked.

1. *TOXOPHORA VIRGATA* n. sp., ♂ ♀.—*Male*.—Head and antennæ black, second joint with a white reflexion on the inner side; a tuft of white scales each side on the frontal triangle; occiput densely beset with pale yellow erect pile. The bluishblack ground-color of the thorax is more or less covered anteriorly with a fulvous tomentum and pale yellow pile; the pleuræ are covered with white, silvery scales; thoracic bristles black. Abdomen black; a stripe of ocher-yellow scales begins at the scutellum and reaches the end of the abdomen, being gradually attenuated; the sides of the abdomen bear, on each segment, a large black spot, framed in by a ring of scales, which is yellowish on the dorsal side, more whitish toward the venter these rings being in close contact, their yellowish scales form, in well-preserved specimens, a longitudinal stripe parallel to the median dorsal stripe, and emitting, on the hind margins of the segments, branches of whitish scales, running toward the venter, which is another way of describing the same thing); venter densely clothed with white scales. Legs black; femora almost entirely, tibiæ partly clothed with white scales. Halteres with a yellow knob; wings grayish or brownish, more or less tinged with yellowish in the costal, the first basal, and the inner end of the marginal cells; a somewhat more saturate, almost brownish, spot on the præfurca; the cross-vein between the second posterior and discal cells is S-shaped, not angular, without stump of a vein (a vestige of one on one of the wings).

Female.—Front shining black, with some white scales on each side above the antennæ, the latter altogether black; in other respects, like the male.

Length about 7^{mm} (measuring the chord of the curve formed by the body).

Hab.—Waco, Texas (Belfrage); Georgia (Morrison). Two males and two females.

2. *TOXOPHORA AMPHITEA* Walker, List., etc., ii, 298.

Head and antennæ black; second joint with a white reflexion on the inner side; a tuft of yellowish-white scales on the frontal triangle; occiput densely beset with pale yellow, erect pile. The black ground-color of the thorax is more or less covered anteriorly with a fulvous tomentum and pale yellow pile; the pleuræ are covered with white, silvery scales; thoracic bristles black. Abdomen black; a longitudinal stripe of scales along the dorsum gradually expands posteriorly; the scales upon it yellowish anteriorly become silvery-white posteriorly; on each side, the posterior margins have a short but broad cross-band of scales, yellow on the anterior, white on the posterior segments; these cross-bands are interrupted before reaching the dorsal stripe on segments 2-4; beyond the fourth segment, the cross-bands become more or less coalescent with that stripe; beyond the third segment, the cross-bands are coalescent with each other on the ventral side; venter with white scales. Legs black; femora with white and yellow, tibiæ with golden-yellowish scales. Wings as in *T. virgata*; but the cross-vein between the discal and second posterior cells is angular and bears a stump of a vein. Length about 5^{mm} (measuring the chord of the curve formed by the body).

Hab.—Middle and Southern States. In preparing this description, I had two males from Kentucky and Georgia before me. The color of the covering of scales on the abdomen is very variable.

3. *TOXOPHORA* spec., from California (H. Edwards).—Very like *T. fucata*, but larger and certainly distinct. I have only a single specimen, not well preserved enough to be described.

4. *Toxophora fulva* Gray, in Griffith's Animal Kingdom, xv, Insects, pt. ii, 779, tab. 126, fig. 5.

Ground-color opaque-black, but partly covered with fulvous scales and hairs. Face grayish-pollinose; front, in the female, covered with yellow scales; vertex with a few black bristles pointing forward; occiput with a dense fulvous fur. Thorax clothed with fulvous hairs on the front part of the dorsum; a fringe of shorter hair of the same color runs around the dorsum, the middle of which is usually denuded and black; scutellum also fringed with yellow hairs; thoracic bristles black. The posterior margins of the abdominal segments have borders of yellow scales, forming cross-bands, which coalesce on the sides of the abdomen; a longitudinal dorsal stripe of similar scales begins at the hind margin of the third segment, and runs to the end of the seventh. Venter for the most part clothed with yellow scales. Legs black,

covered on one side with yellow scales (the posterior side on the four anterior legs and the anterior side on the hind legs). Wings brownish, yellowish along the anterior border; two submarginal cells; in other words, the geniculate anterior branch of the third vein is not connected by a cross-vein with the preceding vein; the cross-vein at the distal end of the discal cell is bisinuated, but bears no stump of a vein. The antennæ of this species are comparatively more slender than those of *T. fucata* and *virgata*; the first joint is clothed with yellowish-white scales.

Length across the curve of the body 8–9^{mm}. Straightened, the body would measure 10–12^{mm}.

Hab.—Georgia (H. K. Morrison). One male and two females.

In Griffith's Animal Kingdom, no *patria* is given; but, according to Walker (List, etc., ii, 298), the specimens came from Abbott's collecting in Georgia. The figure given in that work does not show the longitudinal yellow stripe on the abdomen; nevertheless, the specific identity can hardly be called in doubt. As I observed before, no regular description is appended to the figure. I suspect that *T. leucopyga* Wied. and *T. fulva* are the same species.

EPIBATES nov. gen.

North America contains a number of species of a very elongated, almost *Thereva*-like shape, of a deep black color, and with rather long, distinctly 2-jointed, palpi. One of these species was referred by Macquart to the genus *Apatomyza* Wiedemann, the typical species of which is from the Cape. But already Walker (List, etc., iv, p. 1154), who had identified this species in Mr. Abbott's collection from Georgia, suggested that it belongs to a new genus. Although I have not the same species before me, I possess others which are evidently its congeners. The disagreement between them and Wiedemann's short description consists principally in the structure of the palpi, the last joint of which is not button-shaped, but lanceolate. The discrepancies in the venation, as figured by Wiedemann (tab. iv, f. 1), are only slight. But the general appearance of *Apatomyza punctipennis* on the figure is not that of the North American species above referred to. The abdomen in the latter is cylindrical, not tapering, as in the figure; the wings are longer, the head less close to the thorax; the statement, "scutellum somewhat prolonged, with almost concave sides," finds no application to the American species; all the latter are distinguished by a deep black color, which is not the case with the species from the Cape.

For these reasons, we do not run any great risk in establishing a new genus, *Epibates*, for those American species. But these species, as far as known, have one character in common, which places their generic rights beyond any doubt, if it does not exist in the *Apatomyza* from the Cape. Four of the species before me of which I have male specimens have the thoracic dorsum beset with minute, rigid, sharp, conical points; this is apparently a sexual character, as it does not exist in my female

specimens; unfortunately, none of my species is represented in both sexes.

The two genera recently described by Dr. Loew, and compared by him to *Apatomyza*, *Prorachthes* from Syria (Berl. Ent. Monatsschr., 1868, 380), and *Heterotropus* from Turkestan (Beschr. Eur. Dipt., iii. 180) are very different from *Epibates*. *Prorachthes* differs in the shape of the abdomen, the position of the head, the structure of face and front, of the first antennal joint, the venation; *Heterotropus* has short palpi and no spines on the legs. None of them has the peculiar muricate points on the thorax.

I have six species belonging to the same group, but unfortunately only one specimen of each; four of them are males, and two females; thus I am able to describe only one sex of each species; and this has to be borne in mind in reading my descriptions of the *generic* as well as specific characters. The presence of the sharp points on the thorax of the males of *E. luctifer*, *funestus*, *harrisi*, and *muricatus* proves that they are congeners; the position of *E. marginatus* and *magnus* in the same genus rests on characters taken from the other parts of the body. Macquart does not say anything of the presence of sharp points on the thorax of his *Apatomyza nigra* ♂; but they are easily overlooked in all the species except in the large *E. muricatus*.

Epibates, in Greek, means *a passenger*.

The characters of *Epibates* are as follows:—

Head on the same level with the thorax, and not much broader; occiput moderately convex, more so in the females (*E. marginatus* and *magnus*).

Eyes contiguous in the male for a short distance only, the apex of the vertical triangle being very much drawn out; ocellar tubercle distinct; the ocelli are placed on its sides, and for this reason, in the male, very difficult to perceive; in the two females, the eyes are separated by a broad interval; on each side of the ocellar tubercle, an ocellus is distinctly visible, but I do not perceive the third one (in *E. muricatus*, male, the eyes are separated by a very narrow interval).

Face and *lower part of front* subconically projecting in the profile; on the upper side of this projection, the antennæ are inserted; the interval between their base and the margin of the mouth (the epistoma or face) is narrow, sloping; the head descends but little under the eyes; oral opening oval, oblique, moderately large (Macquart's figure, Dipt. Exot., ii, 1, tab. 11, f. 1, a, showing the head in profile, is exaggerated, and the eyes are made to reach too low).

Proboscis longer by about one-half than the vertical diameter of the head; lips distinctly marked; palpi more than half as long as the proboscis; first joint ribbon-shaped, two or three times the length of the second, which is somewhat lanceolate.

Antennæ shorter than the head; first joint subcylindrical; second not much longer than it is broad, subcylindrical; the third about equal to

the first in length, or a little shorter, flattened, somewhat lanceolate, attenuated at the end; terminal style none (in *E. marginatus* ♀, the antennæ are a little longer than the head, and the first joint is distinctly longer than the third).

Thorax but little convex; its dorsum, in *E. funestus*, *luctifer*, *harrisii*, and *muricatus*, of which I have only male specimens, is beset with minute, rigid, sharp, conical points, arranged in irregular rows. As *E. marginatus* and *magnus*, of which I have only females, do not have these points, it seems very probable that this is a sexual character.

Scutellum comparatively large, almost semicircular, convex, cushion-shaped.

Abdomen cylindrical, long and slender, by one-half longer than head and thorax taken together; in the male, eight segments, the genitals forming the ninth; in the females of *E. marginatus* and *magnus*, I count only seven segments besides that bearing the genitals.

Legs long and slender, beset with sparse spinules along the tibiæ; hind legs by far the longest; *pulvilli* distinct, rather broad; *ungues* curved, broad at base. In my female specimens, I perceive a few stiff spine-like bristles on the under side of the hind femora, two in *E. marginatus*; four or five in *E. magnus*. I do not see anything like it in the males.

Wings but little shorter than the body, rather narrow, attenuated at the base; alula small, very narrow. In *E. muricatus*, the wings are broader.

Venation.—Two submarginal and four posterior cells; first posterior broadly open; upper branch of third vein gently S-shaped, inserted about the middle of the section of that vein beyond the small cross-vein. The latter corresponds to the middle of the discal cell. Præfurca less than half as long as the distance between the bifurcation and the small cross-vein; second vein gently arcuated on its latter half, reaching the margin without forming any sinus; thus the marginal cell is not expanded at its end. The proximal end of the third posterior cell is opposite the small cross-vein; anal cell open (Macquart's figure, Dipt. Exot., ii, 1, tab. 11, f. 1, gives a tolerably correct idea of the venation, except that the anal cell is represented as being closed; the upper branch of the third vein in *E. magnus* and *muricatus* is nearly as bisinuate as represented, but it is less so in the other species). The costal margin in the male sex is beset with minute blunt points, as in *Ploas*; they are almost obsolete in some species (*E. funestus*); very distinct in others (*E. muricatus*).

In the following table I include Macquart's *E. niger* from the data in his description:

Wings infuscated, but anal angle (including at least the second basal, anal, and axillary cells) hyaline:

Small species (7–8^{mm} long):

1. *funestus* (♂).—White Mountains, N. H.

Large species (12–14^{mm} long):

Prevailing pubescence black:

5. *magnus* (♀).—Vancouver Island.

Prevailing pubescence gray :

6. *harrisi* (δ).—Atlantic States (?)

Wings, including the anal angle, infuscated :

Well-marked brown clouds on the cross-veins, and at the bifurcations :

7. *niger* ().—Georgia.

Brown clouds, etc., indistinct or none :

Abdominal segments with a fringe of whitish hairs posteriorly :

4. *marginatus* (φ).—California.

No fringes of whitish hairs on the abdominal segments, which are deep velvet-black :

Small species (8^{mm}); stem of halteres pale; knob brown :

2. *luctifer* (δ).—Vancouver.

Large species (15^{mm}); halteres altogether blackish :

3. *muricatus* (δ).—Sierra Nevada.

1. *EPIBATES FUNESTUS* n. sp., δ .—Deep velvet-black; wings dark brown along the anterior margin, posteriorly hyaline on the proximal, brownish-hyaline on the distal half. Length 7.5^{mm}.

Head, antennæ, proboscis, and palpi black; the frontal triangle and the orbits of the eyes, in a certain light, have a white reflection; under side of the head with long, white pile; oral edge, vertex, and occiput with long black hairs. Thorax deep velvet-black, opaque, beset on the dorsum with minute, sharp, rigid points, and sparse, long, black pile; pleuræ and coxæ clothed with grayish pollen, and sparsely beset with white and blackish hairs. Abdomen deep black, opaque, with some scattered pile on the lateral and under side, which is white at the base and black beyond it. Halteres whitish-yellow, with a brown knob. Legs black. Wings dark brown along the anterior margin as far as the apex, including the first basal, marginal, and two submarginal cells; from the latter posteriorly, the brown becomes gradually evanescent, until it almost disappears in the last posterior cell; second basal, anal, and axillary cells hyaline, or almost so; the surroundings of the anterior cross-vein are darker brown, those of the stigma still more so; on the other cross-veins and on the bifurcation of the third vein the clouds are almost obsolete. The denticulation of the costa is almost obsolete.

Hab.—White Mountains (H. K. Morrison). A single male in Mr. E. Burgess's collection.

2. *EPIBATES LUCTIFER* n. sp., δ .—Deep velvet-black; wings uniformly brown. Length 8^{mm}.

Resembles the preceding in its coloring, but is easily distinguished by the uniformly brown color of the wings, which is only slightly darker on the distal half anteriorly and around the small cross-vein; denticulations on the costa minute, but distinct. Remains of some short, reddish-golden pile are perceptible on the sides of the thoracic dorsum, especially above the root of the wings. The thorax is beset with the same minute, sharp, rigid points; the under side of the head with long,

white hairs, which are also found on the front coxæ and the pleuræ; halteres with a brown knob. Legs black, in a certain light with a purplish reflection.

Hab.—Vancouver Island (G. R. Crotch). A single male.

3. *EPIBATES MURICATUS* n. sp., ♂.—Deep velvet-black; wings infuscated; halteres, including the stem, black; denticulations of the costa large and distinct. Length 15^{mm}.

Whole body uniformly deep black, very opaque on the thorax; all the pile black, including that on the under side of the head. Halteres altogether black. Front tarsi somewhat brownish. The sharp, rigid points with which the thoracic dorsum is beset are very distinct, and of different sizes; some are quite large; short, black pile among them. The wings are comparatively broader here than in the two preceding species; they are tinged with brown, the centers of the cells being somewhat paler; the latter portion of the costal cell dark brown; small cross-veins somewhat clouded; anterior branch of the third vein strongly bisinuate, almost S-shaped; discal cell somewhat broader and shorter than in *E. funestus* and *luctifer*; posterior cells 2, 3, 4, and especially the last, much shorter, the posterior cross-vein being a little farther from the proximal end of the discal cell.

Hab.—Sierra Nevada, California (H. Edwards). A single male.

4. *EPIBATES MARGINATUS* n. sp., ♀.—Black, beset with whitish pile, which forms fringes on the hind margins of the abdominal segments; wings infuscated. Length 8^{mm}.

Antennæ comparatively longer than in *E. funestus*, owing to the length of the first joint, which is distinctly longer than the third; they are black, beset with black pile. Head black, slightly whitish-pollinose along the inner orbits, beset with black pile on face and front, and with white pile on the under side and occiput; face rather projecting. Thorax black, subopaque, beset with long whitish pile, more dense and of a purer white on the pleuræ and coxæ. Abdomen deep velvet-black; hind margins of the segments with a fringe of short whitish pile; the last segment smooth, shining. Halteres with a brownish-white stem and brown knob. Legs black. Wings tinged with blackish-brown, which is more saturate along the veins, so that the inner portion of the cells is paler; the darker color of the base and of the anterior margin is very gradually evanescent posteriorly. The hind femora, on the under side, besides the usual pile, have two minute, stiff, spine-like bristles.

Hab.—San Francisco, Cal. (H. Edwards).

5. *EPIBATES MAGNUS* n. sp., ♀.—Altogether black; thorax deep velvet-black, with black pile; occiput beset with yellowish-white pile; first abdominal segment with a fringe of white pile; wings tinged with brown; second basal, anal, and axillary cells hyaline. Length 12–13^{mm}.

Head beset with black pile, except on the occiput, where it is yellowish-white; front very little shining, with a faint trace of grayish pollen.

Thorax deep velvet-black, with black, moderately long, erect pile; pleuræ somewhat shining, and, in a very oblique light, slightly grayish pollinose. Abdomen moderately shining, beset with sparse black pile, which is more dense on the under side and round the tip; first segment posteriorly with a fringe of white pile; some few white hairs on the side of the second segment on its hind margin. Halteres dark brown, the stem yellowish-brown. Wings infuscated, but less so than in the other species of the genus, darker along the anterior margin, the region of the stigma dark brown; brown clouds on the cross-vein at the base of the fourth posterior cell and on the bifurcation of the third vein, but both very little conspicuous; second basal, anal, and axillary cells hyaline; the fifth vein is margined with brown, the sixth is not. The hind femora on the under side, besides the usual pile, have four or five stiff, spine-like bristles.

Hab.—Vancouver Island (G. R. Crotch).

FIG. 6. *EPIBATES HARRISONI* n. sp., ♂.—Black; thorax and abdomen clothed with long, grayish-white pile; wings hyaline, anterior margin brown (the root, costal, first basal, and marginal cells). Length 14^{mm}.

Epistoma black, shining; occiput thickly clothed with grayish-white pile. Thorax deep black, opaque, clothed with whitish-gray pile, sparsely on the dorsum, more densely on the pleuræ; the rigid, sharp points on the dorsum are distinct. Abdomen cylindrical, black, with grayish-white recumbent pile, rather uniformly spread over all the segments (on the hind margins of each of the segments 3-7 in the middle, there is a small spot, denuded of gray pile, and therefore appearing darker black; these spots are too regular to be an accidental denudation of the specimen, which is nevertheless possible); on the sides of the first four segments long, white, erect pile; on the sides of the following segments, beginning with the fifth, a fringe of long, erect, black pile. Femora black, with some white pile; tibiæ and tarsi dark brown. Halteres yellowish-white, with a brown knob. Root of the wings, costal, first basal, marginal, and the proximal end of the first submarginal cells brown, somewhat darker around the stigma and on the small cross-vein; the remainder of the wing hyaline; veins brown; anterior margin with distinct denticulations.

A single male, in T. W. Harris's collection in the Boston Museum of Natural History; a label with H. Gray upon it. It is very probably from the Northern United States, as nearly all the specimens of the collection.

7. *EPIBATES NIGER* Macquart, Hist. Nat. Dipt., i, 390, 2 (*Apatomyza*); Dipt. Exot., ii, 1, 111, tab. xi, f. 1 (*id.*).

“Length 4½ lines. Black, with gray pile. Palpi reaching the tip of the antennæ; first joint elongated, cylindrical, hairy; the second a little less long, glabrous, attenuated at the base and tip. Wings spotted as in the preceding species (Wiedemann's *Apatomyza punctipennis* from the Cape); anterior margin denticulate on its posterior half in the male.”

Hab.—Georgia.

Observation.—This paper was already in press when I received a specimen of *Epibates* (*Apatomyza*) *niger* Macquart, collected by Mr. H. K. Morrison in Georgia. It is a male, but a not very well preserved specimen. The little spines on the thorax are almost obsolete in this species; with a strong magnifying glass, some traces of them are visible. The eyes are not contiguous on the front, but, like those of *E. muricatus* ♂, separated by a narrow, linear interval. The third antennal joint is much broader than in the other species; it expands immediately beyond the base, contracts again about the middle, and ends in an elongated point; the curves it forms, above and below, are not quite symmetrical, the one below being flatter; altogether, it has the shape of an elongated and somewhat irregular ace of spades. The principal figure of Macquart's gives a somewhat more correct representation of it than the figure of the head in profile. The anal cell is open.

Family THEREVIDÆ.

PSILOCEPHALA COSTALIS Loew, Centur., viii, 16.—California.

THEREVA COMATA Loew, Centur., viii, 9.—California.

THEREVA FUCATA Loew, Centur., x, 37.—California.

THEREVA MELANONEURA Loew, Centur., x, 36.—California.

THEREVA HIRTICEPS Loew, Berl. Entom. Zeitschr., 1874, 382.—San Francisco.

XESTOMYZA PLANICEPS Loew, Centur., x, 38.—California.

California seems to be quite rich in *Therevide*, as I have collected four species of *Thereva* (two in Marin County, one in Southern California, and one in Yosemite Valley), none of which I am able to identify with the above-quoted descriptions. *Xestomyza planiceps* I received from Mr. Henry Edwards. The following snow-white *Thereva* was very common in Yosemite Valley about the beginning of June:—

THEREVA VIALIS n. sp., ♂.—Grayish; clothed with snow-white pile, especially on the abdomen; antennæ black; femora black, with gray pollen; tibiæ brownish-yellow, black at tip; tarsi dark brown, brownish-yellow at base. Length 8–9^{mm}.

Male.—Head white, with white pile; some black bristles on vertex, and alongside of them on the occiput; some others on the face on each side of the antennæ (in some specimens only a few, which, for this reason, are discernible with difficulty); antennæ black, first joint not longer than the two following together, slender, whitish-pollinose, with white pile and near the tip with some black bristles. Thorax gray, being clothed with a dense pollen; two distinct longitudinal stripes white; white pile, especially on the pleuræ; the ordinary bristles black. Abdomen densely clothed with silvery-white pollen and long white pile; a few black bristles on the under side of the hypopygium. Femora dark, clothed with gray pollen and white pile; tibiæ brownish-yellow, the tip black; tarsi dark brown or black, base of the first joint brownish-yellow; on the middle tarsi, this color occupies nearly three-quarters of

the joint. Knob of halteres white, black at base. Wings hyaline; veins brown, except those at base and near the costa, which are pale yellow; fourth posterior cell closed.

Hab.—Yosemite Valley, California, June 9–11, common. Seven males.

Is very like *Thereva candidata* Loew from the Atlantic States, but differs in having a few black bristles on the face each side of the antennæ; the femora dark to the very tip; the tarsi brown, except at base; the wing-veins darker; the third antennal joint likewise darker.

Family SCENOPINIDÆ.

As I have no Californian species of this family, I will describe the following remarkable species from Missouri:—

SCENOPINUS BULBOSUS n. sp., ♂ ♀. *First posterior cell closed*, petiolate; head, thorax, and the sides of the abdomen sparsely covered with coarse, pollen-like grains. Length 5–5½^{mm}.

Antennæ black, hardly reddish at the suture between the second and third joints. Head and thorax blackish-bronze color; the front ♂ is an acute triangle, meeting the triangle of the vertex; the line of contact of the eyes is thus a very small one; in the ♀, the eyes are not contiguous, but separated by the moderately broad front; both front and vertex, in both sexes, are sparsely covered with yellowish-white, coarse, pollen-like grains. Thorax stouter and more gibbous than in *S. fenestralis*, covered above and on the sides with the same pollen-like grains, which are not dense enough, however, to conceal the ground-color. Abdomen black above; its sides and the venter covered with the same grain-like pollen. Halteres brown; legs black; roots of the tarsal joints more or less yellowish. Wings subhyaline (♂), slightly brownish anteriorly (♀); costal cell brownish; first posterior cell closed, the fourth vein being incurved toward the third, and ending in it at a considerable distance from the margin of the wing; the petiole thus formed is about equal in length to the posterior transverse vein in the ♂; a little shorter in the ♀. The second submarginal cell is nearly as long as the first posterior (therefore much longer than in *fenestralis*); the distance between the two cross-veins is a little shorter than the great cross-vein.

Hab.—Missouri, in July (C. V. Riley).

The grains of pollen which distinguish this species appear, under a magnifying power of 100–150, like elongated bulbs inserted on short stalks.

Obs.—This species shares the closed first posterior cell with the new genus *Atrichia*, formed by Loew for a Mexican Scenopinid (Centur., vii, 76); the latter, however, is described as elongated, slender, with slender feet, characters which by no means belong to *S. bulbosus*. The name *Atrichia*, revived by Dr. Loew from Schrank's Fauna Boica, 1803, where it was used for *Scenopinus*, cannot be maintained, as, in the mean time, the same name has been used by Mr. Gould, in 1844, for a genus of

Birds. As *Atrichia* Loew is not the same thing as *Atrichia* Schrank, and cannot, for this reason, date its claim earlier than 1866, *Atrichia* Gould has the priority. I propose to call the genus *Pseudatrichia*.

Family CYRTIDÆ.

The species described here are :—One *Opsebius* from California, and a second one from Vancouver Island; a *Pterodontia* from Oregon; two new *Eulonchi*, which raises to four the number of species of this peculiarly Californian genus. An *Oncodes*, which I also possess, has been already described by Mr. Loew.

The descriptions of a large new *Oceneæ* from Texas and of an *Oncodes* from New England are also added.

EULONCHUS.

Established by Gerstaecker, in the Stett. Ent. Zeitschr., 1856, for *E. smaragdinus*, this genus has been gradually increasing since, and counts now four species. None of them, as far I know, have been found outside of California. Within that State, they occur almost at sea-level, on the sands of Lone Mountain, San Francisco, as well as at an altitude of 8,000 feet in the Sierra Nevada.

Legs altogether yellow:

Proboscis (in ♂ and ♀ longer than the abdomen; body of the female bright metallic green.....*smaragdinus* Gerst.

Proboscis shorter than (♂) or as long as (♀) the abdomen; body metallic blue or purplish in both sexes.....*sapphirinus* n. sp.

Legs, or at least femora, black:

Tip of femora and the greater part of the tibiæ whitish-yellow; tegulæ uniformly white.....*tristis* Loew.

Legs altogether black, only the knees paler; tegulæ margined with black.....*marginatus* n. sp.

1. EULONCHUS SMARAGDINUS Gerstaecker, Stett. Ent. Zeit., 1856, p. 360.—Not uncommon on the sands about Lone Mountain, San Francisco, according to the statement of Mr. H. Edwards. Three green specimens which I have are females. Two male specimens which I received from Mr. Edwards are smaller (one of them only 9–10^{mm} long), the proboscis shorter, although still exceeding the abdomen in length; the coloring is bluish on the thorax, purplish-blue on the abdomen. Are they the males of this species? If they are, Dr. Gerstaecker was mistaken in describing his green individuals with a long proboscis as males.

2. EULONCHUS SAPPHIRINUS n. sp.—Antennæ black, sometimes brownish or reddish toward the tip; epistoma black or bluish-black; ocellar triangle dark blue or purple; sheath of the proboscis black; body metallic blue or purple, sometimes with greenish reflections, clothed with dense, erect, grayish-yellow pile on the thorax; abdomen with similar but much less dense pile, and with an appressed yellowish-white pu-

bescence, visible in a certain light only; feet straw-yellow; tarsi brownish toward the tip; wings grayish-subhyaline; costal cells brownish-yellow; costal and first longitudinal veins black on their proximal half, brownish-yellow toward the end; tegulæ whitish, their margins yellowish; knob of halteres yellow. The proboscis of the male does not reach the end of the abdomen; that of the female does not reach beyond it. Length 9-11^{mm}.

Hab.—Webber Lake, Sierra County, California, July 23-26, not rare, flying in circles around flowers. Three males and two females. A male and a female from Calaveras, Sierra Nevada, California, June (G. R. Crotch), have the proboscis a little longer than the abdomen.

This species is easily distinguished from *E. smaragdinus* ♀ by its smaller size, blue color, shorter proboscis, less yellowish wings; the two latter characters also distinguish the males, which are somewhat alike in coloring.

All my specimens, as far as I remember, were more uniformly blue when I took them, and seem to have assumed the purple and even greenish tinges, which they have now, in the process of drying.

3. *EULONCHUS TRISTIS* Loew, Centur., x, 19.—I found a male and a female in the Coast Range, in the woods of *Sequoia sempervirens*, above Santa Cruz, Cal., on a flower, May 21, 1876.

4. *EULONCHUS MARGINATUS* n. sp.—Metallic green, with bluish reflections on the scutellum, the anterior margins of the segments, etc.; venter metallic blue. Antennæ black. Thorax clothed with dense pale yellowish-white erect pile; abdomen with a short appressed pubescence, which forms whitish cross-bands along the hind margins of the segments. Legs black, and only the knees yellowish-white. Tegulæ with very distinct black margins. Wings subhyaline; all the veins dark brown, except the distal end of the costa and of the first posterior vein, which are reddish-yellow. Proboscis a little longer than the abdomen. Length 9^{mm}.

Hab.—Napa County, California (H. Edwards). A single specimen, apparently a male. The petiole of second submarginal cell is subobsolete; as I have only one specimen, I cannot say whether this is a permanent character of the species.

PTERODONTIA MISELLA n. sp.—Black; clothed with black pile; scutellum black, obscurely reddish on its latter half; second abdominal segment (that is, the first visible segment; the true first segment is concealed under the scutellum) black, with an obscurely marked reddish spot on each side a little back of the scutellum; segments 3-6 rufous, the third and fourth with square black spots in the middle, that on the fourth being narrower; they are confluent with each other and with the black of the second segment. Venter rufous; hind margins of segments 2-5 black. Tegulæ brownish, with broad dark brown margins. Legs brownish-yellow, the four posterior femora black; ungues reddish at base, black at tip. Wings subhyaline; veins yellow; venation similar

to that of the other species; the usual tooth on the edge of the costa, near the end of the first posterior vein, is very little projecting. Length 5^{mm}.

Hab.—Oregon (H. Edwards). A single specimen. This species is very like *P. flavipes* from the Atlantic States, but is smaller and differs in the coloring of the abdomen.

LASIA KLETTI Osten Sacken, in Lieutenant Wheeler's Report Explorations and Surveys, etc., vol. v, Zoölogy, 804.—Arizona.

OCNÆA HELLUO n. sp.—Two submarginal cells; five posterior cells, the first divided in two by a cross-vein, and the second half of it closed and petiolate, the fourth posterior cell likewise closed and short-petiolate; all the longitudinal veins reach the margin; body black, beset with short yellowish pile; hind margins of the abdominal segments with broad yellow borders, expanding along the lateral margins; legs yellow, including the coxæ. Length 13–14^{mm}.

The venation is like that of *O. calida* (Wiedemann, Auss. Zw., ii, tab. vii, f. 2b), with the following modifications:—1. The third vein emits a branch some distance beyond the cross-vein dividing the first posterior cell; thus a second submarginal cell is formed; 2. The cross-vein in the first posterior cell is just opposite the cross-vein at the base of the second posterior cell, and not far beyond it, as in Wiedemann's figure; 3. The vein between the second and third posterior cells reaches the margin; 4. The fourth posterior cell, which is closed, is much longer, forming an irregular parallelogram, with a cross-vein at its base.

Antennæ dark-brown, basal joints reddish, the elongated third joint also somewhat reddish on the inner side. Thorax black, shining, clothed with dense and soft yellowish-gray pile, almost rendering it opaque; humeral callosities whitish-yellow; antalar callosities brownish. Abdomen black, densely clothed with short, erect, yellow pile; all the segments with broad clay-yellow hind borders, expanding laterally so as to occupy the whole lateral margin; ventral segments black, with broad clay-yellow hind borders. Legs including coxæ yellow, the extreme end of the last tarsal joint and the ungues black. Wings very slightly tinged with brownish; costal cell a little more saturate.

Hab.—Dallas, Texas (Boll). One specimen.

Observation.—This fine species is not unlike Erichson's figure of *O. longicornis* (Entomographien, tab. i, f. 8), but the venation is different, the black on the abdomen occupies more space, the hind tibiæ are brown, the abdomen much stouter; the size is larger by one-half than the hair-line of the figure.

OPSEBIUS DILIGENS n. sp.—Of a slightly metallescent brownish-black color, clothed with brownish-yellow pile; legs brownish-yellow; wings tinged with brownish, the tip hyaline; first posterior cell divided in two by a cross-vein; the bases of the third and fourth cells nearly on the same line; anal cell closed and petiolate. Length about 5^{mm}.

The venation is like that of the European *O. inflatus* Loew (Wiener

Entom. Monatschr., 1857, p. 33, tab. i, f. 1), with the following differences:—1. The first posterior cell is divided in two (nearly equal) parts by a cross-vein placed between the end of the discal and the proximal end of the second submarginal cell (the same character distinguishes the two North American *Opsebius* described by Mr. Loew in the Centuries); 2. The third and fourth posterior cells have their proximal ends nearly on the same line; in other words, the insertion of the intercalary vein is coincident with the cross-vein at the base of the fourth posterior cell; 3. The fifth vein runs straight to the margin, and the sixth is incurved toward it a short distance from the margin. The costa is distinctly thickened between the ends of the first and the third veins, and a little beyond the latter. The wing is distinctly tinged with brownish, except at the base and the tip, which are subhyaline.

Body of a uniform brownish-black, slightly metallescent on the thorax. Thorax densely clothed with brownish-yellow erect pile, not dense enough, however, to conceal the shining surface under it. On the abdomen, the same pile is more dense on the second segment; the pile on the two intermediate segments is more blackish, except along the posterior margins, where it is yellowish; the fifth has a shorter and more appressed whitish-yellow pubescence, interspersed with longer pile; the last segment is black, shining, transversely rugose. Legs brownish-yellow; femora slightly tinged with brownish; coxæ, except the extreme tip, brown. Halteres with a yellowish-white knob; tegulæ semitransparent, colorless. Eyes pubescent; antennæ (broken).

Hab.—Vancouver Island (G. R. Crotch). Two specimens.

OPSEBIUS PAUCUS n. sp.—Very like *O. diligens*, but smaller, 4–5^{mm} long; sixth vein interrupted before the nearest cross-vein, and thus the anal cell open; the branches of the fourth vein do not quite reach the margin. Antennæ yellowish-brown at base; distal portion of the last joint and arista nearly black; pubescence of the eyes long and dense. Thorax with very dense, soft, erect, grayish-yellow pile; the greenish-black, shining ground-color but little visible under it. Abdomen brownish-black, moderately shining, densely clothed with brownish-yellow erect pile; the penultimate segment and the hind margin of the preceding one are clothed with recumbent yellowish-white pile. Wings slightly tinged with brownish, much less than in *O. diligens*, but more uniformly, as the paler color of the tip is not apparent. The rest as in *O. diligens*.

Hab.—California (G. R. Crotch). One specimen.

ONCODES MELAMPUS Loew, Centur., x, 17.—California. I have a specimen (brought by G. R. Crotch) which I doubtfully refer here. The tibiæ are brown, not black; the borders of the tegulæ very pale brownish; the wing-veins are very pale, except those near the costa, which are brownish.

ONCODES INCULTUS n. sp.—Brownish-black; humeral callosities brownish-yellow; antescutellar callosities yellowish-brown; posterior

margins of abdominal segments white; legs dark brown; knees brownish-yellow; wings strongly tinged with brown. Length 8^{mm}.

The brownish-black thorax and scutellum are clothed with a dense, short, yellowish pubescence; abdomen dark brown, segments 2 and 3 with narrower, 4 and 5 with broader, white posterior margins; venter, except the base, white; each segment with a black cross-band on the anterior margin. Tegulæ brownish, with narrow dark brown edges. Halteres with a brown knob. Wings comparatively long, strongly and rather uniformly tinged with brown. This color is darker in the costal cells, especially in the interval between the auxiliary and the first veins; costa distinctly incrassate in the region of the stigma; veins brown.

Hab.—White Mountains, New Hampshire. Two specimens.

Easily distinguished from the other described species of the genus by its strongly infuscated wings and its large size. The abdomens of my specimens being somewhat shrunken, the measurement I give is only an approximation.

Family MIDAIDÆ.

We have two Californian *Leptomidas*, the eight other species of the genus belonging to the Mediterranean fauna (Portugal, Algiers, Egypt) or South Africa.

The new genus *Rhaphiomidas* from California is closely related to *Mitrodetus* from Chili.

The anomalous genus *Apiocera*, intermediate between the *Midaidæ* and *Asilidæ*, has been found in Australia, Vandiemen's Land, and Chili. I describe a species from Yosemite Valley, California.

LEPTOMIDAS PANTHERINUS Gerstaecker, Stett. Ent. Zeit., 1868, 85. (Translation.)—"Wings slightly infuscated, with testaceous veins; body, antennæ, and legs luteous; head and basal cross-bands on the abdominal segments black. Length $8\frac{2}{3}$ lines" [about 19^{mm}].

"Antennæ considerably longer than the thorax; the stout basal joint only twice as long as the second, both beset with black bristles; the third joint is twice as long as the two first taken together, with an incrassate, distinctly separated tip; the terminal club is equal to the whole antenna in length, and is divided by a coarctation on the first third of its length in a narrow basal and an elongate-oval apical portion. The color of the antennæ is reddish-yellow; the tip of the third joint and the base of the terminal club are infuscated. Head black, only the small tumid clypeus and the lower oral edge reddish-yellow; pubescence altogether golden-yellow, somewhat longer on the clypeus. The broad labella of the short proboscis reddish-brown. Thorax yellow, with indistinct darker stripes and short yellowish pile on the dorsum; pleuræ shining light brown, variegated with black. Legs uniformly yellow, with light brown coxæ; ungues black at tip; hind femora not incrassate, before the tip on the inner side with a chestnut-

brown longitudinal streak, on the lower side sparsely beset with rather thin spines; hind tibiæ straight, long, and slender, sparsely beset with spines on the inner side as far as the knee; at the tip, a circle of longer spines. Wings uniformly tinged with a diluted brownish; veins pale yellow; halteres yellow. Abdomen of the same ground-color as the thorax, but with black cross-bands; the first segment quite black, except the hind margin, the second black on the anterior half; segments three to six have basal black cross-bands, triangularly expanded in the middle; they become narrower on each consecutive segment, so that the cross-band of the sixth segment is only a narrow anterior border; the hind margin of the segments is paler, more straw-yellow; on the second segment, it has on each side a brown, transverse callosity; the seventh and eighth segments are a little darker than the preceding ones, and are densely beset with black bristles; the spines of the last segment are ferruginous, obtuse.

"A single female from California, in the Berlin Museum."

I took two females on the sands of Lone Mountain, San Francisco, June 29, 1876. The coloring of the antennæ is variable; in one of my specimens, the whole club is black; in the other, it answers Dr. Gerstaecker's description; in both of my specimens, the knob of the halteres is brown, and not yellow.

LEPTOMIDAS TENUIPES Loew, Centur., x, 20.—California.

MIDAS VENTRALIS Gerstaecker, l. c., 102 (syn. *M. rufiventris* Loew, Centur., vii, §22).—California.

I do not know these species.

RHAPHIOMIDAS nov. gen.

Closely allied to *Mitrodetus* Gerstaecker (Stett. Ent. Zeit., 1868, 76), as there are three cells intervening between the forked cell and the margin of the wing, and as the structure of the proboscis is the same, long and linear, directed forward, with very narrow lips at the end; differing, however, from that genus in the structure of the antennæ; in some minor characters of the venation, among them the structure of the second submarginal or forked cell, which is petiolate at the proximal end only, and not at both ends; and in the presence of two distinct ocelli.

Vertex somewhat excavated on each side of the tubercle; the latter broad and flat, bearing two large *ocelli* on its sides (a character, as far as I am aware, unique among the true *Midaidæ*).

Antennæ a little longer than the vertical diameter of the head from the top of the eyes to the lower oral edge, inserted rather low, a short distance above the mouth; the first two joints form an almost cylindrical body, somewhat constricted about two-thirds of its length where the second joint begins; third joint about once and three-quarters of the two first taken together, in the shape of a rabbit's ear, with a ring-like expansion at the basis.

Face very short, in the profile nearly straight, moderately advancing in front of the eyes; oral edge cut obliquely; cheeks moderately broad.

Proboscis, if bent backward, would reach the scutellum, linear, straight, pointing forward; the two narrow lips at the end a little curled up. In my specimen, the head is somewhat distorted from its natural position; the proboscis is longitudinally cleft in two parts, both long and linear, at an angle to each other. Macquart (Dipt. Exot., 4e suppl., tab. iv, f. 1) represents the proboscis of *Mitrodetus* [*Cephalocera*] *dentitarsis* in a somewhat similar manner. Nevertheless, owing to the imperfect condition of my specimen, I am not prepared to affirm that this is a permanent character.

Venation of the wings:—Three cells intervene between the second submarginal cell and the margin of the wing. That cell is petiolate at the proximal end, coarctate at its distal end, which coincides with the tip of the first vein. The first posterior cell comes in contact with the first basal cell (I mean to say, is not petiolate). The small cross-vein near the posterior margin is absent, although a rudiment of it, in the shape of a minute stump of a vein, is perceptible in the usual place. (The venation is not unlike that in Gerstaecker, l. c., tab. i, f. 1; but the second submarginal cell is more ventricose, the contact between the first posterior and first basal is broader, so that the angle of the latter is not projecting; the discal-cell is shorter and broader, the second basal longer, the small cross-vein on the posterior margin absent, etc.)

In front of the halteres, there is a singular conical body, a little shorter than the halteres, the homology of which I do not attempt to explain.

Abdomen of the female with a circle of spines at the end.

I possess only a single, very much injured, female specimen; and if I venture, nevertheless, to describe it, it is on account of its very marked generic characters and its evident relationship to the Chilean genus *Mitrodetus*.

RHAPHIOMIDAS EPISCOPUS n. sp., ♀.—My only specimen having been very much injured by moisture, I can say very little about its natural color; at present, it is uniformly black, opaque (originally, it may have been gray); the three last abdominal segments shining; remains of long, brownish-yellow pile are visible on all parts of the body; short, black, appressed pile on the three last abdominal segments; knob of the halteres yellowish-brown. Antennæ dark brown, the third joint reddish-brown, especially at the base. Front coxæ black, beset with long yellow pile; femora dark brown; tibiæ reddish-brown, with dense, recumbent yellowish pile, and some scattered, long, black bristles; tarsi brownish-red; hind femora black (the middle legs and the hind tibiæ are broken off). Wings subhyaline, with a slight brownish tinge; the costal cell before the humeral cross-vein saturate yellowish-brown; the extreme proximal end of the marginal cell and the distal end of the costal cell have a similar brownish tinge. Length about 25^{mm}.

Hab.—California. One female.

The specimen has been for many years in my collection, labeled "California". I do not remember from whom I received it, but it may have come with a small lot of insects from Lower California.

APIOCERA.

A genus of doubtful systematic position; refused admittance to the *Midaidæ* by Dr. Gerstaecker, the last monographer of the family; excluded by Dr. Loew from the *Asilidæ*; not less remarkable for its geographical distribution.

Westwood (Lond. and Edinb. Phil. Mag., 1835; Arcana Entomologica, vol. i) introduced it for three species from Australia, and referred it, with a doubt, to the *Midaidæ*.

Macquart (Dipt. Exot., 2e suppl., 49, tab. ii, f. 1, 1847) introduced the same form from Van Diemen's Land, under the name of *Pomacera*, establishing a separate family, *Pomaceridæ*, for it.

Philippi (Verh. zool.-bot. Ges., 1865, 702, tab. 25, f. 26) established the genus *Anypennus* for the same form, discovered in Chili; he places it among the *Asilidæ*, and describes two species.

I possess a species from California which is undoubtedly an *Apiocera*. It has the same large, broad, spoon-shaped palpi; a short, strongly retreating face; a proboscis with very large lips; antennæ with a short, somewhat pear-shaped terminal joint, bearing a small style; the venation is exactly like that represented by Philippi in the above-quoted figure; the character of the coloring is the same as that of all the previously described species.

APIOCERA HARUSPEX n. sp., ♂.—Blackish-gray; abdomen black, with white cross-bands; three segments preceding the black hypopygium are white. Length 20^{mm}.

Face and palpi white, beset with white pile; antennæ black, basal joint beset with long white pile; front white; ocellar tubercle blackish. Thorax grayish-black above; humeral callosities white; a whitish longitudinal line and two lateral lines on the dorsum; the latter are expanded anteriorly into broad white triangles; two other white lines, curved anteriorly, between these lateral lines and the pleuræ; pleuræ grayish-white. Abdomen, first segment whitish on the sides, brownish in the middle, and with a fringe of black pile posteriorly; anterior margin of the second segment with a white cross-band, emarginate in the middle, expanding laterally; posterior margin with two large contiguous white triangles, prolonged laterally so as to coalesce on the lateral margin with the anterior cross-band; the intermediate region of the segment is deep black, opaque; third segment black, opaque, with a white cross-band on the anterior margin, emarginate in the middle; fourth segment black, with a vestige of a narrow white margin anteriorly, concealed under the preceding segment; the three following segments white; hypopygium black, large, oblong, resembling that of an *Erax*. Venter white. Legs grayish, with black spines; tibiæ and tarsi reddish-brown.

Wings hyaline; veins dark brown; venation exactly like that in Mr. Philippi's figure of *Anypenus*.

Hab.—Yosemite Valley, California. One male specimen.

Family ASILIDÆ.

In working up my western materials in the family *Asilidæ*, I have paid especial attention to the section of the *Dasyopogonina*, as the most numerous and the most rich in peculiar generic forms. I also described a few of the more striking forms of *Laphrina*. The section *Asilina* I have altogether left out for the present, for the reason that the *Asilina* from the Atlantic States are still in a state of confusion, and it will be better to work up all the species of this difficult group together.

My Californian collection in the section *Asilina* is remarkably small, which may in part be accounted for by the fact that these flies were not in season yet when I left San Francisco for the Sierra Nevada in the middle of July. Up to that date, I had only found a single species of *Machimus* (the Geysers, Sonoma County, May 5-7; also in Mariposa County, and in Yosemite Valley, in June) and an *Erax* (in Mariposa County). In May, June, and the beginning of July, I often visited localities in Marin and Sonoma Counties, also in the immediate surroundings of San Francisco (Lone Mountain for instance), where I could expect to find *Erax*, *Promachus*, *Proctacanthus*, without finding a single specimen, while *Dasyopogonina* were abundant. In the Sierra Nevada, in July, I found an *Erax*, a *Machimus*, a *Tolmerus*, and a species respecting the position of which I am in doubt, and which occurred quite abundantly about Webber Lake.

The most striking peculiarities of the Californian fauna, as far as known, consist in the occurrence of several genera of *Dasyopogonina*, hitherto not found anywhere else (*Ablautatus*, *Dicolonus*, *Callinicus*), and in the great abundance of species of *Cyrtopogon*, especially in the higher regions of the Sierra Nevada. In one locality, Webber Lake, I found thirteen species, nearly all on the same day, a number which exceeds that of all the known European species. *Daulopogon* also is well represented.

The genus *Nicoles*, hitherto found only in North America, is represented by two species in the Atlantic States and two in California; one occurs in Mexico.

Clavator, if my identification be correct, is common to California and Chili.

Among the genera characteristic of the western region in general, I will name the following:—

Ospriocerus, represented now by four or five species, occurs everywhere from Texas to California; also in Mexico. It is not known to occur outside of North America.

Stenopogon, with ten described and many undescribed western species, *Scleropogon*, with two described species, and *Saropogon*, with two spe-

cies, from Texas, also occur abundantly in the countries adjacent to the Mediterranean, the Black, and the Caspian Seas, and extend into Central Asia.

Microstylum, with two or three species in Texas and Kansas, is very abundantly represented in Southern Africa, and occurs also in the East Indies and Australia.

LAPHRIA.

1. LAPHRIA (DASYLLIS) ASTUR n. sp., ♂ ♀.—Like *Laphria posticata* Say, but the tibiæ beset with yellow pile. Length 14–20^{mm}.

Black; face, occiput, thoracic dorsum, and the two penultimate abdominal segments densely clothed with yellow hairs; palpi with black pile; a tuft of black bristles above the mouth is usually concealed under the overhanging yellow hairs of the face; scutellum with black pile. Legs black; front femora on their hind side and all the tibiæ with long yellow hairs; on the hind tibiæ, the yellow hairs do not quite reach the tip. Proximal half of the wings subhyaline; distal half more or less brownish, the inside of the cells being paler.

Hab.—Common in California; Petaluma, April 27; Mendocino, April 29 (J. Behrens); Saucelito, May 16. Most of my specimens, however, I caught about Webber Lake, Sierra Nevada (July 23–25). I have six males and nine females.

This species varies in the extent of the yellow pile, especially around the neck, on the pleuræ, and on the legs. As a rule, specimens taken at high altitudes have more yellow pile than those taken at lower ones. A specimen taken at Petaluma, therefore, but little above sea level, had no trace of yellow hairs on the tibiæ. The specimens from Webber Lake had a great many yellow hairs. The fan-like row of hair in front of the halteres is, in different specimens, either yellow or black. Some specimens have a yellow tuft in front of the wings, and another in front of the coxæ; in others, they are wanting. On the tibiæ, the yellow hairs appear sometimes only at the base.

2. LAPHRIA (DASYLLIS) COLUMBICA Walker, *The Naturalist in Vancouver's Island and British Columbia*, by J. K. Lord, London, 1866, 338.

“*Male.*—Black, with a very slight bronzy tinge; head very thickly clothed with slightly gilded hairs; vertex and hind side with black hairs; mystax composed of black bristles. Thorax clothed with short black hairs; fore part with a fawn-colored pubescence; a band of slightly gilded hairs across the hind part of the scutum. Abdomen clothed towards the tip with slightly gilded hairs; legs mostly clothed with slightly gilded hairs, except towards the tips; hind femora incrassated, with black hairs; hind tibiæ livid, and with slightly gilded hairs, except towards the tips. Wings blackish, discs of most of the areoletts cinereous; veins and halteres black. Length of the body 9 lines; of the wings 16 l.

"This species has most resemblance to *L. posticata*, from which it may be distinguished by the pale hairs on the hind tibiæ."

I owe to the kindness of Mr. Henry Edwards male and female specimens from Vancouver Island, which I refer to this species, although some of the statements in the description do not quite agree with them. It is very like *L. astur*, but it has a band of black pile across the middle of the thorax.

3. *LAPHRIA VULTUR* n. sp., ♂ ♀.—Whole body clothed with reddish-fulvous pile, especially dense on the abdomen; legs black; the black of the thorax as far as visible among the red pile has a bluish opalescent reflection. Length 15-20^{mm}.

There is but little to add to this diagnosis. The abdomen, especially in the female, is much more slender than in *L. astur*. The front legs on their hind side, sometimes also the middle legs are clothed with reddish-fulvous pile; much more in the male than in the female. The wings are hyaline on the proximal, infuscated on the distal half. Male forceps beset with reddish-fulvous pile.

Hab.—The woods of the Coast Range, above Santa Cruz, Cal., May 22; Webber Lake, Sierra Nevada, July 27. I received a specimen from Oregon from Mr. H. Edwards; two males and one female.

4. *LAPHRIA RAPAX* n. sp., ♂.—Head, posterior part of the thorax, and two first abdominal segments with whitish, the remainder of the abdomen, except the genitals, with ardent rufous pile; legs black. Length 20^{mm}.

The lower part of the head and the base of the proboscis beset with whitish pile; face likewise, but many black, erect hairs are mixed with the white ones; hair under the antennæ altogether black. Front part of the thoracic dorsum with short, black pile; the hind part with longer, semi-recumbent, whitish pile; scutellum with some whitish pile; male forceps very large; wings, as usual, brownish on the distal half and hyaline on the proximal.

Hab.—Webber Lake, Sierra Nevada, July 28. A single male.

LAMPRIA.

LAMPRIA FELIS n. sp., ♀.—Head, thorax, base of the abdomen, and coxæ black; the rest of the abdomen and the legs red; wings tinged with brownish. Length 11^{mm}.

The pile on the head is altogether black, except a small tuft of silvery hairs on each side, above the mystax, near the eye. The black of the thoracic dorsum shows a bluish opalescence, a pair of small spots of silvery pollen anteriorly, and another pair of less distinct, similar spots on the humeri. Halteres yellow. First abdominal segment and a large semi-circle on the second bluish-black. Alula and the proximal part of the axillary cell hyaline.

Hab.—Webber Lake, Sierra Nevada, California, (July 26). A single female.

CERATURGUS.

CERATURGUS LOBICORNIS n. sp., ♂ ♀.—The third antennal joint as well as the first joint of the antennal style have the terminal lobes prolonged beyond the insertion of the following joint. Thorax black, beset with short, appressed, golden-yellow pile. Abdomen yellowish-red; venter black. Legs reddish-yellow; base of front and middle femora black. Length, male, 10–11^{mm}; female, 11–12^{mm}.

Face and front black, shining; above the mouth a row of yellowish bristles; a few similar bristles on each side of the front, near the eyes. Antennæ black; third joint a little longer than the two first taken together; at the end, with two lobes, projecting beyond the insertion of the next joint; the two following joints, forming the so-called antennal style, taken together are somewhat shorter than the third joint; the first of them is a little shorter than the second, and has two projecting lobes, longer than those of the third joint. Thorax black, clothed on the dorsum with moderately dense, short, appressed, golden-yellow hairs, under which the shining black surface is visible; in the middle, a geminate, nearly bare, black stripe, formed by lines of denser pile on its sides and in the middle; on the anterior part of the pleuræ, a dense patch of golden pile, followed by a shining black spot behind. Halteres yellow. Abdomen yellowish-red above, smooth, shining; the extreme lateral margins of the segments black (more distinctly so in the female); base somewhat darker in the male; venter black. Legs reddish-yellow; coxæ and trochanters black; base of four anterior femora more or less black; tarsal joints more or less brown at the tip; the fifth, except the root, altogether brown. Wings in the male tinged with brown, especially near the anterior margin; the apex subhyaline; in the female, the basal half is yellowish, the posterior and distal portion brownish. (I suspect that the coloring of the wings is very variable.)

Hab.—Snake River, Idaho (C. Thomas). Two males and one female. I have a female from California (G. R. Crotch), the face and front of which are brownish-red. The thorax also shows traces of reddish about the humeri and on the pleuræ; the venter is red, and the four anterior femora have no black at the base. I believe, nevertheless, that it is the same species. The antennæ of the specimen are broken. The specimens from Idaho had been kept in alcohol; hence the antennæ are somewhat distorted.

DIOCTRIA.

Europe contains between twenty and twenty-five species of this genus while in the North American fauna it was hitherto represented by two rather aberrant species, *D. albius* Walker, from the Atlantic States, and *D. resplendens* Loew, from California. A third species, *D. pusio* n. sp., from California, is remarkably small, but nearer to the normal type of the genus than the other two.

1. *DIOCTRIA ALBIUS* Walker, List, etc., ii, 301.—I have several spe-

cimens from California (San Rafael, Marin County, May 29; Sonoma County, July 4) and Vancouver Island (G. R. Crotch), which are very like *D. albius* from the Atlantic States, but seem to differ in the abdomen being less narrow and less glabrous; the scattered, fine, yellowish-red pile of the abdomen, which is very little conspicuous in the Atlantic specimens, is very distinct in the Californian ones. However, *D. albius* from the Atlantic States is subject to variations the limit of which is, as yet, very doubtful to me. I have ten male and female specimens before me from the Catskill Mountains, New York, from the White Mountains, and from the Palisades, New Jersey, opposite New York. Some of the males have the whole axillary region of the wing distinctly whitish; in others, this whitish tinge is very distinct on the whole proximal half of the wing. One of the male specimens from the White Mountains has the proximal two-thirds of the wings pale yellowish, the distal third blackish, the tibiæ yellowish-red except at the tip, the front femora yellowish-red except a broad black stripe on their upper surface. This specimen may be a distinct species, but it is singular that the two specimens from Vancouver Island also have the base of the tibiæ yellowish-red; the femora, however, are altogether black. The other Californian specimens show the same tendency to vary in the coloring of the wings as the Atlantic specimens. In this uncertainty, I prefer not to describe my Californian specimens until a larger number can be procured.

2. *DIOCTRIA RESPLENDENS* Loew, Centur., x, 21.—California. I have seen (in Mr. Burgess's collection in Boston) a specimen of this easily recognizable species.

3. *DIOCTRIA PUSIO* n. sp., ♀.—Thorax and abdomen black; segments 3-5 of the latter, dull reddish; legs yellowish-red; hind tibiæ dark brown except the tip. Length 4.2^{mm}.

Antennæ long, black, inserted on a small protuberance; third joint (without the style) as long as the first two taken together; the style not quite half as long as the joint, with a small expansion at the base (somewhat like Meigen, tab. 19, fig. 20, only the style, in comparison to the joint, is longer in *D. pusio*); face with a pollen, which is golden-yellow above, silvery below; mystax of a few whitish hairs; front and occiput black; posterior orbits and two spots above the neck on the occiput silvery-pollinose. Thorax black, shining; dorsum with three faintly indicated lines of microscopic pubescence; the lateral ones expanded into triangles anteriorly; pleuræ with several spots with a partly silvery, partly golden reflection. Knob of halteres lemon-yellow. Legs red, including the coxæ; hind tibiæ dark brown, except the tip, which is red and somewhat incrassated; first joint of hind tarsi large and stout. Abdomen black, shining, smooth; second segment with a greenish reflection; the three following segments are reddish, but with darker, metallic reflections. Wings with a rather uniform, slight brownish tinge; anal cell open; veins brown, yellowish at base; venation normal.

Hab.—Sonoma County, California, July 4. A single specimen.

ABLAUTATUS.

A new genus, established by Dr. Loew (Centur., vii. 63) for a Californian species, under the name of *Ablautus*; modified later (Berl. Ent. Zeit., 1874, 377) in *Ablautatus*. The species, *A. trifarius*, is described from a female specimen.

I have a male and two females which undoubtedly belong to this genus, but apparently to a different species, as the legs are altogether black, and beset with white spines, including the tarsi. I caught my species in company with *Clavator sabulorum*, which seems to mimic it, as its body is almost exactly of the same coloring; both occur on sandy soil.

The genus is easily recognizable by its large ungues and the total absence of pulvilli.

The following generic characters belong to *A. mimus*, but seem in the main to agree with *A. trifarius*.

Front and *face* comparatively narrow; face almost flat, with a dense mystax, reaching nearly up to the antennæ; front very little broader above.

Antennæ.—Third joint by about one-half longer than the two first taken together, elongated, with a coarctation a little before the middle, and a slight incrassation beyond the middle (not unlike the third joint in an ordinary *Cyrtopogon*, only both the contraction and expansion are more marked); antennal style short, less than one-fifth the length of the joint, cylindrical, with a microscopic bristle; the two basal joints of the antennæ have, on the under side, several conspicuous bristles, some of them more than half the length of the antennæ; some very small hairs on the upper side.

Thorax.—Besides the usual hairs and bristles, there are some conspicuous bristles on its front part, on the sides of the median stripe, which do not exist in *Cyrtopogon*; scutellum with a row of long, erect bristles on its edge.

Eyes with the facets of the middle region very much enlarged (much more so than in *Clavator*).

Abdomen rather narrow, moderately convex, flatter in the female than in the male, gently tapering toward the tip; male hypopygium rather small; ovipositor with the usual star of bristles. At the base, on the sides, the usual long hair, besides which, on the first segment, a fan-like row of bristles is perceptible, which are white in *A. mimus*, and are described as "lutescent" for *A. trifarius*. I believe I see similar, but shorter, spines on the following segments, but they are white, like the pubescence surrounding them, and difficult to distinguish from it. Besides the longer white pile on the under side, the sides of the abdomen and the hypopygium are clothed with short, more or less recumbent, white pile.

Legs of moderate length and stoutness, very hairy, and beset with

bristles, not only on the tibiæ, but also on the upper side of the front and hind femora; unguis remarkably long, and no vestige of pulvilli; the two last joints of the front tarsi in *A. mimus* are ornamented with a dense brush of short bristles.

Wings like those of *Cyrtopogon*; all posterior cells open; anal cell with a narrow opening; small cross-vein a little beyond the middle of the discal cell.

1. *ABLAUTATUS TRIFARIUS* Loew, Centur., vii, 63, *female* (California).

2. *ABLAUTATUS MIMUS* n. sp., ♂ ♀.—General coloring brownish-gray, with a series of rounded blackish spots along the middle of the abdomen, one at the base of each segment; larger black spots in the anterior corners of the same segments form two lateral series; segments 7 and 8 in the male black, shining, beset with white pile; segment 7 in the female black, shining. Thorax gray, with the usual three darker stripes. Legs black, densely beset with rather long, recumbent white hairs, and long, white, erect bristles; unguis black. The two last joints of the front tarsi in the male appear incrassated, because they are densely beset with black and yellow, recumbent, and closely packed short bristles, forming a kind of brush, the end of which reaches considerably beyond the unguis; the under side of this brush is black, on its upper side it is mixed of black and yellow; the ends of the first three joints of the front tarsi are armed with strong bristles, or spines, which are black, with a yellowish root; a couple of such spines in the middle of the first joint. In the female, the front tarsi are simple, and all the spines upon them are white, like all the other spines on the legs. Halteres honey-yellow. Antennæ black, the spines on the under side of the first two joints brownish-yellow. Fan-like fringe of hair in front of the halteres white. Mystax white, a few black bristles above the mouth; occiput with white pile. Wings very hyaline; veins black. Length 7–8^{mm}.

Hab.—Crafton, near San Bernardino, Southern California, in March.

OSPRIOCERUS.

1. *OSPRIOCERUS ÆACUS* Wied., i, 390 (syn. *Dasyopogon abdominalis* Say).—Not rare about Colorado Springs, Colo. (P. R. Uhler). Wiedemann's description agrees with the female; in the male, the sixth and seventh abdominal segments are red; the hypopygium black. I also have two males from Spanish Peaks, Colo., June 15 (W. L. Carpenter), which agree with the others.

2. *OSPRIOCERUS EUTROPHUS* Loew, Berl. Ent. Zeit., 1874, 355, *female* (Texas).—I have seen two females from Kansas (G. F. Gaumer), which belong here; one of them had the thoracic dorsum reddish, a variety which Dr. Loew mentions as occurring in *O. rhadamanthus*.

3. *OSPRIOCERUS RHADAMANTHUS* Loew, Centur., vii, 52, *male* (Pe-

cos River, New Mexico).—I have no specimen of this species. Is it not the male of the preceding? The difference in the coloring of the abdomen between both corresponds exactly to the sexual difference of the same kind in *O. wacus*.

4. *OSPRIOCERUS MINOS* n. sp., ♂.—Altogether black; wings blackish. Length 17–18^{mm}.

The face is slightly grayish-pollinose; the abdomen is more cylindrical, less flattened than in the male of *O. wacus*; the last antennal joint seems a trifle longer. In other respects, the specimen looks like a unicolorous *wacus*.

Hab.—Golden City, Colo., July 3 (A. S. Packard).

5. *OSPRIOCERUS ÆACIDES* Loew, Centur., vii, 51, California.—I do not know it.

STENOPOGON and SCLEROPOGON.

These genera, especially the former, are very abundantly represented on the western plains and in California. Ten species of *Stenopogon* and two of *Scleropogon* are described by Dr. Loew from those regions. I have several species which, I believe, are new, but I would not attempt to describe them without comparing them with all the previously described species, several of which I do not possess.

DICOLONUS.

I do not know *D. simplex* Loew (Centur., vii, 56), the Californian species for which the genus was established.

CALLINICUS.

CALLINICUS CALCANEUS Loew (Centur., x, 32), for which the genus was established, is not rare in California. I found it about San Rafael, Marin County, May 27, and received several specimens from Mr. H. Edwards, also taken in Marin County.

CLAVATOR.

A species from Southern California agrees very well with the genus *Clavator*, established by Dr. Philippi for several species from Chili (Verh. zool.-bot. Ges., 1855, 699, tab. xxvi, f. 31). The first of these species, *C. punctipennis*, must be considered as the true representative of the genus; the other species have the third posterior cell closed and the antennæ of a different structure; hence it is very doubtful whether they belong in the same genus. The agreement of my species is with *C. punctipennis*.

This generic identification would be rendered certain, if it could be ascertained whether *Clavator punctipennis* belongs in the number of *Dasygogonina* which have a spur at the end of the front tibiæ. Dr. Philippi does not say anything about it, and may have easily overlooked this character. My *C. sabulorum* has such a spur.

Dr. Gerstaecker (Entom. Ber., 1865, 99 and 113) identifies *Clavator* with *Hypenetes* Loew, established for a species from Caffraria; unfortunately, he does say on what grounds this identification is based. Dr. Schiner (Die Wiedemann'schen Asiliden and Novara) reproduces this synonymy, without any remark. Now if *Clavator punctipennis* has, like my Californian species, spurs at the end of the front tibiæ, it cannot be the same thing as *Hypenetes*, which has no such spurs. An attentive scrutiny of Dr. Loew's description discloses other characters which I do not find in my specimen, but which it would be superfluous to discuss here.

Head not unlike that of *Cyrtopogon*, but much smaller and narrower; mouth comparatively much larger and broader, cut obliquely, so that in the profile the head below the face appears retreating; face short, excised, in the profile, under the antennæ, the gibbosity beginning immediately below; the mystax occupies the center of the gibbosity, without reaching the eyes or the antennæ; the front is not perceptibly broader above.

Antennæ.—First joint subcylindrical, short; the second still shorter; the third somewhat longer than the two first taken together, attenuated at the base for about one-quarter of its length and then expanded to three times the breadth of its narrow portion, then attenuating again toward the tip (the shape of the third joint holds the middle between the figures 1 and 2 on page 699 of Philippi); at the end, a minute cylindrical style, ending in a microscopic bristle.

Proboscis a little shorter than the vertical height of the head, directed downward; palpi rather long.

Thoracic dorsum on each side of the central stripe with a longitudinal row of long, stiff, erect bristles; there are seven or eight in each row; a number of similar bristles on the sides of the dorsum. I perceive two on the antescutellar tubercle, two others in front of these, and again two (sometimes three) above the root of the wing, in front of the suture; scutellum with six similar bristles.

Abdomen subcylindrical, narrow, somewhat broader at the base; male hypopygium not stouter than the abdomen; female ovipositor with a star of short spines.

Legs rather strong; tibiæ and tarsi spinous; front and middle femora with a single spine on the hind side a short distance before the tip; front tibiæ with an S-shaped spur at the tip; ungues long; pulvilli also.

Wings like those of *Cyrtopogon*; anal cell very little open, sometimes closed; small cross-vein about the middle of the discal cell; second submarginal cell considerably longer than the second posterior; all posterior cells open; fourth posterior slightly coarctate. (Compare Dr. Philippi's above quoted figure.)

CLAVATOR SABULONUM n. sp., ♂ ♀.—Yellowish-gray; thorax with a geminate blackish stripe; abdomen with a longitudinal row of blackish spots; wings hyaline. Length 7-7.5^{mm}.

Yellowish-gray; face whitish, with a tuft of white pile on the gibbosity; in the female with a few (I count six) black bristles above the mouth, which I do not perceive in the male; ocellar tubercle, in the female, with a tuft of stiff, black bristles (I count eight); in the male, these bristles are white, and the front shows on each side a row of similar, but smaller, white bristles; in the female, the latter bristles are very thin and small. Antennæ black; first joint with white pile beneath; second joint on the under side with a couple of black bristles; occiput with yellowish bristles above, and with long, soft, white hairs below. Thoracic dorsum with a geminate brown stripe in the middle, and two broader stripes on the sides, abbreviated long before the humeri; the fan-shaped fringe of pile in front of the yellow halteres is white in the male, black in the female. Abdomen yellowish-gray, with whitish-gray reflections; an ill-defined, elongated, darker spot, not reaching the posterior margin, in the middle of each segment; a similar dark spot on each side of the segments 2-6; the last segment in the female shining brownish-black; in the male, hypopygium black, shining, with long white pile. Wings hyaline, a little less pure hyaline in the female, in which a strong lens shows hardly perceptible vestiges of brown clouds on the cross-veins. Legs black; femora at the base and tip and base of tibiæ red; tarsi brownish; the spines on the tibiæ in the male are mostly white; some black spines are perceptible on the upper side, especially of the front tibiæ; in the female, the spines are black; very few white ones are visible.

Hab.—Crafton, near San Bernardino, Cal., March, on dry, gravelly soil. Two males and one female.

PYCNOPOGON.

I have never seen a specimen of this genus, and have to rely on the statements of Dr. Loew (Linn. Ent., ii, 526). These statements convince me that I have a species of this genus before me, or at least one closely allied to it. The characters of the species are so well marked that it will easily be recognizable.

PYCNOPOGON CIRRHATUS n. sp., ♂.—Black; thorax with white hairs; abdomen with recumbent, golden-yellow pile, especially dense on its latter part; femora black; tibiæ red; middle tibiæ before the middle with a tuft of black pile. Length 8.5^{mm}.

Head and face clothed with white pile; some black bristles above the mouth and also in the upper part of the occiput. Thorax black (the dorsum is greasy in my specimen), with long, soft, white pile; the usual bristles black. Halteres lemon-yellow; the fan-shaped tuft in front of them rather dense, pale yellow. Abdomen black, shining, finely and sparsely punctate; segments, beginning with the second, clothed with recumbent, silky golden-yellow hair, growing gradually more dense on each subsequent segment; this hair is less dense at the bases of segments 2-5; sides and under side beset with long, yellow hair. Femora

black, with white pile; tibiæ red, with white pile and black and white bristles; the middle tibiæ, on the front side, before the middle, are ornamented with a conspicuous tuft of black bristles, projecting on each side; hind tibiæ with a brownish ring a little before the middle. Wings feebly tinged with yellowish-brown on the proximal two-thirds, the rest hyaline; fourth posterior cell coarctate; anal cell slightly open.

Hab.—Foot-hills of Mariposa County, on the road to Clark's Ranch, beginning of June. A single male.

CYRTOPOGON.

The large number of species of this genus occurring in California is very remarkable. While only ten or eleven species are known from the whole of Europe, I found thirteen species, eleven of which were new, almost all on the same day, near Webster Lake, Sierra Nevada. Another remarkable fact is the peculiar sexual ornamentation of some of these species, especially of the legs of the male, which, as far as I am aware, does not occur in Europe. One of the species so ornamented occurs in the Rocky Mountains.

The structural characters of these numerous species (several of which I left undescribed for want of good specimens) offer a great variety, and will facilitate a subdivision of the genus. The synoptical table I give is a very imperfect attempt at such a grouping. The two last species, *C. cerussatus* and *C. nebulo*, especially the latter, are only provisionally placed in the genus, for want of a better place. In using the analytical table which follows, attention should be paid to the sex of the specimen, as some of the species were described in one sex only.

Synoptical table of the species.

- I. Scutellum rather convex above, its posterior edge rounded; surface black, sometimes pollinose at the base only, and beset with long pile; legs densely pilose, and rather stout (except in *C. princeps*, where they are more slender):
- A. Hind tibiæ more or less reddish in the middle:
- (a) Front tarsi ornamented in the male with dense silvery pile; middle tarsi with disks of black bristles:
1. *callipedilus* ♂ ♀; 2. *cymbalista* ♂ ♀; 3. *plausor* ♂ ♀.
- (aa) Front and middle tarsi not ornamented as above:
4. *montanus* ♂ ♀; 5. *leucozonus* ♀; 6. *aurifex* ♂ ♀.
- AA. All the tibiæ entirely black:
7. *princeps* ♂; 8. *cretaceus* ♀; 9. *longimanus* ♂ ♀.
- II. Scutellum more or less flattened above; surface densely grayish-pollinose; legs moderately hairy, and not very stout (rather hairy in *C. rattus*):

B. Abdomen black, with white spots or cross-bands on the hind margins of the segments :

(b) Legs reddish :

10. *profusus* n. sp. ♂ ♀.

(bb) Legs black :

11. *evidens* n. sp. ♂ ♀ ; 12. *rejectus* n. sp. ♀ ; 13. *nugator* n. sp. (♂ ?) ♀ ; 14. *positivus* n. sp. ♂ ; 15. *sudator* n. sp. ♂ ♀.

BB. Abdomen gray, with black spots :

16. *rattus* n. sp. ♂ ♀.

Aberrant species.

17. *cerussatus* n. sp. ♂ ♀ ; 18. *nebulo* n. sp. ♀.

Analytical table for determining the species.

- (1) { Antennal style fully as long as the third antennal joint ; wings with distinct brown clouds on the cross-veins and on the bifurcation of the third vein 18. *nebulo* n. sp., ♀.
 { Antennal style much shorter than the third antennal joint ; wings without distinct brown clouds, etc., (2):
- (2) { Third antennal joint red, (16):
 { Antennæ altogether black, (3):
- (3) { Hind tibiæ more or less red in the middle, (4):
 { Hind tibiæ black, (9):
- (4) { *Male*: front tarsi with a conspicuous dense fringe of silvery pile ; two last joints of middle tarsi with a disk of black bristles ;
female: hind margins of abdominal segments white on the sides only, sometimes very little, (7):
 { *Male*: front and middle tarsi plain ; *female*: hind margins of abdominal segments 2-5 altogether white, (5):
- (5) { Scutellum convex, black ; the brownish pollen at the base, if any, is hardly perceptible ; densely pilose with long, erect pile ; face in the middle with white pile, (6):
 { Scutellum flat, covered with dense gray pollen ; longer hairs along the edge only ; face altogether with black hairs,
 10. *profusus* n. sp. ♂ ♀.
- (6) { The fan-like row of hairs in front of the halteres is black,
 4. *montanus* Lw., ♂ ♀.
 { The fan-like row of hairs, etc., is white 5. *leucozonus*, Lw., ♀.
- (7) { Scutellum shining black, (8):
 { Scutellum with gray pollen 3. *plausor* n. sp., ♂ ♀.
- (8) { Abdomen with white pile on the sides .. 1. *callipedilus* Lw., ♂ ♀.
 { Abdomen with black pile on the sides from the very base,
 2. *cymbalista* n. sp., ♂ ♀
- (9) { Abdomen gray, with black, shining spots.. 16. *rattus* n. sp., ♂ ♀.
 { Abdomen black, with white cross-bands, (10):
- (10) { White cross-bands on the anterior margins of the segments,
 17. *cerussatus* n. sp., ♂ ♀.
 { White cross-bands on the posterior margins of the segments, (11):

- (11) { Scutellum shining black; legs very hairy ..9. *longimanus* Lw., ♂ ♀.
 { Scutellum with gray pollen; legs moderately hairy, (12):
- (12) { The fan-like fringe of hairs in front of the halteres is white, (13):
 { The fan-like fringe, etc., is black, (15):
- (13) { First abdominal segment with a white cross-band, occupying
 { nearly the whole posterior margin11. *evidens* n. sp., ♂ ♀.
 { First abdominal segment with white spots on the sides only, (14):
- (14) { Wings brownish-hyaline on the distal half; ungues black, reddish
 { at the base only; length 9-10^{mm}12. *rejectus* n. sp., ♀.
 { Wings almost uniformly hyaline; ungues yellowish-white, black
 { at the ends only; length 7-8^{mm}13. *nugator* n. sp., (♂?) ♀.
- (15) { Front and face broad, with a hoary bloom ..15. *sudator* n. sp., ♂ ♀.
 { Front and face rather narrow, the bloom upon them not hoary,
 { 14. *positivus* n. sp., ♂.
- (16) { Tibiæ black, (17):
 { Tibiæ, except the tip, red6. *aurifex* n. sp., ♂ ♀.
- (17) { Scutellum black, shining, (18):
 { Scutellum with gray pollen8. *cretaceus* n. sp., ♀.
- (18) { Hairs on the face black, mixed with some white (compare *longi-*
 { *manus* Lw.).
 { Hairs on the face yellowish; front tarsi of the male unusually
 { long; front and hind tarsi with silvery hairs on the upper side,
 { 7. *princeps* n. sp., ♂.

1. CYRTOPOGON CALLIPEDILUS Loew, Berl. Ent. Zeit., 1874, 358, ♂ ♀.
 —*Male*.—Black; thoracic dorsum with a very weak brownish pollen, forming an indistinct geminate stripe in the middle and some ill-defined marks on the sides; long white pile on the face, the lower part of the occiput, front part of the chest, fore coxæ, and the sides of the two first abdominal segments; black pile on the remainder of the abdomen and the top of the head; some scattered black hairs on the thorax above and some black hairs in the mystax above the mouth. Femora black with long, soft, white pile; tibiæ reddish, beset with blackish pile; tarsi black, except the first joint of the four hind tarsi, which is often reddish to a greater or less extent from the root; the front tarsi, beginning with the second joint, are densely beset on their upper side with recumbent, short, silvery hairs, parted in the middle; the under side of the same joints is densely beset on both sides with short, black bristles; the two last joints of the middle tarsi have on each side a dense, flattened tuft of black bristles, which form together a kind of disk, which is a little broader than long. Wings grayish-hyaline, more hyaline on the proximal half.

Female.—Head, and especially the face, covered with a dense whitish-gray pollen; the thoracic dorsum covered with a brownish-gray pollen, completely concealing the black ground-color, except at the four corners and on the scutellum, which is black and shining; a geminate darker line in the middle of the dorsum, not reaching the scutellum; pleuræ likewise clothed with dense yellowish-gray pollen. Abdomen shining

black, the hind margins of the segments 2-5 with white triangles on each side. The hairs on head and chest are like those of the male, but of a less pure white; the white hair on the sides of the abdomen reaches to its tip, gradually becoming shorter. Legs like those of the male, but the sexual ornaments on the front and middle tarsi are wanting. Wings with the grayish tinge a little more saturate than in the male.

Length, ♂ 11-12^{mm}; ♀ 11-13^{mm}.

Hab.—Yosemite Valley, California, June 5-12; Summit Station, Sierra Nevada, July 17; Webber Lake, Sierra County, California, July 22-26. Eight males and seven females.

Dr. Loew (l. c.) has given a very detailed description of the male; that of the female must have been taken from a very imperfect specimen, as it is not recognizable.

2. *CYRTOPOGON CYMBALISTA* n. sp., ♂ ♀.—*Male.*—Like the preceding in the ornamentation of the four anterior tarsi and in the general coloring of the body, but with the following differences:—

The abdomen is uniformly clothed with black pile. The white pile on the lower part of the occiput and on chest and front coxæ is less long and conspicuous. The black pile on the upper part of the occiput reaches much lower here. Only the four anterior femora have some white pile on their posterior side. The brownish pollen on the thorax is hardly perceptible here. The front tibiæ and the tips of the four hind tibiæ are black. Besides the silvery hair on joints 2-5 of the front tarsi, some silvery pile is also perceptible on the first joint. The under side of the same tarsal joints is not beset with dense brushes of short black bristles, as it is in *C. callipedilus*, so that the white silvery hairs are visible from below, which they are not in the other species. The pulvilli of the four hind tarsi are brown, while in *C. callipedilus* they are whitish. The wings are a little shorter. The abdomen is slightly tapering from base to tip, instead of being nearly cylindrical, as in *C. callipedilus*. A vestige of a spot of whitish pollen is generally visible in the hind corner of the fourth segment.

Female.—Black, shining; thoracic dorsum with a slight brownish pollen, which is a little denser than in the male, but much less dense than in *C. callipedilus* ♀. The hair on the face is deep black; a little whitish pile on the lower part of the occiput and on the front coxæ; pile on the legs black; their coloring the same as in the male; only the front tibiæ sometimes are reddish at the base and along their front side; abdomen with small triangles of whitish pollen on the hind corners of segments 2-4, the largest on the fourth segment. The shape of the abdomen is different from that of *C. callipedilus* ♀; gradually tapering from base to tip, instead of slightly expanding about the middle. Length, ♂ 11-12^{mm}; ♀ 12-13^{mm}.

Hab.—Summit Station, Sierra Nevada, July 17; Webber Lake, July 23-24; both sexes found in each locality. Three males and four females.

3. *CYRTOPOGON PLAUSOR* n. sp., ♂ ♀.—Very like the two preceding

species in the ornamentation of the four anterior tarsi of the male, and at the same time very different, even in those characters.

Male.—Pile on the face pale yellow, sometimes yellowish-white, black above the mouth; lower part of the head posteriorly and front part of the chest with yellowish-white pile; thoracic dorsum, including even the base of the scutellum, covered with a yellowish-brown pollen, except at the four corners, which are black; three stripes on the dorsum are less pollinose, and therefore darker; the intermediate one geminate, and abbreviated posteriorly; the lateral ones broad, abbreviated, and rounded anteriorly, converging toward each other posteriorly, in front of the scutellum; abdomen black, shining, clothed on the sides with dense yellowish pile, gradually diminishing in length toward the tip. Legs black; tibiæ reddish, black at tip; front tibiæ often altogether black. Joints 2-5 of the front tarsi densely beset with silvery-white recumbent hairs along the outer and upper side only, and therefore not parted in the middle (in the two preceding species, the silvery hairs are found both on the outer and inner side of the upper part of the tarsi, and are parted in the middle); some silvery pile on the outside of the first joint; the two last joints of the middle tarsi with a disk-shaped, flat brush of black bristles, as in the two preceding species; pulvilli blackish-brown; all the femora and the four posterior tibiæ beset with long pale yellowish pile. Wings grayish-hyaline.

Female.—Like the male, except in the sexual ornamentation of the front and middle tarsi, etc. Abdomen black, shining, the sides densely beset with pale yellowish-white pile, through which, on segments 2-5, the white pollinose spots in the hind corners of the segments are visible. Will be easily distinguished from *C. callipedilus* ♀ by its pollinose scutellum, less densely pollinose thoracic dorsum, more yellowish pile of the face and chest, etc. Length, ♂ ♀ 12-13^{mm}.

Hab.—Morino Valley, New Mexico, July 1 (Lieut. W. L. Carpenter); Spanish Peaks, June (the same); Cache Valley, Utah (C. Thomas); divide between Idaho and Montana. Six males and two females.

4. CYRTOPOGON MONTANUS Loew, Berl. Ent. Zeitschr., 1874, 362.

Male.—Ater, tibiis tamen posticis præter basim et apicem rufis, pilis nigris et albis vestitus, abdomine toto nigro-piloso, segmentis 2-5 singulis postice fascia albo-pollinosa ornatis, alis cinereo-hyalinis. Long. corp. 3 $\frac{3}{4}$ lin.; long. al. 2 $\frac{3}{4}$ lin.

(Translation).—"Deep black; hind tibiæ dark reddish, brownish-black at base and tip; the upper half of the occiput and the front with long black hairs. The two first antennal joints with scarce, at least in part whitish hairs; third joint wanting. The dense mystax, reaching up to the antennæ, is black on the sides and on the lower part of the face; its inner part is white. Palpi with black hairs; lower half of the occiput and the mentum with white hairs. The thoracic dorsum seems to have been principally covered with grayish pollen; the specimen is too badly preserved to warrant a positive statement. The hairs on thoracic dor-

sum, scutellum, and pleuræ are black; some few scattered pale colored small hairs are mixed with them. Segments 2-5 of the shining black abdomen have each, on their hind margin, a moderately broad cross-band of whitish pollen. The cross-bands on segments 2-4 are interrupted in the described specimen (probably rubbed off?); that of the fifth segment seems to have been interrupted even in the intact specimen. The hairs on the abdomen and hypopygium are, without exception, black; a part of the hairs near the lateral margins has the ends of a lighter color. The hairs on the coxæ are whitish, those on the hind coxæ are mixed with numerous black hairs. The legs are of the same structure as in *C. longimanus* Loew, especially the front tarsi of the same conspicuous length; the pile on the femora is prevaillingly, but not altogether, black; some whitish hairs on the under side, at the basis of the front femora, and short white hairs on the greater part of the upper side of the hind femora, are especially perceptible; the front tibiæ likewise have principally black hairs; on the hind tibiæ only the under side is beset with long black hairs, while elsewhere short white pile, on the upper side longer white pile, is prevailing. The tarsi are almost exclusively beset with black hairs. The bristles on the legs are without exception black (the halteres are wanting). Wings grayish-hyaline, hardly more grayish on the distal half; the veins normal, brownish black; the central cross-veins with vestiges of darker shades in their surroundings, which will probably not be visible in fresher specimens.

“*Hab.*—Sierra Nevada (H. Edwards).”

I have three males from Webber Lake, Sierra Nevada (July 22), which seem to belong to this species. The white pile on the face prevails over the black, which is distinct on the under side only, but very scarce on the sides; a very thin brownish pollen conceals but very little the black, shining thoracic dorsum; a median geminate stripe is hardly visible, but on the side of it a semblance of the figure 5 in gray pollen, with its reverse on the other side, is more distinct; the cross-bands of white pollen on the abdominal segments are all interrupted. Length 8.5-9.5^{mm}.

I will add the description of the females, taken in the same locality, which may belong here.

Female.—Thorax more densely brownish-pollinose; the double figure 5 on each side of the brown median stripe grayish-pollinose; the white abdominal cross-bands entire, except that on the fifth segment; sides of the abdomen beset with white pile, alternating with tufts of black pile at the base of the segments; in some specimens, however, these black tufts are hardly perceptible. The fan-shaped row of hairs in front of the halteres is black here, as it is in the male specimens. Length 10-11^{mm}. Four specimens.

5. CYRTOPOGON LEUCOZONUS Loew, Berl. Ent. Zeitschr., 1874, 364.

Female.—Ater, tibiis posticis tamen et metatarso postico rufis, pilis nigris et albis vestitus, abdomine toto albo-piloso, segmentis 2-5 singulis

postice fascia albo-pollinosa ornatis; alis cinereo-hyalini s. Long. corp. $4\frac{5}{12}$ lin.; long. al. $3\frac{7}{12}$ lin.

(Translation.)—"Deep black; hind tibiæ red, their extreme base brown, the tip hardly infuscated; first joint of the hind tarsi dark reddish, brownish-black toward the tip. Occiput near the vertex and on the upper part of the posterior orbit beset with black pile; below, the pile is white or whitish; front with long black pile. The hairs on the first two antennal joints are whitish, (third joint wanting). The dense mystax, which reaches the antennæ, is black, with a moderate number of white hairs on the inside of its upper half. Palpi with black pile. The thoracic dorsum seems to have been clothed near the humeri with whitish-gray, elsewhere with brownish-gray pollen. (The condition of the specimen forbids any positive statement.) The hair on the thoracic dorsum is principally whitish; from the middle, however, toward the anterior margin, the blackish hairs become gradually more numerous. The usual bristles near the lateral margin and above the root of the wings are black. Numerous whitish hairs are mixed with the long black pile on the scutellum; the hairs on the pleuræ are exclusively whitish. Segments 2-5 of the shining black abdomen each have on their hind margin a moderately broad cross-band of white pollen; that on segment 5 is interrupted in the described specimen (probably denuded). The hairs on the abdomen are without exception white, longer at the base, shorter and more scarce toward the end, on the last segments erect, in the usual manner. The pile on all the coxæ is whitish, without any admixture of black hairs. The hairs on the femora are prevailingly but not exclusively whitish; those on the front femora toward the tip are mostly black on the upper and the front side; on the hind femora, most of the black pile is at the end of their posterior side. The hairs on the front and middle tibiæ are mostly black; on the upper side of the middle tibiæ, numerous white hairs are mixed with them; on the hind tibiæ, the under side is beset with long black hairs, while the remaining pubescence is white; on the upper side, rather dense and moderately long. The hairs on the tarsi are exclusively black; the bristles on the legs are also black. Halteres whitish-yellow, with a brown stem; wings grayish-hyaline, hardly more grayish on the distal half; the venation normal; the veins brownish-black; the central cross-veins show in their immediate surroundings distinct traces of a darker shade, which are probably less distinct in very fresh specimens.

"*Hab.*—Sierra Nevada (H. Edwards).

"*Observation.*—*Cyrt. leucozonus* is so very different from *C. montanus*, especially in the color of the pubescence of the whole thorax, of the abdomen, and of the femora, that I do not dare to take it for the other sex of that species, although in the structure of the legs and in the position of the bristles on them their agreement is such as usually occurs between the sexes of the same species."

I have five female specimens from Webber Lake, Sierra Nevada, July

22, and Yosemite Valley, June 8, which agree with this description, with the single exception that on the face there is more than a "moderate number" of white hairs. The upper part of the mystax may be called white, with a few rare black hairs on the sides. I have no male to match these females.

C. leucozonus and *montanus* seem to belong to a group of closely resembling species. I have several specimens, among them a male from Salt Lake, Utah, which closely resembles the specimens which I have identified with Dr. Loew's descriptions, but cannot possibly be considered as the same species. I am not absolutely certain of having identified those two species correctly; nor am I very confident that the specimens which I described as the female of *montanus* really belong there. In order to render my possible error harmless, I have purposely reproduced Dr. Loew's descriptions, and abstained from describing any species of my own belonging to this group.

6. CYRTOPOGON AURIFEX n. sp., ♂ ♀.

Male.—Abdomen narrow, tapering, black, shining, with some bluish reflections on the first segment and very distinct purplish reflections toward the tip before the hypopygium; first segment on the sides with tufts of black pile anteriorly and white pile posteriorly; the hind part of the second and the greatest part of the third and fourth segments are occupied each by a conspicuous broad fringe of long, erect, yellowish-fulvous fur, with narrow bare spaces between these fringes. The three following segments are covered with short, dense, erect, deep black hairs, forming a brush, especially conspicuous on the sides, and longer posteriorly before the hypopygium; the purplish, black, shining ground-color is almost covered up by this pile; hypopygium black, shining, with but little pile. Face and front with brownish-gray pollen; face with whitish pile above and black pile below; occiput with white pile below and black pile above and on the vertex; third antennal joint red; the style black. Thorax black, brownish-pollinose, especially about the humeri; a brown geminate stripe, with a paler, grayish-yellow dividing-line in the middle. Femora black; front tibiae red at base, black on their distal half; the other tibiae red, broadly black at tip; tarsi black, the base of the first joint and the extreme root of the following joints red; three first joints of the front tarsi with some white pile on the upper side. Wings brownish-hyaline; fourth posterior cell hardly coarctate at all. Length 8.2^{mm}.

Female.—Legs like those of the male; only the red on the tarsi occupies more space and the front tarsi have no silvery pile; the hairs on the face are more scarce and whitish; the abdomen comparatively narrow, shining, black; segments 2-5 each with a moderately broad cross-band of yellowish-white pollen near the posterior margin; segments 2-4 are sparsely clothed with yellowish-fulvous erect pile, not concealing at all the ground-color, and not forming the fringes of fur so conspicuous in the male; segments 5-7 are almost glabrous, some very scarce, short

pile being only perceptible. The thorax is more densely pollinose than in the male; a grayish pollen forms a V-shaped figure posteriorly, the apex of which rests on the scutellum, the ends branch off on each side along the thoracic suture; the geminate grayish stripe is longitudinally divided by a more yellowish line; the usual brownish shadows in the humeral region. Length 9–10^{mm}.

Hab.—Webber Lake, Sierra Nevada, California, July 22. A male and female; in excellent preservation. It will not be difficult to recognize this remarkable species.

7. *CYRTOPOGON PRINCEPS* n. sp., ♂.—Front tarsi remarkably long, once and three-quarters the length of the tibia; their whole upper side beset with a dense fringe of silvery pile; hind femora, tibiæ, and tarsi on the upper side with a similar, but broader, covering of silvery pile. Face and front with a brownish-yellow pollen; mystax pale yellow, black only above the mouth and on the lower part of the face; lower part of the occiput with white, upper part and vertex with black pile; third antennal joint red, rather long and slender, the style black. Thorax black, somewhat shining posteriorly, and somewhat brownish-pollinose, especially about the humeri; scutellum black; thoracic pile black. Abdomen black, shining, with black pile; segments 2–6 with yellowish-gray pollen on the hind margins; on the second segment, this pollen is visible on the sides only; on the third and fourth, it forms an interrupted cross-band; on the two following segments, this cross-band is broader and only subinterrupted by a deep emargination; the sixth segment is entirely covered with the gray pollen, except a small black triangle in front; hypopygium black, with black pile, and only a small fringe of minute yellowish-hairs at the extreme end. Legs black, ornamented as described above; ungues whitish, with black tips. Wings uniformly blackish; veins normal; fourth posterior cell hardly coarctate at all. Length 10.5^{mm}.

Hab.—Webber Lake, Sierra Nevada, California. A single male. A very remarkable species, easily recognizable by the blackish tinge of the wings and the ornamentation of the front and hind legs.

8. *CYRTOPOGON CRETACEUS* n. sp., ♀.—Thoracic dorsum rather evenly clothed with a grayish-white pollen, completely concealing the ground color; the coloring of this pollen is rather uniform, a geminate median stripe is hardly perceptible; ante-scutellar callosities black, shining; scutellum black, brownish-pollinose at the base; pleuræ with dense yellowish-gray pollen. Abdomen shining black; segments 2–5 each with a moderately broad cross-band of yellowish-white pollen on the hind margins. Face and front densely covered with yellowish-gray pollen; mystax white above, black below above the mouth; vertex and upper part of the occiput with black pile; lower part with long white hair. Third antennal joint red or reddish, the style black. Thorax with fine black erect pile on the front part, and with whitish pile on the back part of the dorsum; the base of the scutellum with whitish pile, the remainder with long black pile. On the pleuræ, the fan-like fringe of pile in front of the halteres is mixed of

white and black hairs; the subhumeral callosities and the lower part of the pleuræ are beset with white hairs; but, in front of the root of the wings, there is some black pile. The abdomen on the sides is beset with white pile; it is long and tuft-like at the base, but becomes rather rare beyond the third segment. Legs uniformly deep black, shining; they are much less stout than in *C. callipedilus* ♀; the tibiæ, especially the front pair, are more straight; front tarsi rather long; the pile and bristles on the four anterior legs are black, except some white pile on the under and hind side of the femora; the hind femora and tibiæ are beset with white pile, which is particularly dense on the upper side of the hind tibiæ; the bristles, as usual, are black; the first joint of the hind tarsi shows, in a reflected light, some short, white pile; otherwise the tarsi are uniformly black. Ungues whitish, with black tips. Wings grayish-hyaline; venation normal. Length 10.5^{mm}.

Hab.—Webber Lake, Sierra Nevada, California, July 22. Two females. A third specimen, from the same locality, has the third antennal joint much darker reddish-brown; the thoracic dorsum has distinct brown stripes, and is less whitish; the fan-like fringe of pile in front of the halteres consists of black hairs only, etc. I believe, nevertheless, that the specimen belongs to *C. cretaceus*.

This species, like *C. princeps*, has the ungues whitish, with black tips; both species were found in the same locality; they are too different, however, to be taken, without further evidence, for the sexes of the same species. The other species of *Cyrtopogon*, described in this paper, have the ungues black and more or less brownish or reddish at the base only. *C. profusus* and *nugator* are the only species which, in this respect, resemble the two above-mentioned ones.

9. CYRTOPOGON LONGIMANUS Loew, Berl. Ent. Zeitschr, 1874, 360;

“*Male.*—Totus ater, pilis nigris et albis vestitus, vittis dorsalibus thoracis tribus latissimis fusco-pollinosis, segmentis abdominalibus secundo, tertio, quarto et quinto singulis postice fascia latâ albo-pollinosa ornatis, alarum dimidio basali hyalino, apicali nigricante.—Long. corp. $4\frac{1}{2}$ lin. long. al. $3\frac{5}{12}$ lin. (about 9^{mm} and 7.5^{mm}).

(Translation.) “The ground-color of the whole body is, without exception, shining black. The front with a long black pubescence, with which are mixed some whitish hairs, or such which appear whitish toward their tip. Antennæ black, the two first joints sparsely beset with black hairs, partly whitish toward their tips; the third joint very slender, strongly coarctate in the middle; terminal style slender, a little more than half as long as the joint. The long mystax reaches up to the antennæ, and is composed in the middle of hairs which are whitish, or black at their base only; the hairs on its outer side, all around, are exclusively black, so that, seen from the side, the mystax seems to consist entirely of black hairs; the long pile on the occiput is white; in the vicinity of the vertex and on the greatest part of the posterior orbit, it is black. The pollinose design on the thoracic dorsum resembles that of *C. marginalis* Lw. It consists of three broad stripes cov-

ered with dense brown pollen; the lateral ones are considerably abbreviated anteriorly; the intermediate one, seen from the front side, appears entire; seen from the hind side, it appears bisected by a broad black line; the region in front of the lateral stripes is covered with a thin white pollen, of which there is also a trace in the intervals between the middle stripe and the lateral ones. These intervals do not show the shining surface of the broad lateral margin of the thoracic dorsum, which is entirely free from pollen; the inner end of the thoracic suture, on each side, shows a small spot of more dense whitish pollen. The thoracic dorsum is beset with long black pile, which is rather scarce, except on the shining black sides of the dorsum, where it is a little more dense. Among this black pile, there is a shorter and more delicate white pubescence; it does not exist, however, on the shining black portions of the dorsum. The shining black scutellum is rather densely beset with long, exclusively black, pile. Pleuræ with a thin grayish pollen; their pubescence in front of the halteres and of the roots of the wings is altogether black; above the front coxæ, the stronger hairs are black, the more delicate pile whitish. Segments 2-4 of the shining black abdomen have on the hind margin a very broad cross-band of white pollen, which is even expanded in the middle; a similar cross-band on the fifth* segment is less broad, and a little interrupted in the described specimen (perhaps, in consequence of detrition). The pile on the abdomen is rather long, but becomes gradually shorter toward its end. On the five first segments, it is chiefly white; however, the sides of the three first segments (exclusive of their posterior corners) bear some black pile, which may show a trace of whitish reflection on the tips of the single hairs only. This black pile reaches down to the venter. From segment 6 to the much developed hypopygium the pile on the abdomen is altogether black. Coxæ with whitish pile. The black legs do not show any trace of lighter color; they have the ordinary structure. The front tarsi are comparatively long, equaled only by those of *C. marginalis* and *montanus*. The hairs on the legs are long, chiefly whitish on the femora. At their tip, however, and on the upper and hind side of the front femora, the hairs are more or less exclusively black. On the under side of all the femora, especially toward their base, the hairs have a pale yellowish tinge. The pubescence of the front tibiæ is chiefly black; but on their distal half there is a good deal of white pile. On the hind tibiæ, the hairs are prevailingly white, although there are many black hairs near the base, on the under side more than on the upper side. The hairs on the tarsi are chiefly white, on the upper side of the three first joints of the hind tarsi comparatively long, otherwise short. All the bristles on the legs are black. Halteres blackish-brown. Proximal half of the wings hyaline; distal half blackish-gray; venation normal; veins black.

“*Hab.*—San Francisco (H. Edwards).”

I have three males from San Rafael, Marin County, Cal., March 31,

* The original has fourth; evidently a mistake.

which agree perfectly with Mr. Loew's description, except that the grayish-pollinose cross-bands on segments 2-4 have a distinct black emargination in the middle, which is not mentioned. The third antennal joint is sometimes reddish; the antennal style is long, still I would not call it longer than half of the third joint. The thorax of my specimens shows, on each side of the median stripe, anteriorly, a short streak of whitish pollen. Length 4-10^{mm}.

I will supply a short description of the female, of which I have three specimens, taken on the same day with the males; a fourth is from Sonoma County, end of April.

Female.—The cross-bands of whitish pollen on segments 2-4 are nearly parallel, slightly narrower in the middle, especially on the fourth segment, where they are more expanded on the sides; on the fifth segment, the cross-band is interrupted in the middle. The pile on the sides of the abdomen is white, with the exception of a tuft at the base of the first segment on the sides, and of a smaller one on the sides of the second segment. The prevailing pubescence on the tarsi is black; the white hairs on the hind tarsi, which are conspicuous in the male, are wanting here. The brownish on the distal part of the wings is much less distinct than in the male, hardly perceptible. The antennæ of one of the specimens are somewhat reddish toward the end. Length 10-12^{mm}.

10. *CYRTOPOGON PROFUSUS* n. sp., ♂ ♀.—Thorax, including its sides and corners, and scutellum, densely clothed with gray pollen; three brown stripes on the dorsum; the intermediate one geminate, reaching from the anterior border to the scutellum (where it becomes almost black), longitudinally bisected by a gray line; the lateral stripes broad, abbreviated anteriorly, and bisected transversely by a gray line along the thoracic suture; the two halves thus produced are about equal in size, the anterior one being nearly round; both are dark brown on their inner side; the hair on the dorsum is black; a fringe of black hairs along the edge of the scutellum. Abdomen black, shining; posterior margins of segments 1-5 with a moderately broad cross-band of white pollen; in the male, the segments preceding the hypopygium are also whitish-pollinose; the sides of the abdomen on the basal half have tufts of long, soft, white hair; the fan-like fringe of hairs on the pleuræ in front of the halteres is white. Hypopygium beset with some black pile. Face and front brownish-gray, beset with black pile; in the female, I perceive some white hairs mixed with the black ones in the mystax. Antennæ black. Legs brownish-red; femora with black stripes along the upper side; they are beset with long, soft, white hairs; tibiæ with short white pile and black bristles, a few of the bristles on the middle and hind tibiæ are pale yellow; tarsi reddish-brown, almost black on the upper side; ungues whitish, with black tips; pulvilli whitish. Wings grayish-hyaline; venation normal. Length, male, 11-12^{mm}; female, 12-13^{mm}.

Hab.—Morino Valley, New Mexico, July 1 (W. L. Carpenter); Sangre de Cristo Mountains, July (the same). One male and three females.

The following five species have so many characters in common that a short statement of the distinctive characters of each will be more to the purpose than a long description. They were all taken near Webber Lake, Sierra County, California, July 22-24, nearly in the same locality. *C. rejectus* and *sudator* also occurred at Summit Station, Central Pacific Railroad, July 17. It is not improbable that several other species, belonging in the same group, exist in the same localities, or else that the species are subject to variation, as I have a few specimens left which I cannot refer to any of my species. The characters which these species have in common are:—

Face and front grayish- or brownish-pollinose, beset with black hairs; occiput and mentum with white hairs; antennæ black; thorax grayish- or brownish-pollinose on the whole surface, with more or less well-marked darker stripes; scutellum densely grayish-pollinose, with a fringe of black hairs on the hind margin, and sometimes some pile on its upper surface; abdomen black, shining, with cross-bands of white pollen on the hind margins, sometimes entire, often more or less interrupted, sometimes so much as to leave white spots only on the extreme lateral ends of the margin; this is always the case on the first segment, with the only exception of *C. evidens*, where the whole hind margin of the first segment is whitish-pollinose. The abdomen is beset on the sides of the segments nearer to the base with soft white hair. Halteres with a brownish stem and yellow knob; legs black, with black pile; some white hairs on the under side of the femora, less numerous on the anterior femora. Wings hyaline on the proximal half, slightly tinged with grayish or brownish on the distal half (almost altogether hyaline in *C. nugator*). The fan-like fringe of hairs in front of the halteres is white in the first three, black in the last two, species.

In identifying these species, it must be borne in mind that all the specimens were taken at the same time and in the same locality, and that specimens taken at another season or in other localities may differ in the intensity of the coloring of the thoracic stripes or of the brownish tinge of the wings; the white abdominal cross-bands may be also more subject to variation than I assumed them to be. Still, for each of the species, some permanent distinctive character will remain, as for *nugator* the shape of the abdomen, the hyaline wings, the color of the unguis; for *sudator*, the breadth of the front and its whitish, hoary pollen, etc. *C. rejectus* alone is doubtful to me, and may possibly be only a variety of *C. evidens*.

I. *The fan-like fringe of hairs in front of the halteres is white:*

11. CYRTOPOGON EVIDENS n. sp., ♂ ♀.—First abdominal segment with an uninterrupted white cross-band on the posterior margin; stripes on the thorax very distinctly marked, brown; the longitudinal dividing line of the geminate stripe is very distinct; the portion of the lateral stripe anterior to the thoracic suture is large, conspicuous, of a rich

dark brown; white cross-bands on abdominal segments entire, somewhat interrupted on the fifth segment only, rarely (in the male) on the fourth. Length, ♂ 7-8^{mm}.; ♀ 10-11^{mm}. Two males and four females. (In the male, the brownish tinge of the distal half of the wing is more marked here than in any of the four following species.)

12. *CYRTOPOGON REJECTUS* n. sp., ♀.—First abdominal segment whitish-pollinose on the sides only; the white cross-bands on segments 2-4 interrupted; on segment 5, the extreme sides only of the hind margin are white. Median germinate thoracic stripe less well marked and abbreviated earlier posteriorly; the portion of the lateral stripe anterior to the thoracic suture is well marked, brown. Length 9-10^{mm}. Four females.

13. *CYRTOPOGON NUGATOR* n. sp., (♂?) ♀.—First abdominal segment whitish-pollinose on the sides only; the white cross-bands on segments 2-5 very markedly interrupted; length of the interruption nearly equal on segments 2-4. The abdomen (♀) is narrower, more cylindrical and convex, of more equal breadth from the base than in the ♀ of *evidens* and *rejectus*. Wings almost uniformly hyaline. Thoracic stripes very distinct, more blackish; the portion of the lateral ones preceding the suture is not conspicuously darker, and has not the rich dark brown color which distinguishes it in *evidens* and *rejectus*. Ungues whitish-yellow, the tips black. In size, this species is smaller, the ♀ being only 7-8^{mm}. long. I have a male specimen which seems to belong here on account of its size and hyaline wings; but the stripe on the second abdominal segment is *not* interrupted (the thorax of the specimen is greasy); the unguis are whitish-yellow, with black tips, a very characteristic mark of the species.

II. *The fan-like fringe of hairs in front of the halteres is black:*

14. *CYRTOPOGON POSITIVUS* n. sp., ♂.—Peculiar coloring of the thoracic dorsum: the extreme anterior margin and the posterior beyond the thoracic suture are grayish; the intervening space is of a rich dark brown, the usual stripes coalescing completely; they reach for a very short distance beyond the thoracic suture; the longitudinal dividing line of the median stripe is very feebly marked with paler pollen (sometimes indistinct); front and face rather narrow, clothed with brownish pollen and dense deep black pile; first segment black, with very little white on the sides; posterior margin of abdominal segments 2-5 marked with white on the sides only, the interruption growing wider on each subsequent segment. Length, ♂ 7-8^{mm}. Three males.

15. *CYRTOPOGON SUDATOR* n. sp., ♂ ♀.—Front and face distinctly broader than in the four preceding species, clothed with a whitish hoary bloom; pollen on the thorax also whitish-gray in most specimens; the brownish stripes are variable, but often feebly marked, although distinct. First abdominal segment marked with white on the sides only; in the female, the usual white cross-bands on segments 2-4 are entire, on the fifth interrupted, occasionally subinterrupted on the fourth; in

the male, interrupted on all segments. Length, ♂, 8.5–9^{mm}; ♀ 8.5–10^{mm}. Two males and eight females.

16. *CYRTOPOGON RATTUS* n. sp., ♂ ♀.—Altogether covered with yellowish-gray pollen; thorax with a geminate black line in the middle; abdominal segments on each side anteriorly with a shining black spot. Length 9–10^{mm}.

Face and front grayish-pollinose, the former with a white mystax; the bristles above the mouth are black; ocellar tubercle and occiput beset with whitish hairs; a small tuft of black hairs on each side of the vertex near the upper corner of the eye. Thorax gray, with a black double line in the middle, abbreviated before reaching the scutellum; the lateral stripes are paler brown, ill-defined, and crossed transversely by the grayish-pollinose thoracic suture. The pile on the thorax is whitish anteriorly, black posteriorly; bristles black. Scutellum gray, clothed with long, soft, whitish pile. The fan-like fringe of hairs in front of the halteres is white. Abdomen gray, clothed with soft, whitish pile; segments 2–6 on each side at the base with a large shining black spot, diminishing in size on each subsequent segment. In the female, these spots are much smaller. The seventh segment, in the female, is black, shining; the hypopygium of the male is also free of pollen, but beset with yellowish-white pile. Legs black, beset with long, white pile; bristles on the tibiæ also white, except the terminal ones and those on the front side of the front pair. Halteres with a lemon-yellow knob. Wings hyaline; veins black, normal.

Hab.—Webber Lake, Sierra County, California, July 22. Five males and one female. The antennal style is comparatively shorter here than in all the preceding species, somewhat coalescent with the third joint; the bristle at its tip is very distinct.

17. *CYRTOPOGON CERUSSATUS* n. sp., ♂ ♀.—Black; thorax whitish-pollinose; abdomen with white cross-bands on the *anterior* margin of segments 2–6; the sides of the same segments posteriorly each with a large white spot; wings hyaline; legs black, with white hairs. Length 6.5–8^{mm}.

Face covered with a white, hoary pollen; mystax black, more dense immediately above the mouth than higher up; facial gibbosity rather flat, little prominent; antennæ black, third joint three times the length of the two first taken together, narrow, almost linear; the style is very short, perhaps one-tenth of the length of the joint, cylindrical, with a minute bristle; ocellar tubercle rather large and broad, with deep grooves on each side between it and the orbit of the eye; both the tubercle and the opposite side of the groove are beset with black pile, which, commingling, form a distinct tuft on the top of the head; on each side of this tuft, along the orbit of the eye, there is a narrow margin of minute microscopic yellowish-white hairs; lower down, on the orbit, on a level with the antennæ, there is, on each side, a small tubercle, the upper and outer side of which is clothed with the same microscopic yellowish-white pile; the occiput is beset with white hairs, except

in its upper part, where there are some black hairs. Thorax black, clothed with a thin, gray pollen; three indistinct stripes are somewhat brownish; the lateral ones are incurved and somewhat expanded anteriorly, where they end in a brown spot above the humerus; the median line is simple and rather indistinct; the dorsum is clothed with short, sparse, white pile and longer black bristles; some of the latter form two rows on the lateral thoracic stripes. Scutellum flat, with six black, conspicuous, erect bristles on its hind edge. The fan-like fringe of hairs in front of the halteres is usually mixed of black and white hairs, its upper part being black, the lower one showing some white hairs; in some specimens, principally males, it is altogether white. Abdomen black, shining, moderately convex, of nearly equal breadth; segments 2-6 anteriorly have a narrow cross-band of white pollen, not reaching the lateral margin; on that margin, in the posterior angles of each of the same segments, there is a large white spot. The two basal segments have some long white hairs on the sides. Legs black, densely clothed with short appressed white pile, beset with longer white hairs and black bristles; hind tibiæ gradually incrassated from the base to the tip; first joint of hind tarsi also somewhat stout. Halteres pale brownish. Wings hyaline; venation normal.

Hab.—Los Guilucos, Sonoma County, July 5. Three males and five females.

This species differs in many respects from the typical ones of the genus. The broad ocellar tubercle with the deep grooves on each side, the peculiar tubercles near the eyes on each side of the antennæ, the row of erect bristles on the lateral stripes of the thoracic dorsum, the subclavate hind tibiæ, the shortness of the antennal style in proportion to the length of the third joint, the gently convex but hardly gibbose face, the conspicuous six bristles on the otherwise bare scutellum, are so many characters which are not found in the other species.

Half a dozen specimens, taken in Mariposa County and Yosemite Valley (June 3-13), resemble *C. cerussatus* in having the white stripes on the anterior margins of the thorax; but they have no tubercles near the eyes, and are abundantly distinct in many ways. The specimens being injured, I abstain from describing the species.

18. *CYRTOPOGON NEBULO* n. sp., ♀.—Gray; thorax with a geminate brown stripe; abdomen shining black, with white spots in the hind corners of segments 1-5; wings with brown clouds on the cross-veins and on the bifurcation of the third vein. Length 8-9^{mm}.

Face and front grayish-pollinose, with black hairs; the hairs on the face, in a certain light, look whitish at the tip; occiput with white hairs. Antennæ black. Thorax grayish-pollinose, with brown stripes; the intermediate one dark brown, geminate, abbreviated before reaching the scutellum, but coming in contact with a pair of elongated brown spots in front of the scutellum; scutellum convex, with rather dense, long, and soft white hair, and some blackish bristles along the hind edge;

pleuræ with whitish pile. Halteres with a dark brown knob. Abdomen black, shining, with white hair on the sides; segments 1-5 in the hind corners with a spot of white pollen of moderate size. Legs black, beset with long, white hairs; most of the spines are also whitish, especially toward the tip, the roots being often brownish. Wings hyaline, with black veins; central cross-veins, those at the distal end of the discal cell, the small cross-vein, and the bifurcation of the third vein are very distinctly clouded with brown.

Hab.—Webber Lake, Sierra County, California, July 22. One specimen.

This species does not properly belong in the genus *Cyrtopogon*, from which it differs in the shape of the antennæ; the third joint is gradually tapering from the base to the tip; the antennal style is quite as long as the third joint; altogether, the antennæ are like those of *Anisopogon* (*Heteropogon olim*); but the proportions of the body, the somewhat, although moderately, gibbous face, the character of the mystax, etc., are more like those of *Cyrtopogon*.

ANISOPOGON.

(*Heteropogon olim*, name changed in Berl. Ent. Zeitschr., 1874, 377.)

I have a species from California (G. R. Crotch) and apparently the same from Vancouver Island (H. Edwards); they are not unlike *A. gibbus* from the Atlantic States in stature, but certainly different, the wings being nearly hyaline. The specimens are not well preserved enough for a description.

HOLOPOGON.

A single female specimen, from Webber Lake, Sierra County, July 25, is nearly altogether black, and certainly different from the described species from the Atlantic States.

DAULOPOGON.

(Loew, Berl. Ent. Zeitschr., 1874, 377; formerly *Lasiopogon*.)

This genus seems to be quite abundantly represented in California. I have two species taken in the immediate vicinity of San Francisco, a larger one from Yosemite Valley, and two or three from Webber Lake, Sierra County, California. As the species of this genus are rather difficult to recognize from descriptions, I will describe only one, which has very marked characters.

1. DAULOPOGON BIVITTATUS Loew, Centur., vii, 57; additions in Berl. Ent. Zeitschr., 1874, 370.—I believe I recognize this species in some specimens which I took near San Francisco, March 28; only the small cross-vein is in the middle of the discal cell, rather than beyond it.

2. DAULOPOGON ARENICOLA n. sp., ♂ ♀.—Brownish-gray; abdominal segments 2-6 each with a pair of semicircular brown spots at the base. Length 7-8^{mm}.

Brownish-gray, sometimes with a tinge of yellowish; the mystax and

the few hairs on the vertex and on the upper part of the occiput yellowish-white; those on the lower part of the occiput pure white; antennæ, black. Thorax with two, rather distant, brown stripes, expanded and somewhat diverging anteriorly; the hairs and spines on the thoracic dorsum are whitish; scutellum with a quantity of long, erect, whitish hairs on its edge; a semicircular impressed line parallel to this edge is very distinct. Abdominal segments 2-6 at the base each with a pair of semicircular brown spots, gradually diminishing in size on each subsequent segment; a vestige of such spots is also visible on the seventh segment. Hypopygium of the male black, beset with whitish pile and with an appressed tuft of yellow hairs above the forceps. In the female, the eighth segment is black, shining. Legs yellowish-gray, with short, appressed, whitish pile and yellowish-white bristles. Wings with a slight brownish tinge; small cross-vein before the middle of the discal cell; second posterior cell sometimes very narrow, in some specimens even petiolate; the fourth posterior, in some specimens, coarctate toward the end, even closed; these characters are very inconstant.

Hab.—San Francisco, Cal., on the sands about Lone Mountain, April 6, and again June 29. Four males and four females.

NICOCLES.

(Jaenicke, formerly *Pygostolus*, Loew, Centur., vii, 28.)

Of the two Californian species described by Dr. Loew, I have found only *N. dives*, at the Geysers, Sonoma County, in the first days of May. Mr. James Behrens had taken it a few days before near Mendocino.

Family DOLICHOPODIDÆ.

The first insect of this family which I found after my arrival in California was a *Hydrophorus* (Santa Barbara, January 28). Since then, until the middle of May, I did not come across a single Dolichopodid, although both the fauna and flora of the environs of San Francisco attain their fullest development from the end of March to about the middle of May, when the effect of the cessation of the rain begins to be visible. Among the exuberant insect life of that season I did not discover a single *Dolichopus* in sweeping the grass with my net, nor did I see a single *Psilopus* or *Chrysotus* running on the leaves of low shrubs (in Florida I used to catch them abundantly in such situations as early as March). May 14, I caught a *Hygrocleuthus* and a *Dolichopus*, one specimen of each, on the walls of the railroad station at San Rafael. Since then, in June and July, I found a few *Dolichopodidæ* along the streams of running water in Sonoma County.

All in all, I brought home, from Marin and Sonoma Counties, two *Hygrocleuthus*, one *Dolichopus*, two *Tachytrechus*, one *Liancalus*, and my new genus *Polymedon*; one *Psilopus* from Yosemite Valley; from the High Sierra, two *Dolichopus*, one *Tachytrechus*, one *Scellus*, one *Hydro-*

phorus; sum-total, thirteen species. A new *Scellus* from British Columbia is also described here.

It is rather remarkable that two species of *Hygroceleuthus* should have been brought from the lower altitudes of California, together with only one species of *Dolichopus*, while only four other species of *Hygroceleuthus** are known from the whole world, against more than a hundred *Dolichopus*. It is also remarkable that among the few *Dolichopus* from California described by Mr. Thomson, one should also be a *Hygroceleuthus*, perhaps identical with one of mine, but too insufficiently described, in a female specimen, for identification.

One of the *Tachytrechus* is apparently identical with a species from the Eastern States; the other one is closely allied to, but certainly different from, another species from the same region.

The most remarkable discovery in this family is the new genus *Polymedon*, with its extraordinary development of the face and of the cilia of the tegulæ.

It would seem that, on the whole, *Dolichopodidæ* are but poorly represented in California. The places to look for them, in the vicinity of San Francisco, are probably the marshes surrounding the bay, a locality which I have neglected to visit. In the Sierra, they are somewhat more abundant, in species as well as in specimens.

All the necessary information about the *Dolichopodidæ*, including the definition of the genera, will be found in Dr. Loew's work on them, in the Monographs of N. A. Diptera, vol. ii.

HYGROCELEUTHUS.

I refer to this genus two species, in which the face descends as far as the lower corner of the eye; moreover, the two basal joints of the antennæ, especially in one of these species, are considerably enlarged, a character which belongs to the typical *Hygroceleuthus* (compare Loew, Monographs, etc., ii, 17).

1. HYGROCELEUTHUS CRENATUS n. sp.—*Male*.—First antennal joint longer than usual, expanded on the inside so as to meet a corresponding expansion of the other antenna; second joint nearly as long as the first, on the inside of its basal half a similar expansion; both joints are black, except these enlargements on the inside, which are reddish-yellow; the first joint is beset on the outer and upper side with long and dense black pile; the second has some hairs on its end; third joint comparatively small, subtriangular, black; the dorsal arista appears unusually stout, from the dense pubescence which covers it. Face yellowish-white; cilia of the inferior orbit rather stout, golden-yellow. Thorax and abdomen bright metallic-green; tegulæ yellow, with yellow cilia, sometimes mixed with black hairs; lamellæ of the hypopygium yellow, with a narrow black border. Legs yellow, including the fore coxæ, which have a

* Two in Europe, one in Siberia, one in North America (Loew, Monogr., ii, 17).

greenish-black stripe on the outside; tarsi infuscated from the tip of the first joint; hind tibiæ slightly incrassated, on the inner side glabrous, and with a longitudinal furrow, the bottom of which is brownish. Wings grayish, slightly tinged with yellowish anteriorly, except the costal cell, which is subhyaline; costa with a stout swelling at the tip of the first vein; the posterior margin deeply indented at the end of the fourth vein.

Female.—The antennæ are a little smaller and less hairy, although they have the same structure and coloring; the face is broader; the hind tibiæ are not incrassate and not glabrous on the inner side; the costa is without swelling; the indentation of the posterior alar margin is present. Length 6–7^{mm}.

Hab.—Los Guilucos, Sonoma County, California, July 5. Two males and one female.

2. *HYGROCELEUTHUS AFFLICTUS* n. sp.—*Male*.—Similar in all respects to the preceding species, except that the antennæ are not much larger and not much more hairy than those of an ordinary *Dolichopus*; the first joint has the same yellow expansion on the inner side; the second joint is much smaller, and has only a vestige of yellow on the inner side; the pubescence of the arista is so fine as to require a much stronger magnifying power; the face is silvery-white; the cilia of the inferior orbit almost white; lamellæ of the hypopygium whitish. The hind tibiæ of the male have the same structure, only they are a little more incrassated and the shallow groove on their inside is broader and more distinctly tinged with brown; on each side of the second abdominal segment, there is a tuft of long yellow hair, which does not exist in my specimens of *H. crenatus*; the wings are the same as in the latter species. Length 6–7^{mm}.

Hab.—San Rafael, Cal., May 19. A single male.

Observation.—*Dolichopus lamellicornis* Thomson, Eugénies Resa, etc., 511, 114 (a female), judging from the description of the antennæ, must be a *Hygroceleuthus*. The description does not agree with my female of *H. crenatus*; but it may be the female of *H. afflictus*, which I do not possess. All the characteristic marks of the species do not, of course, exist in the female, which the author describes; but he does not even mention the indentation on the hind margin of the wing, which in *H. crenatus* at least exists in both sexes; and, if the same is the case with the unknown female of *H. afflictus*, this would exclude the synonymy of Mr. Thomson's species.

DOLICHOPUS:

The three species of *Dolichopus* before me, after comparison with the analytical table of the Eastern American species, in the Monographs, etc., vol. ii, 323, may be tabulated as follows:—

I. Prevailing color of the legs black; cilia of the inferior orbit black:

1. *corax* n. sp.

II. Prevailing color of the legs yellow; cilia of the inferior orbit pale; tegulæ with black cilia; fourth longitudinal vein bent, but not broken:

1. Antennæ altogether black; last joint of front tarsi in the male black, with a large lateral thumb-like projection; penultimate joint likewise enlarged, triangular; tip of hind tibiæ and hind tarsi black:

2. *pollex* n. sp.

2. Basal joints of the antennæ red; third joint red at base only, the rest black; front tarsi ♂ with three long and slender joints; fourth joint small, white; the last joint enlarged, lameliform, black:

3. *canaliculatus* Thoms.

Two more species are described by Mr. Thomson (Eugenies Resa, 512), *Dol. metatarsalis* ♂ ♀, and *Dol. aurifer* ♂ ♀. The descriptions are wanting in some very essential characters, as for instance the color of the cilia of the inferior orbit and of the tegulæ. Moreover, it is by no means certain whether these species belong to the genus *Dolichopus* in its present acceptation.

1. *DOLICHOPUS CORAX* n. sp.—*Male*.—Face dull yellow; cilia of the inferior orbit black; antennæ black. Thorax and abdomen of a rather dark metallic-green; pleuræ very little pruinose; tegulæ yellow, with black cilia; hypopygium rather large, black; lamellæ nearly black, yellowish-brown in the middle only. Legs black; front tarsi about once and a third the length of the tibiæ; last joint expanded into a large black lamel, which is fringed with short hair on the edge; hind tibiæ slightly incrassated, shining on the inside, but on their latter half with an opaque brownish streak. Fourth longitudinal vein very greatly bent; wings grayish, slightly tinged with brownish anteriorly.

Female.—Hind tibiæ not incrassated, and without the opaque brown streak; the other sexual marks also absent. Length 5–6^{mm}.

Hab.—Webber Lake, Sierra Nevada, California, July 24–25, common. Seven males and four females.

2. *DOLICHOPUS POLLEX* n. sp.—*Male*.—Face of a dull golden-yellow, narrower toward the mouth; cilia of the inferior orbit whitish; antennæ black, third joint rather pointed. Thorax and abdomen metallic-green, shining, sometimes coppery; hypopygium with rather large, whitish lamellæ, bordered with black; cilia of the tegulæ black. Coxæ black, with a whitish pollen. Legs reddish-yellow; front tarsi about once and a third the length of the tibiæ, whitish-yellow, the tips of the first three joints black; first joint more than one-half the length of the tibia; second joint about one-third as long as the first; third joint shorter than the second, slightly expanded toward the end; fourth joint nearly as long as the third, expanded, triangular, black; the fifth is also black and still more expanded, inverted heart-shaped, with one of the lobes much longer than the other, square at the end, thus form-

ing a stump-, or thumb-like appendage; middle tarsi blackish, except at the base; hind femora with a few black bristles on the latter half of the under side, forming an incipient fringe; hind tibiæ broadly black at the tip, glabrous on the inside; hind tarsi altogether black. Wings with a slight swelling of the costa at the end of the first vein; fourth vein bent but not broken. Length 5-6^{mm}.

Hab—Webber Lake, Sierra Nevada, California, July 24. Three males.

3. *DOLICHOPUS CANALICULATUS* (syn. *Dolichopus canaliculatus* Thomson, *Eugenies Resa*, 512.)—*Male*.—Bright metallic-green, with a slight yellowish pollen on the thorax. Face silvery, somewhat yellowish above; antennæ red; third joint brown, except the under side at the base; cilia of the tegulæ black; lamellæ of the hypopygium unusually long, whitish, foliaceous, narrow at base, margined with brown; the large emargination at the end has a smooth edge, not jagged, and beset with a few almost imperceptible hairs; a smaller emargination alongside of the large one is beset with curved bristles, which extend along the inner edge of the lamella and are much less coarse than in other species. Legs, including front coxæ, pale yellow; front tarsi about once and three-fourths the length of the tibia; three first joints slender, stalk-like, nearly of equal length; the fourth very minute, subtriangular, white; the fifth lamelliform, black; four posterior tarsi brownish, except at base; hind femora on the inner side with a fringe of long yellowish hairs; hind tibiæ on the inside before the middle with a glabrous spot of a brownish-yellow, which sends out a glabrous line, running along the upper side of the tibia to very near its tip. Wings subhyaline; third vein bent but not broken. Length about 5^{mm}.

Hab.—San Rafael, Cal., May 14 and 27. Two males. I also have a female from Brooklyn, near San Francisco, July 11, apparently belonging here. The hairs on the hind femora of the male being on the inner side, and not along the lower edge, are somewhat difficult to perceive.

There can be but little doubt about the synonymy, although I do not quite understand the description of the hind tarsi; at any rate, the word "postici" is inadvertently omitted in that description.

TACHYTRECHUS.

Of the two Californian species which I possess, the one is identical with a species from the Atlantic States, the other closely resembles another species from the same region.

1. *TACHYTRECHUS ANGUSTIPENNIS* (syn. *Tachytrechus angustipennis* Loew, *Monogr.*, etc. ii, 113, 3).—The specimens, males only, described by Mr. Loew, were from the District of Columbia. I have four males and one female from Los Guilucos, Sonoma County, July 6, and a single female from Summit Station, Central Pacific Railroad, in the Sierra Nevada, at 7,000 feet altitude. I hardly doubt of the specific identity. The only discrepancy from Mr. Loew's description is that the brown lines on the thorax are not "very much shortened",

but stop only a short distance before the scutellum. In the female, the three flattened bristles on the hind tibiæ do not exist, and the costa is only imperceptibly incrassate.

2. *TACHYTRECHUS SANUS* n. sp.—*Male*.—First antennal joint rather large, reddish-yellow, beset with black hairs on the upper side, especially long toward the tip; second joint small, placed on the under side of a projection of the first, yellowish; the third subtriangular, small, brownish, and yellowish on the inner side only; arista very slender, glabrous, half as long as the body, with a spatulate expansion at the tip, about one-third of which at the base is white, the rest black (the antenna is like that of *T. mæchus*, figured in Monogr., ii, tab. iii, f. 6, *d*, only the spatule at the end has none of the emargination represented on the figure, and is like tab. iv, f. 12, *c*). Face very long and narrow, somewhat broader below, golden-yellow, but without luster. Cilia of the posterior orbit black; thorax metallic-green, with two distinct bluish lines on the dorsum, which is very slightly grayish-pruinose, especially about the shoulders. Pleuræ somewhat yellowish-pruinose above the coxæ; abdomen metallic-green, whitish-pruinose. Cilia of the tegulæ black; hypopygium greenish, with a large patch of brownish-yellow velvety down near the root; lamellæ of moderate size, reddish-yellow, with black hairs on the apical and yellowish ones on the lateral edge. Prevailing color of the legs yellow; front coxæ of the same color, dusted with golden-yellow; their extreme root black; front femora with scattered black pile on the outer side; front tibiæ with a row of stiff, erect bristles on the inner side, and with another row of still longer bristles on the outside; both, when well preserved, extend beyond the middle of the tibia; front tarsi about the same length with the tibiæ, brownish from the end of the first joint; these tibiæ and tarsi, in a certain light, are silvery-pruinose; middle femora blackish at the extreme root; middle tarsi brownish from the tip of the first joint; proximal half of the hind femora greenish-black; knees infuscated; hind tibiæ black at tip; hind tarsi black; wings subhyaline, rather short. Length 5–6^{mm}.

Hab.—Webber Lake, Sierra County, Sierra Nevada, July 22. Two males.

T. sanus is very like *T. mæchus*, which I used to find abundantly at the Trenton Falls, New York; but the hind femora are broadly black at base, the hind tarsi altogether black, which color also invades the tip of the tibiæ; the antennal arista is much longer, the spatule at its end not emarginate; the thorax has two blue longitudinal lines, etc.

I have a female *Tachytrechus* from Sonoma County (July 6), which evidently belongs to a third species. It has yellow legs; tarsi black; tips of femora to a considerable extent likewise black; cilia of the posterior and inferior orbit whitish; thoracic dorsum yellowish-pollinose, with a median brownish-coppery stripe, which is not pollinose, and stops before reaching the scutellum; dorsal thoracic bristles inserted on brown dots, etc.

POLYMEDON nov. gen.

Face of the male prolonged downward, and dependent in the shape of a silvery sheet, or ribbon; in length, this ribbon is about equal to the upper part of the face between the antennæ and the lower end of the eye. In life, the ribbon is straight; in dried specimens, its end is usually bent inward.

Cilia of the very small tegulæ in the male unusually long (bent backward, they would almost reach the end of the second abdominal segment); they can be folded together like a fan, and then form a long tapering horn- or spine-like body. Those specimens which I examined in life had the cilia folded in that way; in the dried specimens, they are sometimes spread out.

These two extraordinary characters define the genus sufficiently; the other parts of the body may be described as follows:—

Antennæ comparatively short; first joint with a few hairs above; second small; third suboval, with a blunt end; arista subapical, of moderate length and stoutness (the antennæ resemble figure 10, *d*, on plate iv, of volume ii, of the Monographs, etc.).

Face of moderate breadth, nearly parallel, prolonged in the male, as described above; in the female, the face has the usual structure; its lower edge is nearly on a level with the lower corner of the eye, and is not straight, but somewhat angular (compare l. c., tab. iii, f. 6, *b*, where, however, the face is much narrower).

The usual frontal pair of diverging bristles is present; the other converging pair, inserted at the upper corners of the eyes, is so minute as to be almost imperceptible in the male; it has the usual size in the female.

Thorax.—In the male, the double row of minute bristles, usually present in the middle of the dorsum, is altogether wanting; it exists in the female; the lateral rows of larger bristles are present in both sexes.

Hypopygium comparatively large and stout, nearly sessile; external appendages lamelliform, rather small, fringed with bristles.

Legs of moderate length; first joint of the hind tarsi without bristles.

Wings.—The last section of the fourth vein turns off before the middle, and converges toward the third in a very gentle curve; fifth vein in the male obsolete before reaching the margin; in the female, very much attenuate. Costa (δ) so much swollen before the tip of the first vein as to fill out the whole costal cell, except small spaces at both ends; in the female, the swelling is hardly perceptible.

Polymedon is a mythological name.

POLYMEDON FLABELLIFER n. sp.—Face and front silvery-white in the male, as well as the dependent ribbon; greenish-white in the female; cilia of the inferior orbit white; palpi black; antennæ brown above, yellowish-red on the under side. The dark metallic-green thorax in the male is almost altogether covered with a very striking silvery bloom, especially on the dorsum; in the female, this bloom exists only on

the pleuræ, the dorsum being metallic-green, with a coppery stripe in the middle. Abdomen metallic-blue in the male, slightly hoary, especially on the sides, and with black pile; more greenish and blackish in the female. Hypopygium, as well as its lamellæ, black. Tegulæ and their long cilia black. Legs black, only the knees yellowish; front tarsi somewhat flattened. Halteres dark brown. Wings tinged with grayish, more brownish anteriorly. Length about 5^{mm}.

Hab.—Los Guilucos, Sonoma County, California; not rare on stones in running waters; July 5, 1876. Four males and two females.

LIANCALUS.

In the Monographs, ii, 198, Mr. Loew divides the four known species of this genus into two groups. In the first, the appendages of the hypopygium are lamelliform, and the scutellum has only four bristles; in the second, the appendages are filiform, and the scutellum has six bristles. The Californian representative of the genus holds the middle between these two groups. It has lamelliform appendages of the hypopygium and six bristles on the scutellum.

LIANCALUS QUERULUS n. sp.—*Male*.—Metallic-green; thoracic dorsum bluish, with four coppery stripes; posterior orbit with long, soft, white hairs; antennæ black; cilia of the tegulæ pale yellow; halteres of a saturate yellow, brownish at the root; scutellum with six bristles. Legs dark metallic-green; tarsi black; front coxæ elongated, with long, soft, white hairs; first joint of front tarsi short; the second nearly three times as long, and appearing stouter in consequence of a dense brush of very short, microscopic, erect hairs along its whole inner side; third joint only a little longer than the first, with a similar brush of hairs; the two last joints taken together about equal to the third. Wings hyaline, with a large brown spot at the tip, limited anteriorly by the second vein, contiguous to the margin between the tips of the second and third veins, distant from it between the third and fourth veins; reaching but little beyond the latter; not sharply limited, rather evanescent on its proximal side. The metallic bluish-green abdomen is whitish-pruinose on the anterior half of each segment, somewhat blackish along the hind margins. Hypopygium with very small brownish lamellæ.

Female.—The front tarsi have not the same structure as in the male, the first joint being the longest; wings grayish-hyaline, without any apical spot, but with two small rounded brownish-gray spots, with evanescent outline in the first posterior cell, and a similar spot at the end of the discal cell. Length of ♂ and ♀ about 6^{mm}.

Hab.—The Geysers, Sonoma County, May 6.

SCELLUS.

1. SCELLUS VIGIL n. sp.—*Male*.—Thorax grayish above, with two approximate brown lines; abdomen and pleuræ copper-colored, partly

metallic-greenish; wings subhyaline, with a double grayish spot on the great cross-vein, and a similar larger spot on the last section of the fourth vein; anal appendages of the male narrow, white, blackish at the base. Length 3.5–4.5^{mm}.

Face brownish-yellow, narrow above, broader below; antennæ black; the ground-color of the front is concealed under a grayish pollen. Thorax above with a dense gray pollen, almost concealing the coppery ground-color; two approximate brown lines in its middle stop some distance before reaching the scutellum; between their end and the scutellum, an opaque dark brown spot. Pleuræ coppery, with greenish reflections, slightly pruinose. The scutellum, with two bristles, is greenish, coppery, or purplish. Abdomen (very much shrunken and withdrawn in my specimens) coppery, pruinose above, brilliant coppery, and greenish on the sides. Anal appendages ribbon-like, white, blackish near the root. Legs metallic-green or coppery, with purple reflections; tarsi black. The structure of the legs agrees in the main with the description of the legs of *S. filifer* Loew (Monogr., ii, p. 210). Halteres whitish. Wings subhyaline, their root yellowish; costa yellowish-brown before its junction with the first vein; a double grayish spot on the great cross-vein, and a similar larger spot on the last section of the fourth vein; the latter is well defined on the proximal, and evanescent on the distal side.

Hab.—Webber Lake, Sierra Nevada, July 22–24. Three males, found resting on stones on hill-sides.

This species differs from *S. filifer* Loew (Fort Resolution, Hudson's Bay Territory) in the coloring of the wings, which have no longitudinal gray streaks between the veins, the color of the anal appendages, which are not yellow at the end, etc. Nevertheless, the resemblance between the two species must be very great.

2. *SCELLUS MONSTROSUS* n. sp.—*Male*.—Thorax brownish-gray, with several rows of brown dots, on which the bristles are inserted, and two approximate brown lines; wings tinged with brownish; anal appendages of the male at least as long as the abdomen, white; their end brownish-yellow, inverted-spoonshaped. Length 6–7^{mm} (without the appendages).

Face brownish-ocher-yellow; antennæ black; front dull greenish-gray; inferior orbit beset with yellow hair; the superior with stiff, black spines. Ground-color of the thorax concealed under a thick grayish-brown pollen; three rows of brown dots, in linear groups of three or four, bear the usual dorsal bristles; on each side of the intermediate row, there is an uninterrupted brown line, reaching to the scutellum; the coppery ground-color of the thorax is visible on the dorsum above the wings; a large, coppery, shining spot on the upper part of the pleuræ; a smaller one at the foot of the halteres; abdomen copper-colored; halteres yellow, the extreme root brownish; tegulæ with yellow cilia. Anal appendages at least as long as the abdomen, ribbon-

like, white, except at the root, which is brown; they are angularly bent in the middle, the latter half expanded, inverted-spoonshaped, yellowish-brown, bearing a fan-shaped tuft of long hairs at the end. Legs metallic-coppery; tarsi black. Lobe at the end of the front tibiæ very large, deeply emarginate at the base; the long spine on the inner side of the tibiæ appears bifid, from a strong bristle near its tip; middle tibiæ, besides some stiff bristles on the upper and under side, with a fringe of soft hairs on the hind side, which become longer toward the tip, and end there in a tuft of curly hair; the hind tibiæ end in a very long curved spine, hook-shaped at the tip (if stretched out, it would be nearly as long as one-third of the first joint of the hind tarsi); a smaller spine near it. Wings yellowish at the root, otherwise tinged with brown, especially between the first and third veins; costal cell tinged with yellowish; a brown cloud on the great cross-vein; another on the curvature of the fourth vein; some subhyaline spots near the root of the wings, the most conspicuous of which on the proximal end of the third posterior cell.

Hab.—British Columbia (Crotch). A single male.

HYDROPHORUS.

Two species: one from Webber Lake, Sierra Nevada (July 25), is allied to *H. innotatus* Loew from Sitka (Monogr., ii, p. 212) in the coloring of the face, the upper part of which is greenish, and in other characters; its halteres, however, have a yellow, and not an infuscated knob. The other species, taken near Santa Barbara (January 25), is easily distinguished by the color of its first longitudinal vein, which is brownish-yellow; the costa beyond the junction with the first vein is of the same color. I abstain from describing these species, as my specimens are not numerous enough nor well preserved enough for that purpose.

Medeterus breviseta Thomson (Eugenies Resa, etc., 510) from California is a *Hydrophorus*, as the author compares it to *Medeterus litoreus* Fallen, which belongs to that genus.

PSILOPUS.

I found a single species abundant in Yosemite Valley about the beginning of June. It is closely allied to *Psilopus melampus* Loew (Monogr., ii, 253) from Mexico, but shows some differences, especially in the structure of the legs. It would not be safe to describe it without the comparison of specimens of *P. melampus*.

Family EMPIDÆ.

Is abundantly represented in California. I have nine species of *Empis*, taken in Southern California in February and March; in Marin and Sonoma Counties in April and May; and about Webber Lake, Sierra

County, in July. The males of most species are provided with very remarkable appendages on the hind legs.

Rhamphomyia is represented in my collection by more than a dozen species, taken in the same localities.

Of the group *Tachydromina*, I have two or three species, belonging to the genera *Platypalpus* (*Tachydromia* Meig.) and *Tachypeza*.

The only species hitherto described are:—

EMPIS BARBATA Loew, Centur., ii, 19.—California.

RHAMPHOMYIA LUCTUOSA Loew, Centur., vol. ii, 290 (syn. *R. lugens* Loew, Centur., ii, 30).—California.

Family LONCHOPTERIDÆ.

LONCHOPTERA sp.—San Rafael, May 29.

Family PLATYPEZIDÆ.

PLATYPEZA sp.—Santa Barbara, Cal., January 29.

Family SYRPHIDÆ.

As I left San Francisco, going east, about the middle of July—that is, before the best season for collecting *Syrphidæ*, which is August and September, had really begun—my collections cannot be expected fairly to represent the fauna.

The species of *Paragus* (1 species), *Pipiza* (1 sp.), *Orthonera* (1 sp.), *Chilosia* (3 sp.), which I found, have a remarkable family resemblance to the species from the Atlantic States and to the European ones; some of them will probably prove to be identical. The same may be said of *Melanostoma* (3 sp.), *Syrphus* (6 sp.), *Mesograpta* (2 sp.), *Spherophoria* (3 or 4 sp.), *Allograpta* (1 sp.), *Baccha* (2 sp.).

In the genus *Syrphus*, the common occurrence of the European *S. pyrastris* in California, Utah, and as far east as Colorado, is remarkable when we recollect that it has never been found east of the Mississippi. Macquart received it from Chili. The question how it got to these regions is an interesting problem.

The other species of *Syrphus* are either identical with eastern species or closely allied to them. Both *Mesograpta* are species also occurring in the Atlantic States. The *Spherophoria* seem to be more numerous represented in California than east of the Mississippi.

Peculiarly western is the new genus *Eupeodes*, with a single species of common occurrence from California to Colorado.

Of *Eristalis* I have three species from California, two of which reach eastward to Colorado.

Helophilus is represented by two species, one of which (*H. latifrons* Lw.), common in the environs of San Francisco, has a wide easterly range, to Nebraska and probably beyond. The other (*H. polygrammus*) is a very peculiar form, and occurs high up in the Sierra Nevada and in Oregon.

In the genus *Volucella*, I have *V. mexicana* Macq. from Southern California and a new species. I also describe a *Volucella* and a *Temnocera* from Colorado.

Mallota posticata (with some doubt), *Polydonta curvipes* (at least the female), *Tropidia quadrata*, *Syritta pipiens*, have been found in California; *Polydonta* also in Colorado; *Syritta* everywhere.

Two Californian new species, intermediate between *Oriorrhina* and *Brachypalpus*, I doubtfully refer to *Pocota* St. Fargeau.

Chrysochlamys has been found in Utah, but not yet in California.

An interesting discovery is that of a new *Sphecomomyia* from the Sierra Nevada, the third species of the genus, or, perhaps, the second, if the European and the North American specimens belong to the same species, as may very possibly be the case. *S. vittata* has been found in the White Mountains, in the State of New York, and as far south as Virginia (probably in the mountains); recently I received it from Colorado. The European species was first discovered in Lithuania; afterward found in Finland and Norway; never in Western Europe. As far as I can judge from the figure, it seems to be the same as the North American species. The more interesting for this reason is the discovery of a decidedly distinct species, smaller, and with much shorter antennæ, found at an altitude of 7-8,000 feet in the Sierra Nevada. *Ceria* is hitherto represented in California by the single *C. tridentata* Loew.

With such scanty materials, it would be premature to draw any general conclusions about the relationship of the Californian fauna to other faunæ. As the *Syrphidæ* are among those families, the species of which are apt to have a very wide geographical distribution, the common occurrence of so many species in the Atlantic and in the Pacific States has nothing very astonishing. In the same way, many species of *Syrphidæ* are common to Europe and North America. In the occurrence of certain peculiar forms (for instance, *Eupeodes*) as well as of many species which have a wide western distribution, from California to Colorado, and are unknown in the Eastern States, the western fauna asserts its independent character.

The relationship to the European and to the Chilian fauna has hitherto shown itself only in the common occurrence of *Syrphus pyrastris*. In the occurrence of a larger number of species of *Sphaerophoria*, the Californian fauna seems to resemble the European rather than the Eastern American fauna.

PARAGUS sp.—Los Angeles, Cal., in March. A single specimen.

PIPIZA sp.—Geysers, Sonoma County, May 5-7. Very like some of the *Pipizæ* described by Mr. Loew from the Atlantic States, but with darker legs than any of them.

ORTHONEURA.—Summit Station, Sierra Nevada, July 17. A single specimen.

CHILOSIA sp.—Saucelito, Cal., July 1. A single male. Exactly like *Chilosia pallipes* Loew, Centur., iv, 70 (found by me in the District of

Columbia and in the White Mountains), only larger, 8-9^{mm} long; the hind femora are altogether red, with only a slight brownish shade before the apex.

CHILOSIA sp.—Saucelito, Cal., April 2. Two males. Not unlike *Chilosia tristis* Loew from the Atlantic States.

CHILOSIA sp.—Lagunitas Creek, April 15. A single male. Eyes pubescent, and therefore different from all the species from the Atlantic States described by Mr. Loew.

As in the Atlantic States the species of the corresponding genera are yet very little known, it is not worth the while to describe Californian species here.

MELANOSTOMA TIGRINA n. sp.—Dark metallic-green; abdomen velvet-black; segments 3 and 4 each with an olive-green metallic cross-band, the first interrupted, the second connected with the olive-green hind margin of the segment; fifth segment metallic-greenish; legs black, tibiæ brownish-red. Length 8-8.5^{mm}.

Male.—Face and front metallic-greenish-black; the face with a white pollen forming transverse, irregular, dotted ripples, the intervals of which show the ground-color; the cheeks and a stripe running over the facial tubercle are bare of pollen; upper oral edge somewhat upturned and facial tubercle projecting; antennæ black, third joint and arista brown; front faintly and evenly grayish-pollinose, and with erect black pile; vertical triangle metallic-green, with black pile. Thorax metallic-bluish-green, clothed with dull grayish pile, more whitish on the pleuræ. Halteres brownish. Abdomen elongated-elliptical; first segment greenish-black; the second velvet-black, opaque, its lateral edge metallic-olive-green, with a small subtriangular expansion; third segment anteriorly with an interrupted metallic-olive-green cross-band nearly half as broad as the segment, but expanded on the sides along the whole lateral margin; the posterior half of the segment is of a velvet-black, which does not quite reach the lateral margin; the fourth segment is like the third, except that the olive-green cross-band is not interrupted, or only sub-interrupted, and connected by a longitudinal olive-green stripe, cutting through the velvet-black portion with the narrow olive-green hind margin of the segment; thus the velvet-black on this segment forms a broad interrupted cross-band, not quite reaching the lateral margin; fifth segment and hypopygium metallic-green. Femora metallic-green; knees yellowish-brown; tibiæ yellowish-brown or brownish-yellow at the base, darker toward the tip, especially the last pair; tarsi black, first joint of the middle tarsi brown; first joint of the hind tarsi incrassate. Wings subhyaline; stigma brownish-yellow.

Hab.—Saucelito, Marin County, Cal., April 2; Yosemite Valley, June 13. Two males.

The abdomen of this species is broadest at the hind margin of the second segment.

MELANOSTOMA sp.—Petaluma, California, April 28. Abdomen more

linear than the preceding; face very much produced, almost conical, as in the description of *Syrphus trichopus* Thomson (Eugenies Resa, p. 502), which is evidently a *Melanostoma*. The "thorace haud viridi" of that description prevents me, however, from identifying it.

MELANOSTOMA sp.—Santa Barbara, Cal., February 10.

SYRPHUS.

I have six Californian species of this genus (in the restricted sense). They all show the greatest resemblance either to European species or to species from the Atlantic States. *S. pyrastris* is not distinguishable from the European species of that name. I have left the name of *S. lapponicus* to specimens but very little different from specimens from the Atlantic States which would pass under that name. Whether my *S. americanus* is the same as the species from the Atlantic States, the discovery of the as yet unknown female will have to prove. *S. intrudens* is remarkably like my *S. amalopsis* from the White Mountains, but seems to be, nevertheless, a different species. *S. protritus* is very like the common *S. rectus* and the European *S. ribesii*, but differs in the coloring of the legs.

Syrphus affords an interesting field for the study of the limits of variation; of local, perhaps seasonal varieties. It is very desirable that entomologists should collect large numbers in both sexes, and take note of the exact date and locality of each specimen. Until the laws of variation in *Syrphus* are better known, it would be useless to multiply species upon vague and secondary characters. In the present case, as in many others, I have preferred to retain the names of European or Eastern American species whenever the Californian specimens did not show any distinctive characters which I could consider as specific.

Several of my new species I possess in the male sex only. I have, nevertheless, described them, in the hope that these descriptions, owing to the frequent coincidences with the species from the Atlantic States, would not be unwelcome from one who described the latter.

For the detailed descriptions of the eastern species, I refer to my paper, "On the North American Species of the Genus *Syrphus*," in the Proceedings of the Boston Society of Natural History, October 6, 1875.

Syrphus fumipennis Thomson, Eugenies Resa, 499 (California), seems to be very near my *S. americanus* and *opinator*, but does not quite agree with either. The slightly brownish tinge of the wings is not a character to be relied upon.

I. The three abdominal yellow cross-bands are interrupted (dissolved into lunate spots):

Front very much projecting in both sexes; eyes pubescent; in the male, there is on the eyes a conspicuous area of larger facets in the middle; large species, with three pairs of sublunate yellowish-white abdominal spots on velvety-black ground 1. *pyrastris* Lin., ♂ ♀.

Front not unusually projecting; no conspicuous area of larger facets in the middle of the eye of the male; middle-sized species, with three pairs of yellow abdominal spots, the second and third lunate:

Face with a broad brown stripe over the tubercle; eyes pubescent;* abdominal lunules deeply emarginate in the middle2. *intrudens* n. sp., ♂.

Face with a small brown stripe over the tubercle; eyes glabrous; abdominal lunules of nearly equal breadth,
3. *lapponicus* Zett., ♂.

II. The second and third abdominal cross-bands are not interrupted; eyes glabrous:

The second and third cross-bands do not reach the lateral margin of the abdomen:

Face with a brown stripe in the middle on the tubercle; abdominal cross-bands broad4. *americanus* Wied., ♂.

Face and cheeks altogether yellow; abdominal cross-bands rather narrow5. *opinator* n. sp., ♂ ♀.

The second and third cross bands reach the lateral margin of the abdomen; in the male, all the femora are red to the very base, coxæ and trochanters being black6. *protritrus* n. sp., ♂.

1. *SYRPHUS PYRASTRI* (*Syrphus pyrastris* Linné, Fauna Suecica; *Syrphus transfugus* Fabricius, Ent. Syst., iv, 306; *Syrphus affinis* Say, Journ. Acad. Phil., iii, 93, 9).

The Californian specimens do not show any difference from the European ones, which I had for comparison, except that the abdominal yellow spots are a little narrower; and even this difference does not exist in my specimen from Colorado. Macquart (Dipt. Exot., ii, 2, 83 and 88) records the same species from Chili.

It occurs everywhere in California, is not rare, and begins to appear very early. I have specimens from Santa Barbara, February 10; Santa Monica, February 18; Petaluma, April 28; San Rafael, May 29; Yosemite, June; Webber Lake, July 26; Salt Lake, Utah, August 1. I also have it from Southern Colorado (W. L. Carpenter). Say had it from Arkansas. It is very striking that a species of such wide distribution should not occur at all in the Atlantic States.

Say's synonymy is not in the least doubtful; compare especially the foot-note in Wiedemann (Auss. Zw., ii, p. 118), where he explains that *Syrphus transfugus*, to which Say compares his *S. affinis*, is *transfugus* Fabricius, a synonym of *pyrastris*, specimens of which he had sent to Say. I was wrong in connecting *S. affinis* with *S. lapponicus* in my paper on *Syrphus* (p. 149).

In this species, the eyes of the male have an area of large facets in the upper and middle portion; a structure which I have not observed in any

*The pubescence of the eyes is always easier to perceive in male than in female *Syrphi*; in the latter, a very careful examination is often required.

other *Syrphus* (*sensu stricto*.); the hypopygium of the male is much smaller than in *Syrphus*, entirely concealed under the fifth segment; the front remarkably convex in both sexes. These characters fully justify the formation of a separate genus, which I will call *Catabomba*, in allusion to the mode of flight of the species (from *καταβομβέω*, I am humming round).

2. *SYRPHUS INTRUDENS* n. sp.—*Male*.—Eyes pubescent; face brownish-yellow, with a broad black stripe in the middle, abbreviated before the antennæ, and narrower than the yellow portion of the face on each side of it; the black is prolonged along the oral border to the black cheeks, which have a slight greenish reflection; antennæ black, third joint sometimes slightly reddish at the base; front and vertex black, with a greenish reflection and black pile; occiput beset with a fringe of fulvous pile. Thorax dark metallic-green, clothed with fulvous pile, especially conspicuous on the pleuræ; scutellum with a shade of dull yellowish under the strong greenish-metallic luster; its pile is black; a few fulvous hairs on the sides only. Abdomen black, very little shining; on the second segment two oblong yellow spots, not reaching the lateral margin; on the third and fourth segments, a pair of deeply lunate spots, club-shaped at both ends, touching the anterior margin on one side, broadly contiguous to the lateral margin on the other; the deep excision on them has a triangular shape; fourth and fifth segments with a narrow yellow posterior margin. Halteres with a lemon-yellow knob; legs reddish; anterior femora black on their proximal half; hind femora black, except the tip; hind tibiæ with a brown ring in the middle; the other tibiæ also slightly marked with brown; tarsi brownish above. Wings distinctly tinged with brownish; stigma brownish. Length about 10^{mm}.

Hab.—In the woods of the Coast Range, in the spring; Lagunitas Creek, April 15–20; also received from Mr. H. Edwards three males.

Very like *Syrphus amalopsis* O. S. from the White Mountains, N. H., but the pile on the occiput is bright fulvous, not pale yellowish-white; there is more fulvous pile on the thorax; the abdominal spots are a little larger, their inner club-shaped end more clumsy, the emargination deeper; the legs are less dark-colored; the facial tubercle less prominent. Nevertheless, the resemblance is very striking. *S. amalopsis* seems to be a very variable species; in the females which I have seen, the lunate abdominal spots were dissolved in two, thus forming transverse rows of four spots on segments 3 and 4; the cross-bands sometimes touch the lateral margins, sometimes not. The same variations may occur in *S. intrudens*.

3. *SYRPHUS LAPPONICUS* Zetterstedt, Dipt. Scand, ii, 701, 3.—In my above-quoted essay on *Syrphus* (p. 149), I have referred to this species a number of specimens from the Northern Atlantic States and the British Possessions, which agree in all respects with Mr. Zetterstedt's description, and some of which, sent by me to Dr. Loew, were

recognized by him as *S. lapponicus*. Four male specimens from California (Lagunitas Creek, Marin County, April 15; the Geysers, Sonoma County, May 5-7; Yosemite Valley, June 5) do not differ in any essential character from the former. They are a little smaller, and the abdominal lunate spots are a little broader; the thorax is more greenish than bluish. I have specimens from the Atlantic States, however, which even in these particulars agree with my Californians. A specimen from British Columbia is larger, and resembles in all respects some specimens from Maine and New York State. In Europe, the same differences occur, and there seems to exist a good deal of uncertainty about *S. arcuatus* and *lapponicus*, which differ only in the degree of curvature of the third vein. My Californian specimens have this curvature strongly marked, but among my eastern specimens there are some where it is very weak.

The reference to *S. affinis* Say, in my paper (l. c., 149), must be struck out (see *ante*, in *S. pyrastris*).

4. SYRPHUS AMERICANUS (*Syrphus americanus* Wiedemann, Osten Sacken, l. c., 145).—I provisionally refer to this species a dozen of male specimens taken in Marin and Sonoma Counties, California, in April and May, and in Yosemite Valley in June. They are larger than the ordinary specimens from the Atlantic States, and measure from 9.5^{mm} to 11^{mm}. The first yellow cross-band is more broadly interrupted; the two other cross-bands are very variable in breadth, sometimes narrower than their black intervals, emarginate posteriorly. I have no females, and will remark here that they have entirely yellow femora, and that the first abdominal cross-band is, in most cases, *not* interrupted (compare l. c., p. 146); and, unless these characters are also to be found in the females from California, their specific distinctness is no longer doubtful.

A specimen from Oregon (H. Edwards) is smaller, and has the yellow abdominal spots of the first pair laterally prolonged, so as to reach the anterior corner of the segment (instead of being entirely cut off from the edge of the abdomen by a black margin). I am not sure about the specific identity of this specimen.

For a detailed description of *S. americanus*, see my paper on *Syrphus*.

5. SYRPHUS OPINATOR n. sp.—*Male*.—Eyes glabrous; face, including the cheeks, altogether yellow or reddish-yellow; no brown stripe on the facial tubercle; antennæ brown, reddish on the under side; front above the antennæ yellow, the angle between the eyes greenish-black, yellowish-pruinose beset, with black hair; small brown marks above the root of the antennæ. Thorax metallic-bluish-green, densely beset with yellow pile; the broad, geminate, grayish stripe in the middle is subobsolete. Scutellum yellowish-metallic-opalescent, beset with black pile. Abdomen black, opaque on the anterior, subopaque on the posterior part of the segments; the two yellow spots on the second segment are prolonged anteriorly, so as to reach the lateral margin of the segment at its anterior corner; the two other cross-bands are rather

narrow (not much broader than one-fourth of the breadth of the segment), attenuated in the middle (even subinterrupted in one of the specimens); their ends are separated from the lateral margin by a narrow black interval; posterior margin of the fourth segment with a narrow reddish border; that of the fifth still narrower. Legs reddish-yellow; proximal half (or nearly so) of the four anterior femora black; hind femora black, except at tip; hind tarsi infuscated. Stigma brownish; both costal cells distinctly tinged with brown. Length 9-11^{mm}.

Female.—I have two specimens which I refer to this species, on account of their entirely yellow face and the course of the cross-bands, which is nearly the same as in the male; but the femora are entirely reddish-yellow, coxæ and trochanters remaining black. Vertex greenish-black; front metallic-green, densely yellowish-pollinose, its lower part reddish-yellow, except two brownish marks above the root of the antennæ.

Hab.—Marin County, California (Saucelito, April 2; San Geronimo, April 20). Two males and two females.

6. *SYRPHUS PROTITUS* n. sp.—*Male*.—Eyes glabrous; face yellow, with a bluish opalescence; on the cheeks a large blackish spot below the eye, and not quite reaching the oral margin (it is variable in size, sometimes very small); the lower edge of the head behind the mouth and between the lower end of the eyes is again yellow. Antennæ red, sometimes faintly brown on the upper side of the third joint; front brownish-yellow above the antennæ, black, slightly pruinose, and with black pile in the corner between the eyes; vertex black, with black pile; occiput grayish, beset with pale hairs. Thorax dark bronze-green, beset with dense yellowish pile. Scutellum yellowish, with black pile, some yellowish hairs on each side. Abdomen black, opaque, with three reddish-yellow cross-bands, the first of which is broadly interrupted; the two yellow spots thus formed are prolonged along the lateral margin to the very base of the abdomen; the second and third bands reach the lateral margin, being only a little attenuated before it; they are biconvex posteriorly, with an angular emargination in the middle; fourth segment with a yellow border posteriorly; the fifth red, with a black triangle in the middle. Legs altogether reddish, often a brown shade in the middle of the hind tibiæ and on the hind tarsi; femora red from the very base; coxæ and trochanters black. Wings subhyaline; their root tinged with brownish, the costal cell with yellowish; stigma brownish-yellow; third vein nearly straight. Length 10-12^{mm}.

Hab.—Saucelito, Marin County, Cal., April. Four males.

Is very like the common *S. rectus* of the Atlantic States; only in that species the male has black hind femora, the black spot on the cheeks is smaller, and the antennæ are much darker.

EUPEODES nov. gen.

Very like *Syrphus*, from which it can be at once distinguished in the male sex by the large development of the sixth abdominal segment and

of the male hypopygium. In the female, the fifth abdominal segment is about half as long as the preceding, while in *Syrphus* proper the relation between the corresponding segments is as 1 to about 3 or 4. The scutellum in both sexes is unusually raised, exposing the metanotum more than in *Syrphus*; in the female, it has a distinct yellow border, which is not the case in the known American species of *Syrphus*.

The sixth abdominal segment in the male is as long as the two preceding segments taken together, but narrower; it is convex, almost tubular, when seen from above, and unsymmetrical, its end pointing slightly to the right. The seventh segment on the under side of the sixth bears the opening of the anus. Beyond the anus, on the under side of the body, there are two long, linear, subparallel appendages, arcuate, bidentate at the end; these appendages are bent under the body when in repose, and are imbedded in a horny groove on the under side of the sixth segment, which encroaches on the fifth; when in motion, these appendages come out of the groove like a blade of a pen-knife, at an angle to the axis of the abdomen; in length, they are nearly equal to the whole sixth segment.

The name has reference to the structure of the hypopygium.

EUPEODES VOLUCRIS n. sp.—*Male*.—Eyes bare. Face whitish-yellow, with black cheeks and a brown stripe over the facial tubercle; front whitish-yellow, with some black pile; antennæ dark brown; vertex black. Thorax dark metallic-green, sometimes slightly bluish, with very pale yellowish pile; scutellum yellowish, more or less metallescent, with pale yellow pile; abdomen black, opaque; the first segment, the lateral and posterior margins of all the segments, shining; the fifth altogether shining; on the second segment two yellow oblong spots, well separated from the lateral margin; on each of the two following segments, a pair of larger, oblong, yellow spots; those on segment 3 very slightly lunate; the posterior margins of the fourth and fifth segments with narrow yellow margins. The sixth segment is black, shining, sparsely beset with whitish pile; its shape has been described in the generic character. Legs reddish; base of femora black; hind femora black, except the tip; hind tarsi more or less brown on the upper side. Wings hyaline; stigma yellowish-brown; anterior costal cell hyaline, the posterior tinged with yellowish.

Female.—Front and vertex black; across the black a faint subinterrupted arcuate stripe of pollen, leaving a triangular glabrous black space below; lower part of the front yellow, except a dark brown crescent-shaped spot above the root of the antennæ; a narrow yellow space between this spot and the black above. Scutellum distinctly yellow along the edge; the black at the root of the femora is a little less extensive here. Length very variable, from 10^{mm} down to 7^{mm}.

Hab.—California, Nevada, Utah, Colorado, common. I found it commonly in Los Angeles in February; in Marin County in April; in Yosemite in June; in Utah in August. I also have specimens from Den-

ver, Clear Creek, etc., Colo., August (P. R. Uhler); Spanish Peaks, Colo., June 15 (W. L. Carpenter). More than two dozen specimens of both sexes.

MESOGRAPTA GEMINATA (Say), Journ. Acad. Phil., iii, 92, 7 (*Scæva*).—Occurs both in the Atlantic and Pacific States (San Rafael, Cal., April, May; Yosemite, June).

MESOGRAPTA MARGINATA (Say), Journ. Acad. Phil., iii, 92, 6, (*Scæva*).—Common on both coasts (Los Angeles, Cal., in February; Webber Lake, Sierra Nevada, in July); also in Denver, Col. (Uhler). Is not *Syrphus limbiventris* Thomson (Eugenies Resa, 495) simply a variety of this species?

SPHÆROPHORIA SULPHURIPES (Thomson), Eugenies Resa, 500 (*Syrphus*).—Specimens (♀) from San Rafael, May 29, and Yosemite, June 14, agree with Mr. Thomson's description. The cross-band on the fourth segment is sometimes interrupted. Whether the male specimen described by Mr. Thomson belongs here seems doubtful. I have males with entirely yellow coxæ, like those of the female; the cross-bands or segments 2 and 3 are not interrupted, and reach the lateral margin; segments 4-6 are reddish, with brownish marks. In other males, the hind coxæ are dark, but with a yellow spot behind; the cross-bands are laterally interrupted before reaching the margin. I also have specimens with a brown stripe over the face, dark femora, and hypopygium.

California seems to be rich in species of this group, richer than the Atlantic States; and in this it again resembles Europe. In Europe, the definition of the species of *Sphærophoria* is, as yet, an unsolved problem; they seem to be very variable in their coloring, and it would not be safe to multiply descriptions of Californian species based on coloring only. It seems doubtful to me whether the *Syrphus infuscatus* Thomson is not the same species as his *sulphuripes*, and I am not at all sure whether the latter is not identical with the common *Sphærophoria cylindrica* of the Atlantic States.

Among the several species of this genus which I have before me, I will describe only one, which has very marked characters to distinguish it.

SPHÆROPHORIA MICRURA n. sp.—*Male*.—Face of a somewhat livid yellow, with a brown stripe in the middle; front above the antennæ, with a large semicircular greenish-metallic spot; the interval between this spot and the eyes is yellow; antennæ brown, third joint reddish at the base and on the under side; cheeks metallic blackish-green, but oral margin yellow. Thorax dark metallic-green, with the usual antealar humeral yellow stripes; scutellum yellow, with black pile; pleuræ dark metallic, somewhat bluish; abdomen black; first segment with a very narrow basal yellow margin; segments 2-4 each with a straight yellow cross-band, reaching the lateral margin, and framed in anteriorly and posteriorly in velvet-black, opaque cross-bands; the hind margins of the segments are shining bluish-black; the cross-band on segment 2 is narrower than the two others, and

sometimes narrowly interrupted in the middle; segment 5 has yellow sides and two yellow streaks in the middle; the hypopygium is black, and unusually small for a *Spharophoria*. Legs dark brown or black; the ends of the middle and front femora to a greater or less extent brownish-yellow. Wings with a distinct brown tinge. Length 7.5–9^{mm}.

Hab.—California (the Geysers, Sonoma County, May 5–7; San Rafael, May 29; Brooklyn, near San Francisco, July 11). Seven males.

Easily distinguished by the very small, black hypopygium, the color of face and front, the dark legs, etc. The dark metallic color of the cheeks sometime extends along the interval between the occiput and the posterior oral margin; sometimes there is in that interval a more or less extensive yellow spot.

ALLOGRAPTA FRACTA n. sp.—*Male.*—Face, including the frontal triangle, pale yellow, slightly opalescent; a bluish-black stripe extends from the oral edge to the antennæ, forming a semicircle above them; antennæ reddish, third segment brown along the upper edge; vertex black. Thorax bright metallic green, a pale yellow stripe on each side between the humerus and the root of the wings; antescutellar callosity yellowish; scutellum of a saturate yellow, the extreme corners dark; halteres with yellow knobs. First abdominal segment metallic greenish-black, its extreme anterior margin only yellow; the rest of the abdomen black, opaque; an interrupted yellow cross-band on the second segment, equal to about one-third the segment in breadth; a somewhat broader, slightly arched, and not interrupted yellow cross-band on the third segment; on the fourth, two narrow, parallel, longitudinal lines in the middle, and an obliquely placed, large, oval spot on each side of them, yellow; the narrow fifth segment shows a yellow picture, somewhat resembling that of the fourth segment. Legs yellow; tips of tarsi brownish; hind femora with a brown ring before the tip; hind tibiæ with two such rings, one before the middle, the other before the tip; hind tarsi brown, except the under side of the first joint. Wings hyaline; stigma brownish-yellow. Length 7^{mm}.

Hab.—Santa Monica, Cal., February 20, 1876. A single male.

Observation.—I perceive, even in the dry specimen, the difference between the larger facets of the upper half of the eye, and the smaller ones of the lower half, a character which I have pointed out as distinctive of the new genus *Allograpta* (see Buff. Bull. N. H., iii, 49). The coloring of the abdomen of this species is similar in character to that of the typical *A. obliqua* Say.

SPIEGINA.—A single female, from Lagunitas Creek, Marin County, California, April 15, black, with a red abdomen and red legs, seems to differ from *S. infuscata* Loew from Sitka (Centur., iii, 23).

BACCHA LEMUR n. sp.—Wings hyaline, with an incomplete brown cross-band between the stigma and the fourth posterior cell; abdomen with two red cross-bands. Length 10–11^{mm}.

Front and vertex metallic greenish-black, the former (in the ♀)

whitish-pruinose along the eyes; face whitish-pruinose, its ground-color variable, dark metallic-green, with more or less brownish-yellow on the sides and on the facial tubercle, or entirely yellowish; antennæ brown or reddish-brown, inserted on brownish-yellow ground. Thorax metallic greenish-black, with vestiges of whitish-pruinose stripes anteriorly; pleuræ whitish-pruinose, with white pile; scutellum translucent yellowish-brown, with a metallic reflection; halteres with yellow knobs. Abdomen black, shining, with bronze and bluish reflections; a broad blood-red cross-band slightly emarginate in the middle posteriorly, at the base of the third and fourth segments; these cross-bands are slightly pruinose; the sides of the abdomen beset with white pile. Legs pale yellow; hind femora and tibiæ usually each with a brownish ring; sometimes the legs are more brownish, especially on the femora. Wings hyaline; the root before the humeral cross-vein and the extreme base of the second basal cell is infuscated; costal cell hyaline, but the interval between auxiliary and first veins is pale brownish; stigma dark brown, the corner between the costa and the end of the first vein yellowish; a brown, incomplete cross-band between the first and fifth veins; it coalesces with the brown stigma, leaves hyaline the extreme proximal end of the submarginal cell, covers the small cross-vein and the cross-vein at the base of the discal cell, but reaches only very little beyond either, and ends at the fifth vein, filling up the proximal end of the fourth posterior cell.

Hab.—Santa Monica, Cal., February 18; Summit Station, Sierra Nevada, July 17; Fort Bridger, Wyo., August 4; Morino Valley, New Mexico, July 1, W. L. Carpenter. One male and three females.

BACCHA ANGUSTA n. sp.—Wings hyaline at the base, slightly shaded with brownish-gray beyond the cross-veins; abdomen with two yellow cross-bands. Length 7–8^{mm}.

Male.—Face and front metallic-green; antennæ brownish (the head is somewhat injured in my specimen.) Thorax and scutellum bronze-color; halteres brownish-yellow; the tip of the knob brownish. Abdomen: two first segments bronze-color, the second long and very slender, the remainder metallic-brown, with brownish-yellow cross-bands at the base of the third and fourth segments; the cross-band on the fourth segment occupies about one-third of its breadth; that on the third is a little narrower. Wings hyaline from the root to the central cross-veins, slightly tinged with grayish beyond; a brown cloud between the tip of the auxiliary vein and the first vein; beyond this cloud, the space between the costa and the first vein is brownish-yellow. Legs yellowish, more or less tinged with brown in the hind pair.

Hab.—Lagunitas Creek, Marin County, California, April 15. A single male.

VOLUCELLA MEXICANA Macquart.—Besides Mexico and Texas, this species occurs in Southern California. I have received specimens from

the island of Santa Rosa (S. Cal.), through the kindness of Mr. H. Edwards.

VOLUCELLA MARGINATA Say, Journ. Ac. Phil., vi, 166.—Mexico (Say); Waco, Texas (Belfrage); a specimen was kindly given by Mr. E. Burgess.

VOLUCELLA AVIDA n. sp.—Face with a narrow brown stripe; cheeks shining, black; abdomen honey-yellow; hind margins of segments and longitudinal narrow dorsal stripe on segments 2-4 black; wings hyaline; cross-veins and stigma clouded with dark brown. Length 11-12^{mm}.

Antennæ, light-brown; arista of the same color, plumose; third antennal joint about two thirds of the length of the arista, its basal half a little expanded; face pale whitish-yellow, a narrow black stripe runs from the mouth upward, becoming paler and finally obsolete before reaching the antennæ; cheeks black, shining; frontal triangle of the male pale whitish-yellow, beset with black pile; profile straight, with a slight depression under the antennæ; eyes densely pubescent. Thorax greenish-black; on each side, between the humerus and the scutellum, a rather broad, dull, honey-yellow stripe; in front of the scutellum, a yellowish, rather obscure parallelogram, emarginate anteriorly; sides of the dorsum and pleuræ beset with yellowish white hairs. Scutellum yellowish, subtranslucent, beset with black hair along the edge. Abdomen pale honey-yellow; first segment black; the second and third segments posteriorly with a narrow black margin, expanded on each side along the lateral margin, and prolonged in the middle in the shape of a longitudinal black stripe toward the anterior margin; on segment 2, this stripe is broadly expanded, so as to coalesce with the black of the first segment; on segment 3, on the contrary, it is tapering anteriorly; segment 4 with a black cross-band a little beyond the middle, with a subtriangular expansion in the middle, reaching toward the anterior margin; hypopygium, black; the abdomen is clothed with short black hairs on its black portions, and with longer yellowish-white pile in the yellow regions, especially on the sides and around the black triangle on the second segment. Femora black; knees and anterior half of the tibiæ brownish-yellow; tarsi black. Wings, hyaline; latter half of the subcostal cell and the interval between the auxiliary and first longitudinal vein as far as the stigma brownish; stigma dark brown; central cross-veins and small cross-vein with well defined, although small, brown clouds; the second vein ends in the first, some little distance before the tip of the latter.

Hab.—California (G. R. Crotch). A single male.

VOLUCELLA SATUR n. sp.—Face altogether yellow; cheeks yellow, except a black stripe from the lower corner of the eye to the anterior oral edge; abdomen honey-yellow, first segment black, hind margin of segments 2 and 3 with a narrow black border, that of the second segment connected with the black first segment by a broad black stripe

expanding anteriorly; wings hyaline, cross-veins and stigma clouded with pale brown. Length 9-10^{mm}.

Antennæ light brown; arista reddish, plumose; third antennal joint nearly as long as the arista, linear. Face yellow, a black stripe runs obliquely from the lower corner of the eye to the anterior oral margin; behind it the cheeks are yellow; profile of the face straight; the depression under the antennæ is hardly perceptible; the frontal triangle of the male is yellow, beset with black hair, the vertex black; in the female, the front has a greenish tinge, as if underlying the yellow; a slender yellow line runs from the antennæ toward the yellow vertex; the ocelli are placed on a cordiform black spot. Eyes densely pubescent. Thorax blackish-green; on each side, between humerus and scutellum, a rather broad, dull, honey-yellow stripe, with a short black streak in the middle; in front of the scutellum, a yellowish, rather obscure parallelogram, emarginate anteriorly. Pleuræ with a large yellow spot under the humeri; they are beset with yellow pile. Scutellum yellow, with black pile on the edge. Halteres with yellow knobs. Abdomen honey-yellowish; first segment black; second and third with a narrow, parallel, black hind border; the black border of the second segment is connected with the black of the first segment by a black longitudinal stripe, which is narrow in the female, broad and triangularly expanded anteriorly in the male; fourth segment with a broader black hind border; the fifth black. Femora black; knees and two-thirds of the tibiæ brownish-yellow; the last third black, or, on the intermediate pair, brownish; tarsi reddish at base, brownish or black at tip. Wings grayish-hyaline; stigma yellowish, with a small, pale brown cloud; cross-veins at the base of the first and last posterior cells and of the discal cell and the origin of the third vein with small brown clouds; still smaller, almost imperceptible clouds at the tip of the second vein, near its junction with the first, and on the curvature of the vein closing the first posterior cell; this curvature is much less strong here than in *V. fasciata*; the second vein ends in the first close by the tip of the latter.

Hab.—Colorado Plains (W. L. Carpenter). I took a specimen in the railway-carriage, between Wahsatch and Evanston, Utah, at an altitude of 6,800 feet, August 3. Two males and one female.

VOLUCELLA FASCIATA Macquart, Dipt. Exot., ii, 2, 22.—Occurs in Texas; also in Manitou, Colo.

TEMNOCERA SETIGERA n. sp.—Proboscis nearly twice as long as the head, pointed at the end; snout projecting in the shape of a cone; scutellum with fourteen black bristles along the edge; abdomen brownish-yellow, with a black spot at the tip, embracing segment 5 and a part of segment 4. Length 14^{mm}.

Female.—Face and front honey-yellowish, clothed with black pile, which is very short on the face and longer on the front; the face is excavated below the antennæ, its lower part projecting in the shape of a cone, the tip of which is bifid and slightly infuscated. Antennæ: first

two joints yellowish-brown; third joint light brown, excised above, so that its latter portion is much narrower; arista feathery, black; proboscis 7-8^{mm} long, black, pointed. Thorax densely clothed with a yellowish recumbent pubescence, and, mixed with it, short, black, erect pile; they almost conceal the dark greenish ground-color, as well as the obscurely visible yellowish lateral stripes and large yellowish spot in front of the scutellum; on the sides of the thorax, several stiff, black bristles; a pair of such bristles, but smaller, a little in front of the scutellum; pectus blackish. Scutellum somewhat inflated, honey-yellow, beset with a mixed black and yellow pubescence; along the edge fourteen stiff black bristles. Abdomen brownish-yellow; second and third segments with broad blackish parallel borders posteriorly, formed by short and very dense black hairs; the cross-bands thus produced are very distinct when viewed obliquely, although almost invisible from above; that on the second segment occupies more than one-third, that on the third more than one-half of the length of the segment; segment 4 shows posteriorly a semicircular, black, shining spot, occupying the whole posterior margin and reaching beyond the middle of the segment anteriorly; segment 5 is black. Femora black; knees and anterior half of the tibiæ brownish-yellow; the remainder of the tibiæ as well as the tarsi are darker. Wings grayish-hyaline; cross-veins and tip of second vein with small brown clouds; stigma brown.

Hab.—Vermejo River, New Mexico, June 25 (W. L. Carpenter).

I do not hesitate to describe this well-marked species, although I have only a single, not very well preserved female. On account of the bristles on the scutellum and the shape of the third antennal joint, I place it in the genus *Temnocera*, although I do not think that this genus is defined in a very satisfactory manner.

TEMNOCERA MEGACEPHALA Loew, Centur., iv, 57.—California. I do not know this species.

ARCTOPHILA FLAGRANS Osten Sacken, Bulletin Buffalo Soc. N. II., iii, 1875, 69.—*Male.*—Face wax-yellow. Cheeks black. Antennæ: basal joints brownish; third joint reddish, the plumose arista black. Thoracic dorsum densely clothed with yellowish hair, through which, however, the metallic brownish-coppery ground-color is apparent; pleuræ black in the middle, with a stripe formed by yellow pile. Abdomen with long yellow pile at the base and on the sides, with reddish hair in the middle and at the tip; between the hairs, the black metallescent ground-color is apparent. Legs black; front tibiæ beset on the inside with short golden-yellow hairs; three basal joints of the four posterior tarsi brownish-red. Wings with a slight grayish tinge; a brown spot limited by the fourth longitudinal vein, the costa, the small cross-vein, and the origin of the third vein; the latter vein is more deeply sinuate than in *A. bombyformis*. Length 13^{mm}.

Hab.—Colorado Mountains (Lieut. W. L. Carpenter). A single male.

ERISTALIS HIRTUS (*Eristalis hirtus* Loew, Centur., vi, 66; *Eristalis*

temporalis Thomson, Eug. Resa, 490.)—Common in California as well as in the Rocky Mountains (environs of San Francisco, May, June; Yosemite, June; Lake Tahoe, July 19; Webber Lake, July 27; Georgetown, Colo., August 12). I have also specimens from South Park and Twin Lakes, Colorado, by W. L. Carpenter.

The specimens vary in size from 5^{mm} to 8^{mm}. As a rule, those from high altitudes are smaller and darker in color. To Mr. Loew's description of the male, otherwise remarkably accurate and complete, should be added that the frontal triangle above the antennæ is rather convex, and bears a conspicuous tuft of yellowish pile; on the anterior part of the fourth abdominal segment, in the middle, there is a velvet-black streak, similar to a corresponding streak on the preceding segment; and, instead of "in segmentorum *tertii* et *quarti* partibus nigrovelutinis", read "secundi et *tertii*".

The female has a remarkably broad and convex front, a very characteristic mark of the species; it bears a dense crop of yellowish hair. The black vertex has some black pile in the middle. The yellow triangles on the second abdominal segment are usually smaller than in the male; in many specimens, they are subobsolete, brownish; often the yellow disappears entirely, leaving only two shining black triangles on velvety-black ground. On the wings, there is, in some specimens, a brownish shadow in the middle, immediately beyond the central cross-veins. The specimens with the obsolete and subobsolete yellow abdominal triangles seem to come principally from the higher altitudes.

I have seven males and twenty females.

ERISTALIS STIPATOR n. sp.—Eyes pubescent, the yellow arista bare; second abdominal segment with a yellow triangle on each side, framed in posteriorly by a velvety-black cross-band, interrupted (or subinterrupted) in the middle; narrow posterior margins of segments 2-4 yellowish-white, beset with a rather conspicuous fringe of pale golden-yellow, comparatively long hairs, this fringe being broadest on the fourth segment. Length 9^{mm} to 13^{mm}, sometimes larger.

Male.—Face yellowish-white, densely clothed with hairs of the same color; the black stripe in the middle is rather broad; cheeks black, shining; antennæ black, third joint dark brown; arista reddish-yellow, glabrous; eyes pubescent, the suture between them rather short (about half as long as the interval between apex of the frontal triangle and the root of the antennæ), the apex of the vertical triangle being considerably prolonged in front of the antennæ. Thorax greenish-black, unicolorous, shining, beset with yellowish pile, which is denser on the pleuræ. Scutellum reddish-brown. Second abdominal segment with a yellow triangle of the usual shape on each side; a velvet-black cross-band on the anterior margin, another one along the posterior side of the yellow triangles; the latter is interrupted (or subinterrupted) in the middle, oblique on each side, and interrupted before reaching the lateral margin; a smooth bluish-black space is inclosed between the two cross bands

and the triangles; a narrow, shining, triangular space between the last cross-band and yellowish-white posterior margin of the segment, which bears a fringe of pale golden-yellow hairs; the third and fourth segments have the same pale yellowish posterior margin and the golden fringe upon it; on the fourth, however, the fringe is broader, and takes in the whole posterior half of the segment; on the posterior half of the third segment, there is on each side an elongated velvet-black spot; the anterior margin of this segment has a narrow, pale border, as if prolonging the hind margin of the preceding segment; hypopygium black. Legs black; tip of the femora and anterior half of the tibiæ yellowish-white; on the middle pair, three quarters of the tibiæ and the base of the tarsi are of a pale color. Wings hyaline; stigma small, brown.

Female.—Front broad and rather convex, grayish-pollinose, beset with a dense grayish-white down; vertex a little darker; no velvet-black spots on the third segment; lateral abdominal triangles often brownish-yellow; sometimes a reddish-brown shade in the middle of the wing; for the rest, like the male.

Hab.—Manitou Park, Colorado (P. R. Uhler); Morino Valley, New Mexico, July 1 (W. L. Carpenter); Denver, July 10 (A. S. Packard); California (G. R. Crotch). Four males and eight females.

This species is very variable in size; the four males and four females from Manitou being only 9–10^{mm} long. My only specimen from California has the thoracic pile more reddish, that on the face more yellowish.

ERISTALIS sp.—California (H. Edwards). Very like *E. bastardi* of the Atlantic States, but different in the more metallescent surface of the abdomen and the presence of two grayish thoracic stripes in the female, abbreviated posteriorly. Some specimens from Vancouver Island seem also to belong here. As the species seems to be variable, I do not attempt to describe it with the insufficient material which I have on hand.

ERISTALIS ANDROCLUS Walker, List, etc., iii, 612.—The species which, rightly or wrongly, Mr. Loew and myself have identified with Mr. Walker's description, has a very wide distribution. It occurs in Canada, in the White Mountains, in Western New York (Cayuga Lake). I found several specimens near Ogden, Utah, August 2, 1876. Specimens from Yukon River, Alaska, have the arista dark and the velvety spots on the abdomen somewhat different.

HELOPHILUS LATIFRONS Loew, Centur., iv, 73.—My Californian specimens agree with Dr. Loew's original specimens, and also with his description, except the words "hypopygium maris plerumque flavum". In all my specimens, including Dr. Loew's originals, the black ground-color of the hypopygium is concealed under a thick yellowish-gray pollen, and is beset with yellow pile.

H. latifrons (male) differs from *H. similis* (male) of the Atlantic States in the greater breadth of the front (it is at least by one-half broader), the

darker antennæ, the broader yellow cross-bands on the abdomen, leaving a narrower black posterior margin of the segments.

I have five males from Petaluma, Sonoma County, Cal., April 28. Mr. Loew described specimens from Nebraska (F. V. Hayden). I have also seen some from the Red River of the North (R. Kennicott).

HELOPHILUS POLYGRAMMUS Loew, Centur., x, 55.—The author describes the female. In the male, the front is but very little narrower than in the female; the color of the abdomen is lighter yellowish-brown on the sides, especially on the second and third segments.

Hab.—Webber Lake, Sierra County, California, July 27. A male and a female. Oregon (H. Edwards).

MALLOTA POSTICATA Fabricius, Syst. Antl., 237, 21 (*Eristalis*).—I took a male specimen near San Rafael, Cal., May 29, which resembles this species very much. Unfortunately, I have only a single damaged male from the State of New York for comparison. In the Californian specimen, the eyes do not come in contact, as there is a very narrow frontal interval between them. There is a brown cloud in the middle of the wing, especially on the central cross-veins, which does not exist in my eastern specimen. These differences render the specific identity uncertain.

Macquart is wrong when he calls the eyes of the male pubescent. My statement (in the Bull. Buffalo Soc. N. H., Dec., 1875, 64), that the male has a projecting spur in the middle of the hind tibiæ, is likewise erroneous; it was based upon a specimen in which the pubescence of the hind tibiæ was clotted, so as to produce the appearance of a spur.

POLYDONTA CURVIPES (Wiedemann; synonym in the male sex with *P. bicolor* Macq.; in the female with *Helophilus albiceps* Macquart, Dipt. Exot., 1er suppl., 132, 9).—The male of this species is most remarkably different from the female. A female in the Mus. Comp. Zoöl., Cambridge, Mass., from San Francisco, Cal. (W. Holden), resembles the eastern specimens; only the face is more whitish than yellowish, and the vertex a little less thickly yellowish-pruinose. I also have received specimens from Northern New Mexico (W. L. Carpenter). I would not pronounce on the identity of these western specimens before seeing the males.

TROPIDIA QUADRATA (Say), a male from Marin County, California (H. Edwards), does not differ from specimens from the Atlantic States.

POCOTA ALOPEX n. sp.—Black; thoracic dorsum with dense yellowish-rufous pile; pleuræ black; wings tinged with reddish-brown anteriorly, subhyaline posteriorly. Length 10–11^{mm}.

Female.—Antennæ brown, first joint black; arista rufous; head black, shining; front rather broad, beset with yellow pile. Thoracic dorsum beset with dense yellowish-rufous pile, which nearly conceals the shining black, submetallic ground-color; pleuræ black, with black pile; scutellum black, with a purplish reflection and long black pile along the edge; halteres brownish. Abdomen black, shining, beset with black pile and some scattered pale yellow pile toward the tip.

Legs black; knees and base of tibiæ of the two anterior pairs pale brownish; hind femora somewhat incrassate and beset with a tuft of yellow hairs above; hind tibiæ rather stout. Wings tinged with reddish-brown anteriorly, especially along the veins, the inside of the cells being paler; posterior portion subhyaline, slightly brownish along the veins.

Hab.—Marin County, California (H. Edwards). A single female.

Observation.—If a face prolonged downward, and provided with a tubercle in the middle, is to be considered as characteristics of *Criorrhina*, the present species and the following do not belong in that genus. In both of these species, the face forms a short snout, prolonged anteriorly rather than downward, somewhat obtusely keel-shaped above, and deeply emarginate at the tip. There is no tubercle on the face, which is in the profile gently concave between the antennæ and the oral edge. The hind femora are stouter than in *Criorrhina*, especially a short distance before the tip. As these species have no spines on the under side of the hind femora, and as the palpi are rather long and narrow, they cannot be placed in the genus *Brachypalpus*. The great looseness with which most of the genera of *Syrphidae* are defined makes me very little inclined to increase their number without absolute necessity. I prefer, therefore, to place these species provisionally in the genus *Pocota*, adopted by St. Fargeau and resuscitated by Schiner, the face of which is without tubercle, although, judging from the description, it has a somewhat different structure. I will observe here, at the same time, that Schiner calls the genus *Plocota*, while I find *Pocota* in the Encyclopédie Méthodique, probably from *πόζος*, sheep-wool; *ποζώω*, to cover with wool.

POCOTA CYANELLA n. sp.—Thorax greenish-black, beset with long, grayish pile above, and yellowish-white pile on the sides; abdomen dark bluish-metallic; in the male with a black, opaque second segment, and a black, opaque cross-band on the third; legs black. Length 9–10^{mm}.

Face black, shining; snout projecting, keel-shaped above; on each side of the snout, a broad stripe of grayish pollen somewhat conceals the black ground-color; front and vertex black, but little shining in the female, and densely clothed with yellowish-white pile, some of which descends along the sides of the face, below the antennæ; the occiput and the posterior and inferior orbits of the eyes are beset with pile of the same color. Antennæ brown; first joint paler; arista reddish. Thorax metallic greenish-black, densely clothed with pile, which is of a dull-grayish on the dorsum and more yellowish-white on the pleuræ. Halteres brownish. Abdomen dark metallic-blue, beset, especially on the sides, with whitish pile; in the male, the second segment is black, opaque, except two triangles on each side, which are metallic-blue; the third segment has an arcuated, black, opaque cross-band, somewhat interrupted in the middle. Legs black; tibiæ brown; knees of the two first pairs yellowish-brown; the legs are beset with whitish pile, which is longer on the femora, short on the tibiæ; hind femora somewhat in-

crassated; hind tibiæ rather stout and somewhat curved. Wings subhyaline, grayish.

Hab.—Santa Barbara, Cal. Two males and one female. I reared these specimens from pupæ which I had found under the bark of an evergreen oak (*Q. agrifolia*), in February.

SYRITTA PIPIENS Lin. is common in California, Nevada, and Colorado.

CHRYSOCHLAMYS.

I possess three North American species of this genus, all of which seem to be different from the only North American species hitherto described, *C. buccata* Loew. The four species may be tabulated as follows:—

Arista black. 4. *cræsus*.
Arista reddish :

Legs entirely reddish-yellow 2. *dives*.

Anterior femora at base and tips of all the tarsi black . . . 1. *buccata*.

All the femora brown; tibiæ likewise infuscated 3. *nigripes*.

As the resemblance in the coloring of all these species is very great, I will first insert Mr. Loew's description, and then describe the other species by merely stating the differences.

1. CHRYSOCHLAMYS BUCCATA Loew, Centur., iv, 72.—*Female*.

Translation.—“Bronze-colored; scutellum testaceous; front black, with a cross-band of ochraceous pollen in the middle; antennæ black above, rufous below; arista rufous; cheeks with a black stripe. Length $3\frac{7}{12}$ Rhenish lines (a little less than 8^{mm}); length of wing $3\frac{5}{12}$ lines. Blackish bronze-colored, greenish (*‘aeneo-nigra, subvirens’*), shining. Front deep black, shining, with a short, black pubescence; in the middle a rather broad cross-band of ochraceous pollen. Antennæ rather large; first joint deep black, the following joints black above, rufous below; arista glabrous, rufous. Face testaceous-yellowish, very concave and ochraceo-pollinose above, swollen (*‘buccata’*) below, with a large obtuse tubercle, which is somewhat brownish; cheeks separated from the face by a small black stripe. Thoracic dorsum beset with short, lutescent pile; lateral margins and two longitudinal stripes of even breadth, cinereo-pollinose. Scutellum testaceous, beset with short lutescent pile; bristles along the edge black; lateral corners blackish. Abdomen shining, with short lutescent pile; hind margins of segments 1 and 2 deep black, opaque. Legs ochraceous, the proximal half of the four anterior femora and the tips of all the tarsi black; front tibiæ, except their base and tip, and the base of the hind femora, slightly subinfuscated. Wings somewhat cinereous-hyaline, lutescent near the base; costal cell and stigma luteous, the base of the third vein and the cross-veins on the middle of the wing clouded with black.”

Hab.—Virginia.

2. CHRYSOCHLAMYS DIVES n. sp.—*Male and female*.—Very like the

preceding (as far as I can judge from the description), but the female is larger, face altogether beset with ochraceous pollen, except on the tubercle and on the cheeks; the brownish mark on the tubercle is V-shaped; in the male, the front is black, shining above the antennæ only, pollinose along the eyes. Abdomen of a pure bronze-color, densely beset with golden-yellow pile in the female; somewhat darker in the male; the velvet-black hind margins of segments 2 and 3 are subinterrupted in the female, and somewhat broader in the male. Legs of the female of a saturate reddish-yellow, the penultimate tarsal joint slightly infuscated; in the male, the tips of the tarsi are infuscated and the four anterior femora have a brown spot on the front side. Wings yellowish-hyaline on the antero-proximal portion, grayish-hyaline along the posterior margin; costal cell yellow; stigma saturate-yellow; a brown cloud, in the shape of a short cross-band, between the root of the third vein and the cross-vein at the base of the last posterior cell; small cross-vein likewise clouded with brown (the coloring of the wing is more intense in the female than in the male). Seems to be very variable in size; one of the males is about 10^{mm} long, the other 8^{mm}; the female nearly 12^{mm}.

Hab.—Kentucky (F. G. Sanborn). Two males and one female.

3. *CHRYSOCHLAMYS NIGRIPES* n. sp.—*Male and female.*—General coloring much duller than in *Chr. dives*, metallic blackish-green; pollen on the face and front dull yellowish; frontal pollinose cross-band (♀) much narrower, and hence the black, shining space above the antennæ larger. The prevailing pubescence on thorax and scutellum is black; black, opaque hind margins of the segments 2 and 3 in the male only, *not in the female*. Femora brown, except the tip; tibiæ brownish-yellow, more or less infuscated before the tip, especially the front pair; tarsi brownish-red at base, brown at tip. Wings grayish-hyaline, feebly tinged with brownish-yellow at the root and on the stigma; costal cell subhyaline in the female; brownish clouds on cross-veins very weak. Length about 9^{mm}.

Hab.—Massachusetts (F. G. Sanborn). A male and a female on the same pin.

4. *CHRYSOCILLAMYS CRÆSUS.*—*Male.*—Very like *C. dives*, but differs in the arista being black and the hind margins of the abdominal segments 2 and 3 without velvet-black hind borders. The brown spot on the facial tubercle is of an indefinite outline, not V-shaped, as in the two preceding species. Antennæ reddish-brown, very little darker along the upper edge. Abdomen uniformly of a bright bronze-green, thickly beset with golden-yellow pile. Legs altogether of a saturate reddish-yellow. Length 10–11^{mm}, but much broader than the male of *C. dives* of the same size.

Hab.—Near Salt Lake City, Utah (Mr. Barfoot).

SPHECOMYIA BREVICORNIS n. sp.—*Male.*—Antennæ black, about half as long as the eye from its upper to its lower corner; they are inserted

on a conical, black projection of the front; joints nearly of the same length, the first cylindrical, the second subtriangular, the third rounded, somewhat brownish; arista yellowish. Face and front golden-yellow, the former with a black stripe reaching from the antennæ to the mouth; cheeks black; vertex black; posterior orbits golden-yellow. Thorax black; humeri, two dorsal lines, interrupted in the middle and not reaching the scutellum, a large spot on the pleuræ and a smaller one under it yellow; scutellum yellow, its posterior edge black, beset with brownish pile; halteres with yellowish knobs. Abdomen yellow; first segment black at base; the second segment has two narrow black cross-bands, the one at the base, the other about the middle; the second does not reach the lateral margins; they are connected in the middle by a black line; the third segment has a narrow black border anteriorly, a small, black, diamond-shaped spot in the middle, and two black streaks on each side between this spot and the lateral margin; the black anterior margin of the fourth segment is entirely concealed under the preceding segment, but a diamond-shaped black spot in the middle and black streaks on the sides are similar to those of the preceding segment; hypopygium yellow. Femora black, except the tip, which is yellowish; the hind femora have the latter half brownish-yellow; tibiæ and tarsi brownish-yellow; the two last joints of the tarsi black; the end of the third joint brown. Wings tinged with brownish, somewhat yellowish at the base and along the anterior margin; a brownish cloud on the cross-veins. Length 11-12^{mm}.

Hab.—Webber Lake, Sierra County, California, July 27. A single male.

This species is very like the well known *Sphecomyia vittata*, but is smaller, has the two first joints of the antennæ much shorter, and a somewhat different picture of the third and fourth abdominal segments; the femora are darker. In other respects, the resemblance is great. It is not improbable that the female has a somewhat different abdominal picture.

SPHECOMYIA VITTATA has been brought from Southern Colorado by Lieut. W. L. Carpenter.

CERIA TRIDENS Loew, Centur., x, 57.—A male from Sierra Nevada, California (H. Edwards), agrees with the description, except that the hind tarsi are yellowish at the base.

Family MYOPIDÆ.

My Californian collection contains species of the genera *Conops*, *Myopa*, and *Zodion*.

MUSCIDÆ (in the widest sense).

In this large division, I will confine myself for the present to the publication of a few species belonging to the *Ortalidæ* and *Trypetidæ*, the two families so thoroughly worked up by Dr. Loew in the third volume of the Monographs of the North American Diptera. To the small num-

ber of the western species which I am able to describe now, I add a few interesting new species, recently discovered in the Atlantic States.

A very striking *Dejeania*, very common in the Rocky Mountains of Colorado, deserves to be described at once, in order to draw the attention of collectors to its habits. It is very remarkable that *Dejeania*, a South American and Mexican genus, should occur so commonly at high altitudes in the Rocky Mountains among alpine forms, and it would be worth the while to investigate on what insect (probably Lepidopterous) it preys as a parasite.

DEJEANIA VEXATRIX n. sp., ♂ ♀.—Head and thorax brownish-yellow; abdomen bright ferruginous red, with a reddish-yellow pubescence and with black spines; legs red; wings pale brownish. Length 12–13^{mm} (exclusive of the length of the bristles, antennæ, etc.).

Face and cheeks pale yellow; cheeks with some long and soft fulvous pile; front brownish-yellow, with a brownish-red longitudinal stripe in the middle. Antennæ: basal joint reddish; third joint reddish-brown; arista black; palpi reddish-yellow, with short black pile. Thorax brownish-yellow, with black bristles and a shorter soft yellowish pubescence; on the dorsum, four black lines are perceptible; the intermediate pairs diverge posteriorly, and do not reach much beyond the suture; the lateral lines are broadly interrupted at the suture, and do not reach either the anterior or the posterior margin. Scutellum nearly of the same color with the thorax, with numerous black spines. Abdomen bright ferruginous red, with black spines, and a shorter, dense, rufous pubescence, especially perceptible posteriorly; on the first segment, under the scutellum, there is a triangular black spot; in some specimens, this spot encroaches slightly upon the second segment; sometimes there are similar triangular spots in the middle of the third and fourth segments, the spot on the fourth segment being occasionally very large; the spot on the third segment is entirely wanting in the majority of my specimens. Legs yellowish-red, with black bristles and yellow pile on the femora. Wings tinged with brownish; the veins reddish-yellow near the base.

Hab.—Rocky Mountains in Colorado, common. I found it very commonly about Georgetown, Colo., at an altitude of 8–9,000 feet. Among the described *Dejeania*, *D. rufipalpis* Macq. from Mexico seems nearest to it.

Family ORTALIDÆ.

PYRGOTA DEBILIS n. sp. ♀—Brownish; wings mottled with numerous pellucid spots; front yellow, tinged with brownish; ovipositor almost of equal breadth, blunt at tip. Length (including ovipositor) 7–8^{mm}; wing 8–9^{mm}.

Head pale yellow; front above the antennæ with a tinge of reddish-brown; sides of front and vertex yellow, the latter with a black dot in the middle; occiput yellow, with a brown spot in the shape of a W above the neck; antennal foveæ separated by a brown ridge, which is forked in front and connected with brown lines separating the sides of

the face from the middle. Antennæ yellowish-brown; first joint brown; arista 2-jointed, but first joint extremely small. Thorax pale yellow; a double brown stripe in the middle, abbreviated behind; a lateral brown stripe on each side, abbreviated in front and interrupted at the suture; a humeral brown dot; a pleural, irregular brown stripe, running from the neck to the root of halteres; a pectoral brown spot below it. Scutellum yellow; metathorax brown, with a yellow line in the middle. Abdomen brownish-yellow, more brown on the sides, narrow, almost linear. Ovipositor about two-thirds of the abdomen in length, brownish-yellow, with brown margins; it is of nearly equal breadth, the tip being broad and bluntly truncate; on its anterior portion, on both sides, there are shallow depressions, with slightly projecting corners under them. Feet brownish-yellow; femora tipped with black; tibiæ with brown rings a little beyond the middle, which are pale on the four anterior and more distinct on the hind tibiæ. Wings pale brown, densely mottled with pale dots; a short brown band connects the small cross-vein with the costa; posterior cross-vein more oblique than in *P. valida* Harris, and last section of fourth vein much less arcuated.

Hab.—Bee Springs, Kentucky (F. G. Sanborn). Two females.

This species is very like *P. valida* Harris in its general appearance, but much smaller; head and feet have a different coloring, the ovipositor a totally different structure, the posterior cross-vein a different position, etc. It cannot well be *Oxycephala maculipennis* Macquart, which is larger, etc.

Family TRYPETIDÆ.

TRYPETA (ÆDICARENA) PERSUASA n. sp., ♂.—Wings like *Monographs*, etc., iii, tab. xi, f. 15, except that the infuscated border of the apex is prolonged along the anterior margin, so as to come in contact with the cross-band at the end of the second longitudinal vein. The brown spot on the pointed end of the anal cell is much larger; the basal portion of the wing, including the costal cell, but excluding the hyaline inside of the second basal cell, is yellow. Head yellow; front bright gamboge-yellow, with a silky reflection. Antennæ reddish-yellow; arista yellowish at base; frontal bristles black. Thorax reddish-yellow, with a grayish pollen, somewhat concealing two indistinct longitudinal brownish stripes, expanded anteriorly, and bearing two darker spots posteriorly; a large black spot on each side between the root of the wings and the scutellum; two smaller black spots at the base of the scutellum. Halteres yellow. Abdomen ferruginous-red, with a slight grayish-yellow pollen clothed with recumbent black pile; no longer bristles. Legs reddish-yellow. Length about 6^{mm}.

Hab.—Denver, Colo. (P. R. Uhler and A. S. Packard, in July). Two male specimens. The description of the thorax was drawn from Mr. Uhler's specimen; on the other, the stripes and spots upon it were much less visible.

Observation.—This species is most closely allied to *T. tetanops* Loew

(Monogr., iii, 245) from Mexico, for which the subgenus *Ædicarena* was established. The peculiar structure of the large head, proboscis, eyes, the short wings, the straight course of the third vein, etc., are all to be found in *T. persuasa*, as described in *T. tetanops*. This is the second *Ædicarena* known, and the first in the United States, therefore an interesting addition to the fauna.

TRYPETA (EUARESTA ?) sp.—Very like *T. aequalis* Loew (Monogr., i, 86, and iii, 308, tab. x, f. 20), but probably different; on the front femora above, a black stripe, not mentioned in Dr. Loew's description, and not visible in my eastern specimens. The wings are broader and the hyaline spots on them larger. Cañon City, Colo. (P. R. Uhler).

TRYPETA (EUTRETA) SPARSA, Loew, Monogr., i, 78, iii, 274, tab. x, f. 13.—A specimen from Manitou, Colo. (Uhler), and another from Southern California agree in the main with the specimens from the Atlantic States. (Compare, however, what Dr. Loew says about this species in the 3d volume of the Monographs).

TRYPETA (*sensu stricto*) sp.—A single female from Colorado Springs (P. R. Uhler) is very like *T. palposa* Loew (Monogr., iii, 253, tab. x, f. 9). The picture of the wings is like the quoted figure, only the brown cross-bands covering the two cross-veins are *not* connected on the fifth vein in my specimen. As Dr. Loew's specimen was a male, and indifferently preserved, it will be more prudent to wait for more material.

TRYPETA (ASPILOTA) ALBA Loew, Monogr., iii, 285, tab. xi, f. 11.—Cañon City, Colo. (P. R. Uhler). I observe, however, that the third antennal joint is not *round*, as stated in the description, but has a distinctly marked angle at the end.

TRYPETA (ENSINA) HUMILIS Loew, Monogr., i, 81, iii, 291, tab. x, f. 17.—Cuba (Lw.); Key West; the Bermudas; Denver, Colo. (Uhler).

TRYPETA (STRAUSSIA) LONGIPENNIS Loew, Monogr., i, 65, iii, 238, tab. x, f. 2♂, 3♀.—Different localities in Southern Colorado in June (W. L. Carpenter). The singular variety *longitudinalis* Lw. also occurred there; also in Golden, Colo., July 3 (A. S. Packard).

TRYPETA (URELLIA) sp.—Very common at Crafton, near San Bernardino, in Southern California, in March. Resembles *T. solaris* Loew (Monogr., i, 84, iii, 325, tab. x, f. 19) very much. The spot on the wings of the female is almost exactly like the figure, which is also taken from a female; at the same time, that spot is subject to considerable variations in different specimens. In the male the spot is smaller, and the two rays running toward the apex, as well as that reaching toward the stigma, are not to be found; but in this sex likewise it is difficult to find two specimens absolutely alike. A small gray spot on the fifth vein, mentioned in the description of *T. actinobola* Lw., sometimes, but not always, makes its appearance here. A difference which seems to be constant lies in the fact that there is no brown around the small cross-vein, nor any dot on its proximal side nor in the discal cell. This species seems to have a wide distribution; I have a female from Santa Monica,

Cal., and another, exactly similar, from Colorado Springs (Uhler). Before describing this species, it will be necessary to compare it to the original specimens of *T. solaris* and *actinobola*. *Trypeta femoralis* Thomson (Eug. Resa, 582) is an *Urellia*, and may be only a variety of my species.

TRYPETA (TEPHRITIS) FINALIS Loew, Monogr., iii, 296, tab. xi, f. 4 (California and Texas).—Very common about Lake Tahoe and Webber Lake, Cal. (July 18–22), on *Wyettia mollis*, a Composite, which is evidently its food-plant.

TRYPETA (ACIDIA) FAUSTA n. sp., ♂ ♀.—Black; head, lateral stripes of thorax, scutellum, tibiæ, and tarsi yellowish or yellow; wings nearly like those of *A. fratria* (Monographs of North American Diptera, iii, tab. x, f. 4), but their proximal third hyaline with a narrow black cross-band. Length 4–5^{mm}.

Face, palpi, proboscis, and occipital orbit pale yellow; antennæ and lower portion of front orange-yellow; sides of front pale yellow, its upper portion ferruginous-yellow, grayish-pollinose; occiput blackish. Thorax black; dorsum clothed with a short golden-yellow pubescence and a grayish pollen, forming two broad stripes; the longer bristles are black; a yellow stripe between the humerus and the root of the wing; scutellum pure yellow. Abdomen black, with black hairs. Legs: coxæ blackish, yellowish at the tip; trochanters clay-yellowish; femora black, their tip clay-yellowish; tibiæ and tarsi clay-yellowish. Halteres yellowish. The base of the wings is as in *A. suavis*, the apical portion like that of *A. fratria* (Monographs, etc., vol. iii, tab. x, fig. 10, and f. 4). The basal third of the wing is hyaline, tinged with yellow at the root and on the veins, and with a narrow black cross-band, beginning at the humeral cross-vein and ending on the sixth longitudinal vein (see fig. 10); the black color begins exactly where it does in fig. 10, and incloses a hyaline triangle reaching from the costa to the interval between the third and fourth veins; a hyaline spot is inclosed by the black on the distal part of the discal cell (as in fig. 4, only smaller); the black region emits a cross band toward the posterior border, parallel to the black border, running along the apical portion of the costa (as in fig. 4); the sinus between that cross-band and the black costal border is less deep than in fig. 4, and only reaches the third vein; sometimes it is surmounted by a small hyaline dot. The distance between the two cross-veins is as in fig. 10,—that is, the small cross vein is about the middle of the discal cell; the anal cell is not drawn out in a point at all.

Hab.—Mount Washington, alpine region (George Dimmock). A male and a female.

TRYPETA (EDASPI) PENELOPE, ♂ ♀.—Reddish-yellow; upper side of thorax black, clothed with short, coarse, yellowish bristles; scutellum and metathorax black, shining; wings with three brownish cross-bands; cross-veins very approximate. Length about 4^{mm}.

Head and antennæ reddish-yellow; cheeks pale yellow; thorax black

and shining above, clothed with short, coarse, yellowish or reddish (♀) bristles; under side of the thorax pale yellowish; scutellum black, shining, with four bristles; metathorax black, shining; abdomen reddish; ovipositor reddish, not longer than the last abdominal segment; feet reddish-yellow. The cross-bands on the wings are somewhat like *Monographs*, etc., vol. iii, tab. xi, fig. 17 or 18; first a short one, starting from the humeral cross-vein; next two bands forming an inverted V, the angle of which rests on the anterior margin, the two ends on the posterior one; finally, a band along the apical margin, coalescent at one end with the angle of the V, and ending on the other side in the second posterior cell, close beyond the tip of the fourth vein. The color of these bands is reddish-brown; the ends of the V and the posterior portion of the apical band are darker brown. There is a small brownish cloud on the posterior margin between the two branches of the V, and a very narrow hyaline space between the apical band and the costal vein near the tip of second longitudinal vein; sometimes this space is reduced to a small spot only (at any rate, this hyaline space is much smaller than in the above-quoted figures).

Hab.—Manlius, N. Y. (J. H. Comstock).

Observation.—This species has all the characters of a true *Ædaspis*; approximate cross-veins, the posterior one especially being very oblique; a black, shining scutellum; a short ovipositor, etc.

TRYPETA (EUTRETA) DIANA n. sp., ♂ ♀.—Black, shining; abdomen red, except the tip, which is black; wings broad, black, with whitish drops, the apex margined with white. Length, ♂ 5^{mm}; ♀ (with the ovipositor) 6–7^{mm}. Length of wing, ♂ 3^{mm}; ♀ 4^{mm}.

Front broad, reddish, with black bristles on the sides; the usual bristles on the vertex likewise black; but besides these there are numerous stubble-shaped whitish (♂) or whitish yellow (♀) bristles on the vertex and on the posterior orbit above. Antennæ pale yellowish; arista, except at the basis, black. Face whitish-pollinose. Thorax black, shining, clothed above with short whitish hairs, not dense enough to interfere with the luster of the dorsum. Legs black, shining; tarsi pale. Abdomen blood-red. The two last segments in the male and the ovipositor in the female black. The penultimate segment in the male shows a narrow, reddish, posterior border. The first joint of the ovipositor is about equal to the two last segments taken together. The wings are broad, rounded, black, covered with numerous white round dots, rather uniformly spread over the disk of the wing, but not encroaching upon a rather broad border, which is uniformly black. At and beyond the tip of the sixth longitudinal vein, however, the white dots reach the margin of the wing. The apex of the wing between the tip of the second vein and the middle of the second posterior cell has a crescent-shaped white border. The posterior cross-vein is very oblique and only gently curved.

A male and a female specimen were bred by Mr. C. V. Riley from a

gall on the Wild Sage (*Artemisia tridentata*) in Missouri. The flies issued June 7 and 9.

Observation.—The wing of this species is altogether like that of *Trypeta sparsa* Wied. (Monographs, etc., vol. iv, tab. x, f. 13), only the coloring is darker brown; the white dots are less dense; there is no white mark at the tip of the first longitudinal vein; the white apical crescent begins exactly at the tip of the second vein, having only a yellowish prolongation before it. In the male specimen, the white drops are very faint, and disappear entirely in the surroundings of the fifth longitudinal vein.

TRYPETA (ZONOSEMA) BASIOLUM n. sp., ♂ ♀.—Yellow; somewhat ferruginous on the thorax; metathorax with two black spots; wings not unlike Monographs, etc., iii, tab. xi, f. 15, only the brown border on the apex is prolonged anteriorly, so as to come in contact with the cross-band. Length 5–6^{mm}.

Yellow; somewhat ferruginous on the thorax and front; antennæ yellow, reaching beyond the middle of the face; third joint elongated, its upper edge straight, perhaps even slightly concave; its tip angular; arista brown, yellowish at base, finely pubescent; bristles on the head black; two black spots on the metathorax under the scutellum; they are rounded in the male, larger and in the shape of a longitudinal stripe in the female; a small black dot immediately behind the root of the wing, I perceive only in the female. Abdomen brownish-yellow, with black pile; ovipositor broad, inverted-trapezoidal, shorter than the two last segments taken together, yellowish-ferruginous. Wings subhyaline; a short, oblique, pale brown mark in the costal cell near the humeral cross-vein; a pale brown cloud in the innermost proximal end of the first basal cell; a similar pale cloud on the angular vein closing the anal cell; a brown cross-band runs from the anterior margin, covers the small cross-vein, and stops short in the middle of the third posterior cell without reaching the hind margin; the anterior end of this cross-band is very dark brown, and nearly fills out the interval between the ends of the auxiliary and first veins; a second cross-band begins at the distal end of the marginal cell, which it fills out, except its extreme tip, covers the great cross-vein, and ends, on the posterior margin of the wing, in the distal end of the third posterior cell; in the middle, between these two principal cross-bands, on the anterior margin, there is a short, oblique, brown streak, which bisects the marginal cell, and is prolonged as a pale shadow across the submarginal; along the apex of the wing, there is a brown border, which begins at the second cross-band and ends a little beyond the fourth vein.

Hab.—Brookline, Mass. (Fred. C. Bowditch). Two specimens.

Observation.—Meigen's tab. 43, f. 16, very nearly represents the picture of the wings of this species, only the cross-bands in my species are farther apart toward their end. Meigen's figure represents the wing of *Zonosema alternata* Fall. (syn. *continua* Meig.), and I believe that *T. basiolum* must likewise be placed in the subgenus *Zonosema*.

GENERAL REMARKS ON THE DIPTERA OF THE WESTERN REGION, AND OF CALIFORNIA IN PARTICULAR.

In the introductory paragraphs to the families of *Diptera*, of which I have treated in the preceding pages, I have attempted some generalizations concerning the character of the Western, and especially of the Californian, faunæ, and their relationship to other faunæ. In trying now to sum up these generalities, I become more than ever aware of the insufficiency of our present knowledge of the *Diptera* of that fauna, and of the meagerness of the results obtained. If I persist, nevertheless, in my attempt, it is because I find that the general results thus far reached for the order of *Diptera* coincide with those obtained in the other orders of insects, and that their publication, even in their present imperfect form, may tend to confirm the accuracy of those results.

The belief of many, and under which I confess to have labored until better informed, that the Rocky Mountains form a natural boundary for a distinct entomological fauna, is erroneous. It is a well-known fact that somewhere between the Rocky Mountains and the Mississippi there is a line, west of which agriculture becomes precarious without artificial irrigation. This line, which some observers place about longitude 98°, marks the eastern limit of a region which extends to the Pacific Ocean, and is characterized by peculiar conditions of life and a peculiar fauna. Among these conditions, the principal, the one which determines the most striking features of the whole region, is *summer dryness*. The natural limits of this region, both north and south, are countries where summer rains prevail. In the north, this limit marks the beginning of northern forms, some of which are circumpolar; in the south, the advent of a tropical fauna. All living beings, and the insects among the rest, have to adapt themselves to that condition of dryness. This explains the prevalence of *Heteromera* among the Beetles the remarkably stout carapace of which enables them to withstand desiccation for a surprisingly long time (in Lacordaire's collection, an *Eleodes* remained alive on its pin for seven months, of course without any food). Such *Heteromera* escape the heat of the day by their nocturnal habits. Their usually black color is the concomitant of such habits. Certain *Carabidæ*, also nocturnal, have the same black color, and often a remarkable resemblance to the *Heteromera* in their outward appearance. Dry soil and sunny exposures attract the burrowing *Hymenoptera*—Bees, Sandwasps, *Mutilla*—which form another characteristic feature of the region. The nests of these are infested by numerous parasites—the *Meloidæ* among *Coleoptera*, the *Bombylidæ* among *Diptera*. Such is the explanation of the presence in the Western Plains of numerous species of *Cantharis* (*Epicauta*) and of the *Bombylidæ*, which prevail among the *Diptera* of the region as much as the *Heteromera* among the Beetles.

The same conditions of life, with the same results, exist in other continents. There is a vast region in the Old World which resembles, in that respect, the North American western region. It is the so-called

Mediterranean and Central Asiatic region, extending from Portugal to Turkestan, and embracing Southern Europe and Northern Africa. It is also characterized by the prevalence of *Heteromera* among the *Coleoptera* and of *Bombyliidæ* among the *Diptera*. It displays a remarkable unity of character through that vast expanse of country. The very striking genus *Julodis* (*Buprestidæ*) occurs in Spain as well as in Turkestan, and nowhere else, except at the Cape of Good Hope. The small family of *Glaphyridæ* (*Lamellicornia*) is almost exclusively confined to the same Mediterranean region, and also, although in other forms to the Cape. The genera *Cleonus* and *Brachycerus* (*Rhyncophora*) living on sandy soil and in hot situations characterize the same Mediterranean and Central Asiatic region.

The same unity of character distinguishes the North American western fauna. Besides the *Melasomata* and other *Heteromera*, which occur in increasing numbers from the Plains of Kansas and Colorado to California, the entomologist is struck by the occurrence of other forms of *Coleoptera*, unknown in the Atlantic States; for instance, the *Dasytidæ*, which occur in Colorado and in California, and are also represented in Europe. *Masaris*, a very peculiar genus of *Vespidæ*, for a long time known only from Algiers, has been found since in the Rocky Mountains, in Texas, and in California. A number of *Odonata* occur in California, in the Yellowstone region, and in Colorado, but do not extend farther east. Among the *Diptera*, I will quote some leading species, as *Tabanus punctifer*, *Silvius gigantulus*, *Eupeodes volueris*, *Lordotus gibbus*, the genus *Ospriocerus*, which occur in the whole western region, and not in the Atlantic States; *Lordotus*, *Eupeodes*, and *Ospriocerus*, being new genera, as far as known, peculiar to that region; *Silvius*, a European genus, which, if it occurs at all in the Atlantic States, must be exceedingly rare. The very remarkable case of *Syrphus pyrastri*, a European Syrphid, very common in California, and also found in Colorado and New Mexico, but never east of the Mississippi, will be discussed below.

The resemblance between the western and the Mediterranean and Central Asiatic fauna, is an analogy, due to the identity of meteoric conditions; it is not a relationship. The same families of insects will prevail, not necessarily the same genera. Thus, among the *Heteromera*, the great majority of genera in both regions are different. The *Diptera* are more cosmopolitan in the distribution of their genera. Such large genera as *Bombylius*, *Anthrax*, *Stenopogon*, *Saropogon*, belonging to dry regions, are the same in the Old World and in North America; but, in the same families, *Bombyliidæ* and *Asilidæ*, a number of small genera occur, peculiar to each region. Cases of identity of small and exclusive genera, like the above-quoted one of the Vespids *Masaris*, are for this reason very interesting. *Pedinocoris brachonyx* Mayr is a large aquatic *Hemipteron*, of which I brought specimens from San Diego, Cal. Mr. Uhler tells me that the same genus is known to occur in Egypt and Turkey. Among the *Diptera*, I will name the small genus *Xestomyza*, a singular Therevid represented in the Mediterranean fauna, at the Cape, and in California.

Altogether different from that analogy, arising from the similarity of meteoric conditions, are certain resemblances between the western fauna (and especially that of California) and the fauna of Northern and Central Europe, resemblances manifested in cases of generic and even specific identity. These cases derive their significance from the fact that they are foreign to the fauna of the Eastern United States; and they are the more strange, as, far from being favored by any similitude of meteoric and botanic conditions, they seem to exist in spite of differences in these conditions. Northern and Central Europe, in their climate and the character of their vegetation, are certainly more like the northern Atlantic States of the Union than the western region. In such cases, faunal resemblances are more than analogies, and seem to indicate some relationship, some hidden genetic connection between the faunas of Europe and the western portion of this continent.

A European who has lived for some time in the Eastern States of the Union, and crosses the Rocky Mountains for the first time, is soon struck by the appearance of the Magpie, a European bird unknown in the Eastern States. I am told that many parallel cases occur among birds. Similar coincidences occur in all the orders of insects.

Plusia gamma is very common in California, and also occurs in Colorado and Texas; not in the Atlantic States. It is a well-known European species. The genus *Parnassius* occurs in the Coast Range, the Sierra Nevada, and the Rocky Mountains; it is found in the Alps in Europe, in Sweden, and in Finland; it is not found east of the Mississippi. *Argynnis*, *Melitæa*, *Lycæna*, and the *Satyridæ*, are by far more common in California and in Europe than in the Eastern States. The Californian *Papilio zolicaon* is almost the same as the European *P. machaon*. In Mr. Grote's Check List, etc. (p. 22), I find the statement that *Ochria saucelita* Grote is a *Noctua*, with a horned clypeus, like the European *Ochria flavago* Hübner, and that no similar case is known to occur in the Eastern States.

Among the *Neuroptera*, there is the European genus *Rhaphidia*, quite common in California, and occurring in several species; it is unknown in the Atlantic States. Among the *Orthoptera*, the genus *Locusta* occurs in Europe and in the Western Region, and not in the Atlantic States. Among the *Diptera*, I found in the Yosemite Valley a species of the genus *Elliptera* (*Tipulidæ*), a genus discovered in Europe within the last fifteen years only, and not known to occur in the Atlantic States. A species of the European genus *Silvius* is common in California, and also occurs in Colorado; I have never seen a *Silvius* taken east of the Mississippi, although one is described by Wiedemann. The genus *Spherophoria* (*Melithreptus* Loew, *Syrphidæ*) is more abundantly represented in California and in Europe than in the Atlantic States. The Californian *Leptidæ* have a more European general appearance than those of the Atlantic States. The above-mentioned *Syrphus pyrastris* is a common European insect, the larvæ of which live on *Aphides*; it is quite

common in all parts of California; I also have specimens from Utah, Colorado, and Northern New Mexico. To my knowledge, it has never been found east of the Mississippi. The suggestion that *S. pyrastris* may have been accidentally introduced in California, and is gradually spreading eastward, may be met by the fact that Say's *Syrphus affinis*, which is nothing else but *S. pyrastris*, was caught by that entomologist near the Arkansas River as early as 1820, and does not seem to have advanced eastward since. The occurrence of this species in the west gains a peculiar significance from its simultaneous occurrence in Chili, recorded by Macquart.

Not all the coincidences with the European fauna just alluded to belong to the whole western fauna. Many are peculiar to California only, although, owing to our imperfect knowledge of the western *Diptera*, we are often unable to state which among them belong to the one or to the other category.

The affinities with the Chilian fauna seem to be especially Californian. Besides the case of *Syrphus pyrastris*, just mentioned, the following instances have occurred to me:—The Tipulid *Protoplasta vipio*, from California, belongs to a remarkable group, hitherto represented by three species only: *Macrochile spectrum*, a fossil *Dipteron* from the Prussian amber; *Protoplasta fitchii*, from the Atlantic States; and *Tanyderus pictus*, from Chili. A somewhat analogous case is that of *Eriocera californica* (*Tipulidæ*), one of the *Eriocera*, with enormously prolonged antennæ in the male. Of such *Eriocera* I have hitherto known only three species from the northern United States, two fossil species in amber, and one from Chili (the *Megistocera chilensis* of Philippi, which I strongly suspect to be an *Eriocera*). My new genus *Rhaphiomidas* (*Midaidæ*) has its nearest relative in *Mitrodetus* from Chili. The genus *Clavator* (*Asilidæ*) from Chili, if my identification be correct, is represented in California. The most interesting case is that of *Apiocera*, an anomalous genus, intermediate between *Asilidæ* and *Midaidæ*, and hitherto found only in Chili and Australia. I describe a species from California.

Several genera of *Diptera* have not been yet found outside of the limits of California, although it is very probable that they have a somewhat wider distribution. Such are *Eulonchus* (*Cyrtidæ*), *Dicolonus*, *Ablautatus* (*Asilidæ*), *Pantarbes*, *Paracosmus* (*Bombylidæ*), the extraordinary genus *Polymedon* (*Dolichopodidæ*), and *Phyllolabis* (*Tipulidæ*).

Ospriocerus (*Asilidæ*), *Lordotus* (*Bombyl.*), and *Erupeodes* (*Syrphidæ*) have already been named as peculiar to the whole western region.

Among the singularities of the Californian fauna of *Diptera* I will mention the apparent rarity of *Trichocera* (*Tipul.*), of which I found only a single specimen of a rather peculiar species; the apparently frequent occurrence of *Hygroceleuthus* (*Dolichop.*), of which I found two species, before I had collected more than one *Dolichopus* (in the Eastern States, a single species of *Hygroceleuthus* is known, and some fifty species of *Dolichopus*); the large number of *Tipulæ* and the comparatively rare *Pachyrrhinæ*;

the occurrence of *Trimicra pilipes*, apparently identical with the European and probably with the North American *T. anomala*, although the latter is comparatively rare in the Eastern States, while *T. pilipes* is exceedingly common in all California in winter.

In the whole western region, the genera *Tabanus* and *Chrysops* seem to be far less abundant in species than in the region east of the Mississippi.

Of the anomalous family *Blepharoceridæ*, all the species of which seem to be rare and local, I have described a species from Yosemite Valley and a new genus from the Rocky Mountains.

After having detailed the peculiarities of the western, and especially of the Californian, Dipterous fauna, it remains for us to examine what they have in common with the eastern fauna. As a rule, cases of specific identity between those regions occur more frequently in those same families in which cases of specific identity are more frequent between Europe and North America. Several Californian *Limnobia* are not distinguishable from eastern species. *Trimicra pilipes*, already mentioned, and *Symplecta punctipennis*, seem to be species of nearly universal occurrence. Several *Syrphidæ*, common in the Eastern States, also occur in California. *Asilidæ* and *Tabanidæ*, on the contrary, seem to be different in both regions, just as no species of these two families is as yet known to be common to North America and Europe.

The genera *Ceraturgus*, *Nicocles* (*Asilidæ*), *Triptotricha* (*Leptidæ*), and the singular *Epibates* (*Bombylidæ*), are worth noticing as being common to both sides of North America, and not found yet outside of that continent. The remarkable genus *Rachicercus* (*Xylophagidæ*) belonged in the same category, until recently, when it was found in Spain.

In the mountain-ranges which cross the western region from north to south, some northern and subarctic genera and species are able to reach very far south, and thus to come in contact with the forms of the local fauna. In Yosemite Valley, at an altitude of 4,000 feet, the mixture of truly Californian forms with those peculiar to the Sierra is only beginning, the latter being comparatively rare. Around Webber Lake, that is, farther north, and at an altitude of 7,000 to 8,000 feet, Californian genera and species still occur in abundance, but more northern forms are frequently met with them. The northern genus *Scellus* (*Dolichopodidæ*) occurs alongside of the Californian *Eulonchus* (*Cyrtidæ*). With the Californian *Dasyllis astur* (*Asilidæ*) and *Laphria vultur* (*id.*), I found *Laphria rapax* (*id.*), which looks like a northern form, although I may be mistaken in my surmise. The specimens of *Dasyllis astur*, found at that altitude, have much more yellow pile on their legs, neck, and pleuræ than those which were taken but little above sea-level. According to the same law, *Dasyllis flavicollis* Say, which ranges from Canada to Texas, has much more yellow on its legs and pleuræ in the north than in the south. Many interesting species were found round Webber Lake :

I will name a new *Tachytrechus* (*Dolichop.*), related to *T. mæchus* of the Eastern States, which I used to find abundantly near the Trenton Falls, New York; a new *Sphecomyia* (*Syrphidæ*), a remarkable genus, of which only two species were hitherto known, one in Europe and the other in North America, and those two may yet turn out to be identical; thirteen species of the genus *Cyrtopogon* (*Asilidæ*), eleven of which were undescribed, and some of them remarkably handsome (in Dr. Schiner's Catalogue of *Asilidæ*, published in 1866, only thirteen species of *Cyrtopogon* are enumerated for the whole world). The other orders of insects afforded the same interest. *Parnassius* was very common; two new species of *Cicada* were found, etc.

Of the fauna of the Rocky Mountains, I had occasion to speak in another place (Report on the Diptera collected by Lieutenant Carpenter in Colorado in 1873, in the Annual Report of the United States Geological and Geographical Survey of the Territories for that year). The relationship of the fauna in the higher regions of those mountains to that of the northern latitudes of the continent is much more marked than that of the fauna round Webber Lake in the Sierra. A series of characteristic northern forms were found in Lieutenant Carpenter's collection:—*Hesperinus brevifrons* (*Bibionidæ*), which had been received from Mackenzie River and collected by myself on Mount Washington; *Arctophila flagrans*, *Tipula macrolabis*, *Helophilus bilineatus*, etc. For want of time, I did not collect much in the Rocky Mountains, but was struck by the frequent occurrence, near Georgetown, Colo. (8,500 feet altitude), of a species of *Dejeania* (*Tachinidæ*), a genus which was hitherto received from South America and Mexico. Near Manitou, Colo. (altitude 6,400 feet), another very large and peculiar Tachinid occurred, of which I also have specimens, collected by Mr. Cleveland near San Diego.

Such facts, as well as many others mentioned in the course of the present paper, prove that there is a great deal to be learned yet about the laws regulating the geographical distribution of insects. In the mean while, it is useful to keep such facts in view by singling them out from the arid mass of descriptive entomology.

ART. XIV.—REPORT UPON THE INSECTS COLLECTED BY P. R. UHLER DURING THE EXPLORATIONS OF 1875, INCLUDING MONOGRAPHS OF THE FAMILIES CYDNIDÆ AND SALDÆ, AND THE HEMIPTERA COLLECTED BY A. S. PACKARD, JR., M. D.

BY P. R. UHLER.

[PLATES 27, 28.]

LETTER OF TRANSMITTAL.

BALTIMORE, *January 1, 1877.*

DEAR SIR: The results of my observations and collecting during the two weeks that I was enabled, through your courtesy, to spend on the plains and mountains of Eastern Colorado, are embodied, as far as possible, in the following pages.

Although much hindered by rains, hail, and snow-storms, I was able to extend rapidly a series of collecting trips from Denver, and a few miles north of it as far as the Grand Cañon of the Arkansas River, a few miles west of Cañon City. In all the sections visited, I had no occasion to complain of the scarcity of insect life. Indeed, in such places as were moderately supplied with water, either in the cañons of the mountains or on the farms and lands adjacent to the creeks and irrigating canals, many kinds of insects were as abundant as we find them to be in corresponding situations in the Atlantic States. It was only in the perfectly desert spots which afforded no sustenance for vegetation that an absence of these creatures was to be noted. An examination of the country in and adjoining Denver, particularly on the west side, showed that the common weeds of the eastern division of the continent had already established themselves there, and that, as was to be expected, many of the common insects dependent upon them were present in abundance. On the open commons of the suburbs of Denver I was delighted to see large patches of showy flowers, and to observe how certain insects of similar colors flew to and rested upon them. Very conspicuously was this the case with a delicately blue *Lupin*, with fine large heads, which occurred in vast numbers near a mill-race running through a low part of the plains. Two species of the little bluets, *Lycana melissa* and *L. rapahoe*, settled upon these flowers, and when at rest were very difficult to recognize. *Dunais archippus* Cramer was widely distributed, except in the high mountains, and was generally observed to be mat-

ing. It was common in most places away from the mountains, but less common in Clear Creek Cañon, in the Ute Pass and adjoining gulches, and in the Cañon of the Arkansas. Specimens were to be seen along the route from Baltimore all the way to Kansas City; while in Eastern Kansas it seemed to be more abundant than anywhere else. On the treeless plains, it and all other large flying insects, excepting the grasshoppers and dragon-flies, ceased to appear until we reached the vicinity of water and cultivated lands, when it was again seen on the wing, flying with its wonted vigor.

In the Clear Creek Cañon and adjacent gulches, the large and showy *Papilio daunus* Boisd. was flying rapidly and agitatedly over the water, as if seeking for a plant upon which to deposit its eggs. One specimen was also noticed in the Ute Pass on August 13. All of them were too restless to admit of capture, and at no time were they within reach of my net. At the same time and in the first-mentioned place, *Pieris oleracea*, *Vanessa antiopa*, *Limenitis weidemeyeri* in very fresh condition, a large *Argynnis*, *Colias eurytheme*, and a small *Melitæa*, were either seen or captured. A very fine large *Satyrus* was tolerably common in Beaver Brook Gulch, and another species occurred in the gulch near Manitou. *Colias eurytheme* and *Pieris protodice* were abundant near Denver and even in the city, flying upon the flowers of an Euphorbiaceous plant which bears leaves margined with white.

Nothing was conducted with success in the station at the mouth of Beaver Brook, and, but for my short stay, great numbers and many species of Geometrids and other *Heterocera* might have been readily acquired.

Coleoptera of many species were readily taken both on the plains and in the mountains. Several kinds, such as *Epicauta ferruginea* Say, *Cicindela punctulata* Fab., *Chauliognathus basalis* Lec., *Eleodes obsoleta* Say, and *Asida opaca* Say, were found in almost all places on the plains at a short distance from the mountains. The former occurred in large numbers upon the flowers of *Helianthus* and other plants with yellow flowers, although in a few cases it was met with upon the white blossoms of the *Euphorbia*. *Cicindela punctulata* was common upon black muddy patches in Beaver Brook Gulch and in Clear Creek Cañon. It was very variable, and generally of the greenish color, with the white spots and lunules large. Specimens seen in and around Denver were all of the black-bronze type, with very small white markings. Those of the alkaline soils of the region near Cañon City were the most brilliant and highly metallic in their color. *Cicindela pulchra* Say was found singly upon blackish sand near the Arkansas River, August 11, at a distance of about one-half of a mile from the mouth of the Great Cañon. It was very wary, and of the variety with scarcely perceptible markings. *Chauliognathus basalis* Lec. was quite common upon sunflowers, chiefly upon the plains and near the foot-hills. It seemed to furnish about two distinct types, both of form and marking, the former having varieties

more numerous than the other. Those of Denver were generally large and stout, with the thorax longer, more rounded, and reflexed anteriorly, and with the discoidal black spot almost always broken into several parts, or divided down the middle. Those from Bijou were of the same type. The specimens from Colorado Springs and southward occurred almost invariably on a bushy weed bearing, densely packed, small yellow flowers. They were narrow, close-set, with the thorax truncated in front, and the anterior margin evenly turned up, the disk dull, the black spot entire and covering all but the margins, and with antennæ flattened. *Eleodes obsoletus* occurred under rubbish and dried dung, and around the base of Yucca and Cacti. It extended all the way from Denver to Cañon City on the hill-sides, and was most abundant between Colorado Springs and the Garden of the Gods. It was variable in all the localities, but most so near the last-named city. *Eleodes hispilabris* and *E. extricata* first occurred to me near Colorado Springs, and from thence extended southwardly to Cañon City. I did not meet with any specimens near Denver, nor at Golden, nor anywhere within the limits of the mountains. *Eleodes suturalis* Say was rare and found only near Denver. *Eleodes tricostata* Say was not seen elsewhere than between Colorado Springs and the Garden of the Gods; but the specimens found nearest to the mountains were more flattened, and had the costal margin of the elytra more prominently recurved. *Eleodes nigrina* Lec. was rare, and taken only in Manitou Park. Two specimens of *Asida elata* Lec. were found running among the grass in the evening twilight, the one near Colorado Springs and the other a short distance west of Cañon City. *Asida opaca* Say was tolerably common and quite variable in the width of its thorax and elytra and in the amount and prominence of the reticulations of the surface of the latter.

Of the *Erotylidae*, *Cypherotylus boisduvali* Chev., occurred only in Clear Creek Cañon. It was crawling on the surface at a considerable elevation above the bed of the creek, and in the midst of the pine woods, where there was bark and rubbish upon the ground. The closest scrutiny failed to detect more than a single specimen, and I was induced to believe that the season was too far advanced for its appearance in the usual numbers.

Meloidæ were not numerous in species, but *Epicauta ferruginea* Say was abundant everywhere, in the mountains and cañons and on the plains. The sunflowers and thistles were sometimes crowded with them, but generally only two or three were at once upon a single flower. It was very variable in size, ranging from 6 to 10 millimeters in length. Usually it affected the yellow flowers, which corresponded well with its color; but occasionally it was quite as abundant upon the white flowers of the *Euphorbia* and other similar plants. Dwarf specimens were quite common, and frequented the same places as the large ones. In this connection, however, it should be borne in mind that the summer was a remarkable one, with very variable degrees of tempera-

ture and moisture, and sudden changes of heat and cold. The driving storms of wind were very favorable to the wide distribution of insect life; but these winds were generally from the mountains toward the plains, and should have increased the fauna of the latter at the expense of the former.

No living specimens of *Cantharis nuttalli* were seen, but in Manitou Park a single dead specimen was found beneath a piece of wood.

In the mountain-gorges near Clear Creek Cañon and in Beaver Brook Gulch, various kinds of beetles were on wing in the sunshine, flying from the peaks above, and lodging on the sides of rocks, trees, and fallen wood. A few specimens of several species of *Cerambycidae* and *Buprestidae* were thus procured at the same time with grasshoppers, and beautiful red and steel-blue moths of the group *Zygenidae*. The delicate and showy *Omoiala vermiculata* Grote was met with early in August in full daylight, flying over Clear Creek in the cañon, and also over Beaver Brook. Its flight was languid, but strongly reminded me of that of *Heliconia charetonia* Linn. It would sail about for a few minutes, and then lodge upon one of the willows or other bushes projecting over the rapids, and then take flight again, flying and resting at short intervals. At Bijou, a few beetles were taken, of species different from those found at either of the other stations which I visited. Among them *Pyrota engelmanni* Lec. was the most conspicuous. It was quite common upon the flowers of a Golden-rod, which grew low and bushy. Many pairs were seen and some taken while sexually united, the males being always smaller than the females.

In the same situations, as well as on the smaller sunflowers, *Epicauta pensylvanica* DG., *Nemognatha immaculata* Say, and *Zonitis atripennis* Say were quite common. Most of these insects imbedded themselves in the pollen of the flowers, and flew from one to the other. They carried considerable quantities of the pollen upon their heads and wing-covers, and might readily have aided in the fertilization of those flowers.

A few specimens of *Euryomia inda* Linn. were buzzing near the ground in the vicinity of the railroad-track, not alighting for more than an instant at a time, and then off again in a tortuous line, as if they were bent upon searching the ground for lost treasure. Flowers of a few species were quite abundant in this region, and, upon every head, a beetle, fly, or wasp was settled, either buried in the mass of stamens and petals, or running rapidly over the surface.

Orthoptera of many kinds were very numerous at this place, particularly of the Grasshopper tribe. The large, lubberly *Brachyepelus magnus* Girard was abundant in several of its forms, and in all three of its states of color. It inhabits especially the undulated spots where the grass is taller, and often in the midst of the patches of low sunflowers. Many of the latter plants are no more than a foot in height, while bearing a flower as much as four inches in diameter. Upon one of these a large female of *Brachyepelus* crawled, and began to eat the petals of

one side. Continuing, it next ate into the mass of green seeds, chewing away with great rapidity; in one minute, it had consumed nearly a square inch, and when I returned to the spot in fifteen minutes, the grasshopper was still clinging to a fragment of the calyx, but every vestige of the flower had disappeared. This species did not occur in countless myriads as others of the grasshoppers; only a few were seen on a spot; at a distance of a few feet there were others, and so, over a surface of an acre, only a few hundreds were to be found.

Not so with the *Caloptenus spretus*, although in this neighborhood but a few stragglers were to be seen. In the mountains, however, south of Denver, such multitudes were flying that walking or riding was rendered almost unendurable by the continued thumps which one received upon the face. Buried in grasshoppers would have been almost literally true of my condition on the morning of August 16, when I walked from Colorado City to the mountains at Manitou. When I arrived in Denver, on August 4, sporadic examples of this insect were to be seen on the commons in the city and on the plains adjoining. The next day, and for several days afterward, no crowds had appeared in the near vicinity of this place. No swarms were flying over the lower section of the Clear Creek Cañon and gulches during August 6, 7, or 8. In the latter, single individuals would come flying down upon the mountainsides from the higher levels, in company with, or at the same time as, other species, but never in multitudes. Nor were the nymphs of this species to be found in that locality. Of other kinds, chiefly *Ædipodas*, many young ones were hopping about in the paths and roads and in the woods among the rocks. Some of these were but slightly advanced in their larval stage, and were quite small. Others were almost ready to begin their final moult. The grass and Indian corn near Golden was still untouched, and the unusual amount of moisture had helped the crops to put on their healthiest covering of green.

After passing to the west of Pueblo, on the morning of August 10, I began to hear of the depredations of this grasshopper. As the train passed the corn-fields in the valley of the Arkansas, now and then a large field would be observed to have been stripped of its leaves, and in many cases the top would be bent over and broken. Often the stalk with a part of the tassel attached would be seen lying on the ground, where it had fallen after having been gnawed through, or snapped off by the numbers which had alighted on it. But the insects were not there; they had evidently flown off to other places. After arriving at Cañon City, and for the next two days, swarms of these insects were occasionally seen flying from the direction of the mountains. None of them, however, took the trouble to settle near the mountains; all went over, far aloft, and alighted five or more miles east of the city. In the mouth of the cañon of the Arkansas, there was much for them to eat, but only a few could be seen in places where the grass and weeds were dense and high.

Returning on the 12th of August, the valley of the Arkansas as far as Pueblo (how much farther I do not know) presented a scene of sad desolation. At all the lower levels, the floods had completed the destruction which the grasshoppers had partly effected, and left the farms with not one growing stalk, where a few days before broad tracts were covered with luxuriant crops. Perhaps half a dozen fields, chiefly a little higher and farther back from the river, were untouched; but nearly all the others within sight had been totally destroyed.

Arriving at Colorado Springs on the afternoon of this day, no indications of their ravages were to be seen. A few specimens could be noticed here and there, hopping about in the grass, and adjacent to the water-courses somewhat larger numbers were set in motion by the sweeping of my net. No complaint was being made of noticeable damage being done by them in this section, and no remark was heard relative to their appearance. The next day, at Manitou, they were seen hopping in great numbers, but no swarms were alighting from the air.

Ascending the mountains in the Ute Pass on the following day, the rocks in many places were observed to be almost covered with them, and their continued headlong descent from the elevated points above caused them to dash headlong against the faces and eyes of the drivers and horses, to the great discomfort of both. After reaching the Divide, they had ceased to be troublesome, and no more than single examples were met with on the mountains and in Manitou Park. In the mean time, heavy local showers of rain drenched the peaks and poured in floods through the gulches, drowning the insects or washing them away. Perhaps for that reason the grasshoppers had generally disappeared from the mountains when I returned through the Ute Pass. But a different scene presented itself when I arrived at Colorado City: the air was filled with the buzz of wings; the ground was everywhere covered with a leaping, struggling mass of grasshoppers. In some places, they were piled up several inches deep. Fresh hordes were continually arriving from the mountains. A dusky spot, several acres in extent, might be seen in the air high up, and in a few seconds the surface of the ground received new additions to the already countless numbers. Strangely enough, they were not universally distributed. Only a few localities west of the railroad were overrun by them, and several of these were covered with a luxuriant growth of weeds and wild flowers. Some of the corn-fields were not attacked, although only a few rods from the spots upon which they lodged. A few smaller swarms left the places upon which they first alighted, and flew off toward the southeast. Evidently, they were preparing to continue the species. Many of the males were chasing the females, and a few had already united in sexual intercourse. As my time for remaining in this vicinity was all exhausted at noon of the 17th of August, I did not have the opportunity to see many of them in the act of depositing their eggs; and during the next two days, which were spent near Denver, no swarms of the species appeared. Small numbers of

them were to be met with in the grass and tall weeds, but they showed no disposition to assemble or to fly in the air. In the region near Colorado Springs, their insect enemies were quite numerous. The *Tachina* and another kind of fly were observed in many instances balancing over a grasshopper that was trying to crouch in the thickest of the weeds and grass or to dodge sideways at each attempt of its enemy to reach it with her ovipositor. Immense numbers of the grasshoppers were lying dead upon the ground, perhaps crushed by the masses of their fellows that had crowded above them. The prodigious rapidity with which they sometimes strike the ground must cause the destruction of considerable numbers of them. Besides this, the local storms which arise from the mountain-region around Pike's Peak catch some of the swarms and dash them suddenly toward the surface and against the hill-sides. At this place also, the females were much more numerous than the males, and, in the cases that I was able to count them, the former were ten times as numerous as the latter. Several other forms of *Calopteni* also belong to the hills and depressions of the surface west of Colorado City, and still other species inhabit the various kinds of soils near Cañon City. *Caloptenus bivittatus* Say was moderately abundant near Denver, near Colorado Springs, and in the valley of the Arkansas. *Ædipoda carolina* Linn. was on the plains wherever I went.

Crickets were quite uncommon. Beneath stones and sticks near Colorado City, and in the mouth of the cañon of the Arkansas, a few specimens were found; but those from the first-named place were only half grown. A single specimen only was met with near Denver, and that one had taken shelter beneath rubbish in a garden. *Xiphidium* was very common in shrubby spots near the Platte River adjoining Denver; and *Æcanthus* was numerous at Colorado City and in the valley of the Arkansas.

Neuroptera and *Pseudoneuroptera* were seen in every locality, but my time was too limited to permit me to use it in chasing them. The few that I captured were usually such as flew near me, or settled upon the bushes and trees close by. On the dry sandy parts of the plains, two species of *Myrmeleon* were frequently around as I swept my net through the taller grass or flowers and weeds. In Clear Creek Cañon, *Æschna* of two species, a *Gomphus*, and two kinds of *Agrion*, occurred at occasional intervals between the ridges of the mountains. *Diplax semicineta* Say was present in large numbers upon a wet spot of ground west of Denver. Not being a very wild species, it was readily captured, and I was thus able to procure a fair series of them in their several varieties. *Hemerobius* was taken in Clear Creek Cañon; and, in the same place, as well as at Denver, a species of *Chrysopa* was quite common. *Chloroperla* was abundant in the mouth of Arkansas Cañon. *Diplax rubicundula* Say was noticed at various points on the railroad leading through Kansas, chiefly on wet spots upon the farms. In the same or similar localities, I noticed *Libellula pulchella* Drury, *L. basalis* Say, quite

numerous, and *Mesothemis longipennis* Burm. Several kinds of *Gomphina* and *Æschne* were also seen, but they could not be captured, and the species could not be recognized.

Diptera were very numerous everywhere, but a little less so in the cañons. Wherever flowers were in bloom, specimens were found resting upon or flying about them. *Bombylius*, *Anthrax*, and *Asilidæ* were seen in every locality; but on the sandy plains, where plants were numerous, they were astonishingly frequent. The colors and forms of most of these were quite attractive, and strongly set in relief by the green color of the plants; they added much to the lively effect of the scene. Some of the species did not extend south of Colorado Springs, while others were seen only in Clear Creek Cañon.

The beautiful *Ospriocerus æacus* Wied. was met with singly in a few places south of the divide, but near Denver it was replaced by an *Asilus*, having a dull brown thorax, with four curving pale lines on the dorsum, with smoke-brown wings and short, slender, tapering antennæ, and with narrower wings than the preceding. Both of these forms are very attractive, and strongly resemble *Midas*, as well in their manner of flight as in the scarlet abdomen with red base and tip. When in repose, the red color of the body is concealed by the wings, but when flying it is very conspicuous and in strong contrast with all of its surroundings. I was much struck by the method which the former sometimes adopts to conceal itself from a pursuer. On a hill-side not far from Colorado Springs, I started a specimen while using my sweeping-net. At first, it rose three or four feet in the air, and then flew off with rather heavy but direct flight toward the thick patches of weeds and grass. As I noticed where it lodged and followed closely, it again rose and flew off to a distance of somewhat more than a rod. After repeating this three times, and finding itself still pursued, it flew to a lot of scattered stones, some of which were of a dark granitic rock, mixed largely with crystals of reddish felspar, and settled upon a dark spot of one of the pieces, which so well accorded with its color that only with great difficulty could I detect it.

Lordotus gibbus Loew was quite rare, being seen in only two or three places near Colorado Springs. The beautiful golden fur which covered its whole body shone with high luster in the sunlight, and foiled the yellow color of the sunflowers upon which it settled. A very beautiful *Mallophora*, coated with bright, silky, yellow plush, occurred sparingly in Beaver Brook Gulch. It was very fond of resting upon the rocks jutting over the road leading up the mountain. As disturbed by persons passing over the road, it would fly from rock to rock, and, when chased for the distance of a few rods, would fly off at a tangent, and return to the rock from which it first started.

A *Stenopogon*, allied to, if not identical with, *S. fasciatus* Say, was quite common upon sandy spots near Denver, and in Cañon City upon the banks of the Arkansas River. The places on which it settled corre-

sponded with similar ones on the shores of the ocean and bays of Maryland, where the *S. fasciatus* abounds.

The pretty *Odontomyia nigrirostris* Loew occurred singly upon the sunflowers at Colorado City. It sometimes remained over night upon the flowers, but was often seen flying toward them in the bright sunlight. Other species were taken in the same locality, most of which were not nearly so numerous as the first mentioned.

Mosquitos were very numerous on plants in marshy situations and near them, particularly in the western suburbs of Denver.

Muscidæ were tolerably common in houses; but several forms of *Sarcophaga*, *Desia*, etc., were distributed all over the more fertile parts of the plains and cañons.

Tipulidæ were scarce in every locality that I visited. Several very neat forms of *Trypeta* were common on the plains in the vicinity of water.

Of all the orders of the insects, none were more abundantly and conspicuously represented than the *Hymenoptera*; although of one or two families, such as the Saw-flies and *Uroceridæ*, not a single example was seen. *Cynipidæ* were very scarce, and represented only by a few small galls upon stunted oaks near Manitou. Ants were numerous; the ground in loose soils at the mouth of the Cañon of the Arkansas was everywhere undermined by a species with a red head. A species closely resembling *Formica rufa* makes hills of sand on most parts of the plains within a few miles from the mountains. They construct hillocks ranging in height from 9 inches to 1½ feet, and from 2 to 3 feet in width at base. These nests are dome-shaped, constructed of the soil brought from beneath the surface, and covered on the outer surface with waterproof clay-earth, cementing variously colored pebbles all over the surface. Their appearance is sometimes that of a loosely made mosaic, and is very conspicuous in some places, owing to the different colors of the pebbles and bits of minerals used in construction. In general, the entrance-holes are situated on the side away from the mountains, usually on the southeast side, opposite the direction of the prevailing rain-storms. Some of them were placed quite near the prairie-dog mounds; but in no instance did I observe any of them to be connected with them. Occasionally a gopher-burrow may be seen to penetrate one of the ant-hills, and in all such cases I could not detect the presence of the ants. They were in no wise different from the others, which were abundantly peopled by the ants. But as other hills were found destitute of ants, I presumed that these had also been deserted before being occupied by the gophers.

In this connection, although they do not belong to this order, it may be not amiss to speak of the white ants. They were found abundantly beneath loose bark in the region near Cañon City, but more particularly under stones on the hill-sides adjacent to Colorado Springs. All the sexes and forms were present in the unwinged stages. Nymphs of males and females had rudiments of the wing-cases, but none had

reached maturity. The species was very similar in size and appearance to *Termes flavipes* Kollar; the color yellowish-white, and the head and pronotum narrower than in that species.

At Cañon City, a beautiful honey-bee, *Apis fasciata*, was moderately common upon the flowers of a great variety of plants. It struck me as an interesting fact that in no single instance was this insect to be seen upon the flower of *Helianthus*, although I examined every flower of this kind that was in bloom over a tract of surface two miles long by more than a quarter of a mile wide. In no other place did I meet with a single specimen of honey-bee of the genus *Apis*. Humble-bees were very rare; the only one seen was a rubbed specimen of *Bombus ternarius* Say, flying in Beaver Brook Gulch. There was, however, a rich representation of forms in the genera *Melissodes*, *Megachile*, *Anthidium*, *Colletes*, etc. Some of the smaller *Apidae* were extremely abundant, and at least one form was found in each locality. They all frequented the flowers, being most abundant upon the plains in places where the plants were numerous and of various kinds. The great heads of small pink flowers of the *Polanisia* were sometimes swarming near Denver with several varieties of *Aculeata*, such as *Priononyx*, *Myzine*, *Polistes*, etc. A new species of *Panurgus*, about one-fourth of an inch in length, with slender yellow bands across the abdomen, lodged on the white flowers of the white-bordered *Euphorbia* near Denver, being found nowhere else. While another species of that genus, of a little larger size, and having interrupted whitish bands across the abdomen, was equally common at Cañon City upon another totally different looking Euphorbiaceous plant, but was not seen north of this place. So many forms of both plants and insects are found only in the one or other of the two regions north and south of the divide—as, for example, the one represented by the vicinity of Denver, and the other by the country around Cañon City—that I am induced to believe that they constitute parts of distinct areas of distribution.

Permit me to remark, in conclusion, that the parts of Eastern Colorado, within the reach of irrigation, might be made the greatest honey-producing garden of this continent. The great numbers of bee-like *Hymenoptera* already there, and the astonishing variety and abundance of flowering plants, growing even upon the almost arid soils, point to this as the natural home of the bee-culturist.

Very respectfully, yours,

P. R. UHLER.

Prof. F. V. HAYDEN,
U. S. Geologist-in-charge.

HEMIPTERA.

HETEROPTERA.

Fam. CORIMELÆNIDÆ.

CORIMELÆNA White.

*C. minutoides.**Cimex nitiduloides* Wolff, Icones Cim., 98, pl. x, fig. 92.

During the month of August, a few specimens of this insect were found near Colorado Springs, concealed among the roots of Yuccas and of other plants growing on the plains near the foot-hills. The season was particularly rainy, and snow or hail occasionally succeeded the thunder-storms. Sudden cold had the effect to chase many insects into sheltered places, and the dense leaves and roots of the grasses and Yuccas afforded an ever-present shelter to many kinds of beetles and bugs.

Fam. PACHYCORIDÆ.

HOMÆMUS Dallas.

1. *H. œneifrons.**Scutellera œneifrons* Say, Long's Exped., App., 299, No. 2.

Specimens were swept from the rank, growing weeds skirting, or not remote from, the water-courses. West of Denver, they occurred in swampy spots near the South Platte River, and on the high table-land near the foot-hills, where the irrigation-trenches water the farms. A few very clearly marked specimens were beaten from bushes in Beaver Brook Gulch and in Clear Creek Cañon.

In general, these western mountain specimens are not so dull colored, nor so broad, as those which occur on the eastern side of the continent.

2. *H. bijugis.**Homæmus bijugis* Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, 393.

Not uncommon in the city of Denver, particularly on rank-growing plants in damp situations.

Subfam. EURYGASTRINÆ.

EURYGASTER Lap.

*E. alternatus.**Tetyra alternata* Say, Amer. Ent., tab. iii, p. 43, fig. 3.

Common in Colorado, in September, in the region of the foot-hills. Baron Osten Sacken collected a specimen in the Yosemite Valley, California, in June, and another at Los Angeles, California, in March. The species varies much in the amount of dark clouding and marbling on the scutellum and corium, and also in the size of the dark spots on the connexivum.

Summary of the Cydnidæ of North America.

Fam. CYDNIDÆ.

Form generally oval, suborbicular, or quadrangularly elliptical; head clypeate, semicircular; antennæ of five joints (exceptionally of four), which are loosely united by slender threads between the second and third, third and fourth, and fourth and fifth joints, inserted under the flat margin of the sides of the head; rostrum of four joints, the second of which is usually compressed; scutellum either broad and bluntly rounded or triangular, with the apex pressed down; tibiæ beset with stout spines, generally fossorial; the first ventral segment very narrow, generally occult. Color generally black, or piceous.

I. Tribe CYDNINI.

Femora compressed; tibiæ closely armed with stout spines, the anterior pair more or less compressed; the tarsi slender, filiform.

Scheme of genera.

I. Scutellum triangular, convex:

Head with erect, submarginal bristles, or teeth:

Body very deep and convex:

Ostiolar canal fusiform..... *Cyrtomenus*.

Ostiolar canal a long gutter..... *Amnestus*.

II. Scutellum broadly rounded:

Head with comb-teeth:

Body deep and convex:

Ostiolar canal obsolete, sulcate, with raised margins; surface closely hairy..... *Trichocoris*.

Ostiolar canal short, at tip enlarged into a circular auricle; surface hairy exteriorly..... *Microporus*.

III. Scutellum triangular, narrow at tip:

A. Head with submarginal comb-teeth:

a. Pronotum, collum with an impressed, submarginal, deeply arcuated line:

Ostiolar canal reaching almost to the outer end of the episternum, flat, clavately rounded at tip.. *Macroporus*.

Ostiolar canal short, ligulate, obliquely indented next the tip..... *Homaloporus*.

Ostiolar canal half the length of episternum, flat, fusiform, scale-like behind, oblique at tip; pronotal submarginal line obsolete..... *Æthus*.

b. Pronotum without the arcuated line:

Ostiolar canal short, narrow, subfusiform, with the ostiole at tip..... *Rhytidoporus*.

Ostiolar canal obsolete, shorter than the coxa, narrow-ligulate..... *Cryptoporus*.

B. Head destitute of submarginal teeth :

Ostiolar canal fusiform, rather flat, transversely incised next the tip; pronotum with an impressed sinuated anteromarginal line.....*Pangæus*.

Ostiolar canal long, spatulate, but broad and rounded at tip; pronotum without the sinuated line....*Melanæthus*.

Ostiolar orifice at the inner end of an oval scale, which is placed, exteriorly on the episternum.....*Lobonotus*.

CYRTOMENUS Amyot & Serv.

Form oval, deep, very convex in all its diameters. Head strongly clypeate, the cheeks lamellate, bilobate, with the margin abruptly recurved; the submargin with comb-like, erect teeth, and with long, remote bristles; the surface obliquely ridged and grooved, and the ocelli large; second joint of antennæ much shorter than the third, fourth and fifth stouter, ovate, moniliate. Pronotum transverse, strongly convex, with the lateral margins recurved, the anterior submargin with an arcuated, abbreviated impressed line, in front of which the margin is thick and raised; a transverse deeply impressed line on the middle, abbreviated near the margins, divides the surface into two almost equal parts. Prosternal flaps lamellar, high, lunate; odoriferous canal not half the length of the episternum, fusiform, with a small auriculate appendix at the tip; tibiæ all compressed and distinctly curved, the spines and teeth of the outer surface stout, and the latter set in prominent wavings of the surface; interior margin of the anterior coxæ prominently, archedly carinate. Scutellum convex, a little longer than wide, a little contracted at tip, but not narrow, bluntly rounded. Corium wide, blunt, obliquely subtruncated on the posterior margin, the costal margin broadly curved, the edge thick for more than half its length, ciliated; epipleura wide, a little more than one-half the length of the corium, longitudinally scooped out, suddenly narrowed before the tip, the tip slender, acute.

1. *C. mutabilis*.

Cydnus mutabilis Perty, Delectus Anim., art. 33, fig. 6.

Cyrtomenus castaneus Amyot & Serv., Hemipt., 91, No. 1.

Chestnut-brown, or rufo-piceous, obese, suborbicular, bristly about the sides, on the margins, beneath, and on the legs and rostrum; the surface smooth and highly polished. Head semicircular, emarginated in front, paler anteriorly, the surface uneven, with a few irregular, indented points, and on each side with a series of oblique ridges and depressed lines between them; the lateral lobes broadly depressed anteriorly, with the margins strongly recurved and ciliated with ferruginous bristles, their interspaces with indented points; tylus shorter than the lateral lobes, tapering toward the tip; base of head tumid, highly polished, minutely and obsoletely wrinkled and punctured; ocelli very near

the eyes, reddish-orange, or pale red; antennæ pale ferruginous, the second joint very short and slender, third fusiform, stouter, rather longer than the fifth joint, fourth and fifth ovate, the fifth a little longer than the fourth; rostrum pale ferruginous, reaching to the posterior coxæ, the basal joint with fine pubescence, second joint as long as the third, curved, broad, compressed, ciliated with long bristles, third joint compressed, a little wider toward the apex, carrying a very few shorter bristles. Pronotum deeply sinuated to admit the head, the lunate impression adjoining the anterior margin densely charged with coarse, deep punctures, which become less dense exteriorly; the submargin opposite the middle of the eye with a coarse puncture carrying a long bristle; the lateral margins slightly oblique, curving inward at the anterior angles, beset with thirteen or fourteen coarse punctures, each carrying a bristle, the edge recurved; posterior margin moderately arcuated, very smooth, feebly scooped out next the humeri, the humeri a little humped, the angles rectangular and a little rounded; transverse dorsal line wide and deep, lunately impressed each side, charged with rather remote, but very coarse, deep punctures, which scatter into irregular series behind the line, aggregate each side, and are thence continued forward to a patch of denser and finer punctures behind the anterior angles. Scutellum with remote, irregularly placed, coarse, deep punctures, those of the exterior submargin denser, and almost in contact with a marginal sutural series of denser and finer ones which extend not quite to the tip; the base with an impressed line having close, fine, dragged punctures; tip smooth, depressed, blunt, impunctate. Legs pale ferruginous, the spines and tips of femora piceous, tarsi pale yellow; the anterior tibial teeth eight in number, the two basal ones very slender, the others very stout and blunt. Corium highly polished, coarsely distinctly punctured in the sutures, excepting the costal and the one bounding the discoidal areole exteriorly; the costal suture with series of obsolete punctures, punctures becoming fewer and less coarse posteriorly, behind the middle, exteriorly, to the tip almost impunctate; costal margin scooped out at base, and from thence to the middle with a series of six to eight coarse punctures, each carrying a bristle; clavus long and narrow, bounded at base on the inner margin with a single series of distinct punctures, and on the outer margin beginning with a double series, but continuing with a single series of punctures to near the tip of the suture; membrane pale, charged with about ten radiating nervures. Disks of the episterna corrugated, dull, the outer section areate and highly polished. Venter polished, paler than the upper surface, ciliated on the lateral margin with long, remote bristles; base of the first segment rastrated longitudinally each side; disks of the second, third, and fourth segments each with a series of remote, coarse punctures bearing bristles; base a little inflated in the middle.

Length $6\frac{1}{2}$ -9 millimeters. Width of base of pronotum $4\frac{1}{2}$ - $5\frac{1}{2}$ millimeters.

Inhabits South Carolina, Georgia, Florida, Guiana, and Brazil.

This species has not yet been brought from Texas or the region west of the great plains unless the next species shall prove to be a form of it. The differences separating them seem ample, but long series from many localities may yield the intermediate links.

2. *C. obtusus*, new sp.

Form of the preceding; colors generally a little darker. It differs in having a shorter and more blunt head, more deeply emarginate in front, and the lateral lobes more widely rounded and recurved. Punctures less numerous on the disk and sides of the pronotum, the lateral margins almost sinuated, the lunate impression behind the head narrower; scutellum very coarsely and sparingly punctured and destitute of punctures near the base; anterior tibiæ with ten stout teeth, rostrum reaching between the posterior coxæ almost to their posterior extremity. The remaining characters are not different from those of the preceding species.

Length 8-9½ millimeters. Width of base of pronotum 5-6 millimeters.

From Texas, Arizona, Mexico, and perhaps the same as that from Cape Saint Lucas, Lower California. Many of the specimens which I have inspected show conspicuously the results of wear upon the bristles of the head and teeth of the fore tibiæ. In two individuals, these appendages were entirely broken off and the bases worn.

AMNESTUS Dallas.

Subquadrangular; moderately deep, more convex beneath than above. Head very small, semicircular, longer than broad, the margin armed with a few very stout, short teeth, of which four are placed on the tip of the tylus; tylus longer than the lateral lobes, ridged and long; eyes large, prominent; ocelli large, placed near the eyes. Antennæ of five joints, the basal one short, the second very short, slender, third about as long as the fourth, tapering toward the base, much longer than the second and basal together, fourth and fifth long fusiform, very slenderly articulated. Rostrum long and slender, inserted close to the apex of the head, the basal joint shortest, second and third much longer, about equal, the fourth more slender, shorter than the third; bucculæ composed of a rounded, short plate each side, extending back but a little more than half the length of the throat. Prosternum elevated, bounded each side by a broad, arched plate, the central gutter broad and concave. Pronotum subquadrate, a little wider than long, convex on the disk in front, with the anterior angles broadly rounded, the transverse impressed line placed behind the middle. Ostiolar canal slender, extending almost to the outer margin of the episternum, grooved, with the sides carinately elevated. Scutellum triangular, subequilateral, almost acute, the tip not distinctly contracted. Legs rather slender, not heavily spined, the anterior tibiæ compressed, armed with a single row of stout teeth on the

outer edge and with a few more slender and very oblique teeth on the under side near the inner margin (anterior femora sometimes with a stout tooth near the base, bifid at tip). Corium broad and short, sinuated on its posterior margin, the costal margin arcuated posteriorly, the epipleura slender, but protracted almost to the tip of the corium; membrane long, with three or four longitudinal indistinct nervures.

1. *A. spinifrons*.

Cydnius spinifrons Say, Journ. Acad. Phila., iv, 316, No. 2.

Chestnut-brown; oblong-subquadrate. Head longer than wide, coarsely, unevenly punctured, ciliated and tuberculated, the tylus prominent and convex, carried back narrower almost to the base of the head. Antennæ, rostrum, and legs pale ferruginous, the former slender and long, the basal joint a little longer than the second, which is very short and slender, third slender at base, but gradually enlarging toward the tip, longer than either of the others, and about equal to the second and fourth united, the fourth and fifth subequal, attached by very slender bases. Rostrum reaching up on the posterior coxæ, becoming slender toward the tip, the basal joint longer than the head, second a little longer, hairy, very slightly compressed, not much stouter than the third, third much longer, fourth slender, a little shorter than the second. Pronotum subquadrangular, the lateral margins straight and parallel, the anterior margin not deeply sinuated next the head, edged with a narrow, smooth seam, the angles bluntly rounded; posterior side a little arcuated, the margin high and convex, a little sinuated interiorly to the prominent, smooth, humeral angles; the surface polished, variolously, closely punctate behind the transverse line, a little more finely and densely so each side and behind the head; disk of the anterior lobe very finely and sparsely punctate, and the posterior submargin with finer and remote punctures; the sides remotely ciliate. Anterior tibiæ with five stout piceous teeth and four finer ones on the outer edge; posterior tibiæ long, very slightly curved, slender, armed with few and slender spines. Pro- and meso-pleuræ pale chestnut-brown, highly polished; ostiolar canal very high, narrow, and long, placed on a dull, dark, rugose episternum. Scutellum convex, remotely, moderately, coarsely punctate. Corium highly polished, a little paler than the pronotum, coarsely, deeply, closely punctate, excepting on the middle of the posterior submargin and discal areole; punctures of the clavus-sutures finer; membrane white, protracted much behind the abdomen. Venter pale, minutely, densely scabrous and closely pubescent. Epimera of the metasthium produced backward over the base of the abdomen in smooth, triangular flaps.

Length 4 millimeters. Width of base of pronotum 2 millimeters.

Occurs in many parts of the United States. Mr. Say found it first in Missouri; since then it has been brought from Texas, Illinois, Indiana, Michigan, Pennsylvania, and Georgia. I have found it twice in Mary-

land, once near Baltimore in a loamy valley, beneath decaying wood, on the 18th of March. More than one-half of the specimens which have passed through my hands have been destitute of the forked tooth beneath the anterior femora. Those which possessed it have all been females.

This very novel form of *Hemiptera* deserves further notice. Almost nothing is known of its habits, and not enough of them in any of their stages have yet been collected to determine the meaning of their singular and elaborate structure.

2. *A. pusillus*.

Amnestus pusillus Uhler, Bull. U. S. Geol. Surv., 2d ser., vol. ii, No. v, p. 12.

This a small, pale, species, often common in many parts of the Atlantic region. In the Black Mountain range of North Carolina, and in Tennessee, it has been met with in large numbers. It seems to be less convex above than the preceding species, and more uniformly punctured, and no specimens have yet been seen to have the forked tooth on the anterior femora.

TRICHOCORIS Uhler.

Oval, convex, hirsute, very convex beneath. Head bluntly semicircular, deeply seated, the anterior angles of the pronotum protracted to the middle of the eyes. Eyes sunk to the middle in the margin of the head; the ocelli placed near to them and on a line with their base. Clypeal submargin with erect, blunt teeth; the tylus broad, flat, defined almost to the base of the cranium; the lateral lobes longer. Rostrum reaching behind the anterior coxæ; the basal joint as long as the head inclosed by the bucculæ; the bucculæ gently arched, a little wider than the rostrum, and extending almost to the base of the head; the second joint longest, a little bent, arched, and compressed; the third a little longer than the fourth. Prosternum raised, broadly scooped out, the sides with prominent, lunate, obliquely placed lobes, which almost inclose the base of the antennæ. Xyphus of the metasternum triangular, acute at tip, sunken in the middle. Ostiolar canal rather flat, placed close to the suture between the meso- and meta-stethium, running outward more than half the length of the episternum, slenderly sulcated on its posterior margin, slightly tubular at the outer end; the plate on which it is set is narrow, acutely triangular beyond the ostiole. Scutellum about two-thirds of the length of the abdomen, broad and longer than broad, wide, blunt, and not obviously contracted at tip, remotely bristly. Hemelytra a little wider than the abdomen, shorter than the scutellum, the costal margin broadly arcuated, the posterior margin of the corium bluntly oblique, slightly sinuated; epipleuræ long and narrow; membrane scarcely extending beyond the abdomen, directed obliquely downward when closed. Legs stout; tibiæ with numerous long stout spines and bristles. the anterior pair moderately

compressed, subtriquetral when viewed from the edge. Venter obesely convex, the segments beset with long, remote bristles; connexivum compressed, sharp-edged, interrupted at the incisures, closely ciliated.

T. conformis.

Trichocoris conformis Uhler, Bull. U. S. Geol. Surv., vol. ii, No. v, p. 11.

Oval, blackish-piceous, moderately convex above, hirsute, with long, close, ferruginous hairs, those on the sides more dense; the sides almost parallel. Head flat, coarsely punctate in more or less oblique lines, or irregularly punctate and wrinkled, clothed each side with long, remote, erect hairs; teeth of the submargin close-set, short, erect; the tip of the tylus armed with two teeth; apex of the clypeus quadrately emarginate; lateral margin and eyes reddish-brown. Antennæ rust-brown, the basal joints tinged with piceous, the third, fourth, and fifth joints particularly clothed with fine yellow pubescence; basal joint barely reaching the tip of the head; second more slender, shorter, and more slender than the third; third somewhat long, gradually wider toward the tip; fourth and fifth subequal, long ovate, stouter than the third. Rostrum ferruginous, tinged with piceous, reaching behind the intermediate coxæ. Pronotum blackish-piceous, almost twice as broad as long, sometimes tinged with rufo-piceous on the lateral margins, the anterior angles curved forward, a little rounded, the lateral margins straight, a little oblique, the edge sharp, slanting downward, densely clothed with long ferruginous hairs; posterior margin subtruncate, the angles almost rectangles, a little rounded; surface variolosely punctate on the posterior lobe and sides, the punctate portions invested with close, long hairs; the anterior lobe almost bald and destitute of punctures. Pronotum with coarse, irregularly placed, mostly remote punctures, those of the sides confluent in a broad, depressed line next the margin. Sides of the prosternum anteriorly a little raised; medio- and post-pectus coarsely, remotely punctate. Corium broad, broader behind, finely, remotely, obsoletely, on the exterior area more densely and deeply, punctate, invested with long, remote hairs; the lateral edge densely hirsute; membrane brownish. Legs rufo-piceous; the tarsi ferruginous and very slender, the second joint being very small; anterior femora on the upper side and exterior to the middle line with a series of broad, shallow pits; the femora and tibiæ ciliated with long ferruginous bristles. Venter obesely convex, polished, invested with long ferruginous bristles, finely, remotely punctate; sides of the segments more closely punctate, and with a submarginal series of variolose punctures; the disk broadly impunctate.

Length $5\frac{1}{2}$ – $6\frac{1}{2}$ millimeters. Width of base of pronotum 3 – $3\frac{1}{2}$ millimeters.

From California, and from near San Francisco.

This form is much more hairy than any other that has thus far been found upon this continent, and that character will at present readily

enable the student to recognize it at first sight. Its general affinities seem to be with *Æthus* as understood by Mr. Dallas, but more minute examination of its details readily shows its distinctness from any genus hitherto established.

MICROPORUS Uhler.

Ovate or oval, broad, round, deep, hairy, polished. Head broadly rounded, feebly convex, the tylus shorter than the lateral lobes; submargin closely set with short, stout teeth and long bristles, the edge sharp, recurved, broad beneath. Antennæ, basal joint barely reaching the tip of clypeus; second very short, only a little more than one-half the length of the third; the third more slender, fusiform, shorter than the basal, but about of the same length as the fourth; fourth and fifth stouter, rounded at each end, subequal. Rostrum reaching between the intermediate coxæ, the second joint longest, compressed, arched above, a little curved; third and fourth joints subequal, each a little shorter than the basal one, the bucculæ narrow, a little arched anteriorly, protracted narrower almost to the base of the head. Pronotum transverse, the transverse impression indistinct, the surface arching in conformity with the curve of the head, the anterior angles a little produced, rounded, the anterior margin deeply sinuated, the lateral margin fringed with long ciliæ. Anterior femora compressed, armed with stout spines on the outer and inner edges, those of the tip longest. Ostiolar canal short, placed very near the sternum, the inner end a tapering ridge, the outer end a rounded button sunken in the center. Scutellum about two thirds as long as the abdomen, bluntly triangular, wide, and rounded at tip, the apex a little bent down. Corium short and wide, the outer angle produced backward, the epipleura long, grooved. Outer margins of the venter compressed.

1. *M. obliquus*.

Microporus obliquus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 394.

Chestnut-brown, polished, subovate, the lateral margins of pronotum and corium fringed with long ferruginous hairs. Face almost flat, each side with long, oblique, punctured striae; the tylus transversely and less distinctly grooved; anterior margin bluntly rounded, the submargin thickly set with short, stout teeth, and with a few long bristles between them; the lateral lobes sparingly punctate, with a round fovea adjacent to each eye, and another near the tip, each side of the tylus. Rostrum yellow, extending to the intermediate coxæ, the apical joint slender, a little shorter than the third, the third gradually widened toward the tip. Basal and next joint of the antennæ slender, the second shortest, third, fourth, and fifth moniliate, narrowed at the ends, the apical one a little longer than the fourth, the third and fourth subequal. Base of the head convex, impunctate. Pronotum transverse, the lateral margins oblique, densely ciliate with ferruginous bristles, the anterior angles a little advanced, rounded; anterior divis-

ion of the surface impunctate, excepting along the middle, in the lunate impression, and on each side; surface behind the transverse impression coarsely, not densely, punctate, the posterior submargin and humeri impunctate, the posterior margin deflexed, a little arcuated, and feebly sinuated before the humeral angles. Anterior tibiæ armed on the front margin with long and very stout spines; tarsi pale yellow. Scutellum polished, remotely punctate, the base almost destitute of punctures; tip a little depressed, bluntly and angularly rounded. Hemelytra remotely, finely punctured, those of the apical portion becoming finer and almost obsolete; the costal margin broadly arcuated, ciliated at base with long bristles; membrane and wings milk-white. Venter smooth in the middle, sides minutely scabrous; anal segment punctate; the lateral margins fringed with long hairs.

Length $4\frac{1}{2}$ millimeters. Width of base of pronotum $2\frac{1}{3}$ millimeters.

Obtained at Ogden, Utah; also collected in Central Texas by G. W. Belfrage, and by myself west of Denver, Colo.

2. *M. testudinatus*.

Microporus testudinatus Uhler, Bull. U. S. Geol. Surv., 2d ser., vol. ii, No. 5, p. 10.

Ovate, broadly rounded, more convex than the preceding species. Head slanting in conformity with the curve of the pronotum; the anterior margin broadly recurved and rounded, feebly emarginate in front, the submargin with long setæ and stout, close teeth, of which two are on the tip of the tylus; surface smooth, polished, impunctate; an impressed point each side near the eye, and each side of the tylus is an oblique impressed line; tylus shorter than the lateral lobes, the latter bluntly rounded and obsoletely wrinkled. Antennæ pale ferruginous, the second joint slender, much the shortest, cylindrical; the third, fourth, and fifth subequal in length. Rostrum reaching upon the intermediate coxæ, pale ferruginous, the third and fourth joints subequal, together longer than the second. Pronotum transverse, in front much narrower than behind; the anterior margin deeply emarginated to receive the head, the angles moderately protracted forward, bluntly rounded; the lateral margins steep, the edge very thin, convexly arcuated, closely fringed with long ferruginous hairs; posterior margin feebly rounded, the exterior angles rectangular, a little rounded; surface smooth, polished, obsoletely punctate each side and behind the middle, the anterior division smoother, and with a very few minute punctures; behind each eye is a sunken point, and across the middle a series of six similar points. Pectus pale piceous, the disks of pleural pieces darker. Legs pale ferruginous, more or less tinged with piceous; the spines blackish piceous; femora compressed, having two rows of punctures carrying ciliæ; spines of the outer margin of anterior tibiæ longer, the submargin with a slender groove bearing coarse punctures; the posterior tibiæ long, feebly curved, hardly thicker toward the end; the tarsi slender, yellow; the intermediate joint small. Scutellum very broad, polished,

convex, remotely, finely, obsolete punctate, the tip broad. Corium short and wide, the costal margin arcuated, rather uniformly, deeply punctate, the sutures punctate in series, the subcostal linear impression continued to beyond the middle and coarsely punctate; membrane short, broadly rounded, pale brownish. Venter very convex, polished, ciliated across the segments, and with bristles on the outer edge of the connexivum; the lateral and posterior surface minutely punctate.

Length $4\frac{1}{2}$ millimeters. Width of base of pronotum $2\frac{1}{2}$ millimeters. Width of venter 3 millimeters.

Inhabits California and Mexico.

MACROPORUS Uhler.

Broadly oval, feebly convex; the sides of the head and pronotum sparingly ciliated. Head broad, clypeate; the margins broadly reflexed; the submargin armed with short, erect teeth; the tylus flattened, a little narrowed at tip, the recurved margin crossing its tip; bucculæ almost percurrent, narrow, nearly straight, not expanded at tip. Rostrum reaching between the intermediate coxæ; the basal joint a little shorter than the bucculæ; the second long, rather shorter than the third and fourth united; the two latter subequal. Antennæ, basal joint not quite reaching the apex of the head; the second more slender, very short; third longest, gradually enlarging toward the tip; fourth and fifth subequal, each a little shorter than the third, moniliate, long-ovate. Pronotum transverse, subquadrate, the sides oblique, narrowing toward the front, remotely ciliated, and curved inward toward the acute anterior angles; the edge recurved; the anterior margin deeply sunken to receive the head; the submargin with an impressed line running parallel to the margin, and bounding a rim-like collum; the posterior margin a little arcuated, the angles rectangular, the humeri not prominently elevated, and without a sinus on the adjoining margin; the surface almost destitute of the transverse, impressed line; behind each eye with an excavated point. Ostiolar canal very long, slender, flat, reaching almost to the outer margin of the episternum, slenderly grooved and carinate; the tip thickened, widened, and rounded. Scutellum short, almost as wide as long; the tip narrow, obliquely rounded, not extending beyond the inner angle of the corium, the sides near the tip very feebly sinuated. Prosternum but slightly elevated; the lateral lobes blunt, drawn down in front, and transversely indented there. Anterior tarsi moderately flattened, few-spined. Corium broad, reaching to the penultimate segment of the abdomen; the costal margin broadly arcuated near the tip; the edge blade-like and broadly recurved at base.

M. repetitus, new sp.

Broadly oval, castaneous, or rufo-piceous, broad posteriorly. Head bluntly rounded in front, with short, close teeth and remote bristles; the margin broadly recurved, rufescent; the submargin grooved; disk

a little convex, somewhat finely punctate, the base almost impunctate; the margin posteriorly broadly excavated, and near each eye and at the basal angle of the tylus is a small round pit; ocelli red, placed remotely from each other and a little behind the front line of the eyes. Rostrum ferruginous or pale piceous; the second joint much compressed, long. Antennæ moderately stout; the second joint scarcely one-half as long as the third; the third gradually enlarged toward the tip; the fourth and fifth subequal, long-oval. Pronotum narrowing anteriorly; the sides oblique, curving inward at the prolonged anterior angles, smooth, finely and closely punctate, excepting the anterior part of the disk; the anterior margin deeply sinuated; the collum narrow, smooth, but distinctly defined; the outer margins remotely ciliated; posterior angles direct, not tumid, with steep sides; the intra-humeral impressions obsolete. Pectus rufo-piceous, smooth, impunctured, darker on the posterior pleural pieces. Legs and coxæ flavous, or pale rufo-piceous; the anterior tibiæ very moderately compressed, armed exteriorly with about six dark spines; the spines of the posterior tibiæ stout, long, rather remote, black-piceous; the tarsi testaceous, their middle joint very short. Scutellum a little flattened, polished, and impunctured on the disk; the remaining surface closely punctate, minutely rugulose; the edge very narrowly recurved; the tip faintly impressed, obsoletely carinated. Corium wide, moderately convex, smooth, coarsely, closely punctate, on the disk obsoletely punctate; the posterior margin feebly sinuated, furnished with a thinner border, and with the outer angle a little produced. Embolium broad, reaching to the second ventral segment, longitudinally scooped out, minutely scabrous. Membrane brownish-white, a little declivous posteriorly. Venter polished, minutely shagreened, and wrinkled each side and behind; the genital segment almost vertical, and crowned with a few erect bristles; the margins of the connexivum with a few remote bristles.

Length $3\frac{1}{2}$ –4 millimeters. Width of base of pronotum 2– $2\frac{1}{2}$ millimeters.

From the vicinity of San Francisco; collected by Messrs. Henry Edwards and James Behrens. One specimen has been obtained in the vicinity of Baltimore.

HOMALOPORUS, new genus.

Ovate; sides of pronotum oblique, remotely ciliated, curving almost abruptly inward at the anterior angles, the angles a little prolonged; anterior margin moderately deeply sinuated, furnished with a narrow flat collum, which extends distinctly to the outer angles, and is defined by a clean-cut, deep line bearing two indented points behind each eye; surface rather flat, more convex on the anterior lobe, the transverse line distinct, narrow, abbreviated each side, terminating in a sunken point before the submargin, and each side of tip, anteriorly, with an indented point; the posterior margin slightly arcuated, a little sinuated near the

humeri, the angles rectangular, the humeri a little prominent. Head bluntly rounded, radiately, not very distinctly, wrinkled on the cheeks, with a deep indentation each side anteriorly, and a shallower, wider one next each eye; margins abruptly recurved, the submargin grooved, set with close, minute teeth and slender bristles; the tylus reaching to the front, the lateral lobes not quite meeting in front of it, its sides almost straight and parallel. Basal and second joints of the antennæ slender and very short, the first not reaching to the margin of the head; the third joint enlarging toward the tip, a little shorter than the fourth; fourth and fifth longer, subequal, thicker, long-oval. Rostrum of moderate length, the basal joint almost as long as the head, a little shorter than the bucculæ; the bucculæ of moderate width, tapering posteriorly, a little wider in front; second joint compressed, a little arcuated, longest; third joint less robust and shorter than the second, but longer than the apical one; the apical very slender, acute at tip. Ostiolar canal less than half the length of the episternum, placed next to the suture, ligulate, a little raised, before the apex obliquely impressed; the apex scale-like angular, acute. Legs moderate, the anterior tibiæ moderately compressed, the exterior margin armed with about seven teeth. Scutellum depressed, a little longer than wide, narrow at tip and distinctly contracted, the apex bent down. Corium wide, with two grooved lines on the outer side of the discoidal area, the inner of which is arrested behind the middle, the posterior margin a little oblique, subtruncated, costal margin strongly arcuated, its base remotely ciliated; epipleura long, wide at base. Margins of the venter remotely ciliated.

H. congruus, new sp.

Light rufo-castaneous, polished, shining, remotely and slenderly ciliated on the sides of the head, pronotum, corium, and abdomen ovate, moderately flat above. Head almost flat, each side of the tylus with at least three oblique grooves, which define intervening, not very distinct, wide wrinkles; pits each side, anteriorly, deep, distinct, moderately large, those next the eyes large and shallow; impressed line each side of tylus deep and well defined, contracted near the middle; the surface not apparently punctured; ocelli small, placed very far back, and near the eyes, a depression between them and the eyes; the eyes rather flat, somewhat deeply seated, the margin in front of them prominently recurved. Antennæ, rostrum and tarsi pale ferruginous, or ochreous-yellow, the joints of the former moderately short, the second joint very short. Rostrum reaching to the intermediate coxæ, the apical joint very slender. Pronotum subquadrate, a little wider than long, the sides straight, a little narrowing toward the front, the edge recurved, the anterior angles a little protracted, the margin exterior to them curved inward; surface moderately flat, remotely punctate on the transverse line and behind it, and on the sides, more particularly next the anterior angles; the disk anteriorly with one or two shallow pits each side; the anterior

margin abruptly sinuated, margin of the sinus with a collum, which becomes narrower each side as it runs outward to the exterior angles, behind each eye with two dragged indentations. Scutellum flattened on the middle, remotely, a little coarsely, punctate, the apex and a little before it somewhat rugulose. Legs pale chestnut-brown, or ferruginous, the spines and teeth piceous, those of the outer edge of anterior tibiæ short and not very stout. Propleuræ and outer area of the meso-, meta-, and epi-sterna pale, smooth, highly polished. Corium finely, remotely punctate, the punctures somewhat obsolete upon the disk, those of the sutures coarser; membrane white, longer than the venter. Venter smooth, highly polished, faintly wrinkled on the sides of the disk and pale, posteriorly.

Length 5 millimeters. Width of base of pronotum 3 millimeters.

This very interesting little species, which might easily be confounded with either *Macroporus repetitus* or *Rhytidoporus indentatus*, was first discovered by Mr. Benjamin H. Smith in the vicinity of Denver City, Colo. Since then it has been taken in Dallas County, Texas, by G. W. Belfrage; and a few specimens occurred to me while collecting insects near the foot-hills of the Rocky Mountains, west of Denver, in August, 1875. The summer was a particularly rainy one, and the sudden chilling of the atmosphere by a hail-storm would cause this insect, together with beetles, flies, *Hymenoptera*, and other *Hemiptera*, to take refuge under the tufts of grass and roots of Yuccas and other flowers and herbs, where they remained secure from the driving elements.

ÆTHUS Stål.

Oval, long oval, or subovate, moderately convex; head short and wide, the margins reflexed, the submargins with erect teeth and bristles; the lateral lobes flattened, equal to the tylus in length; the base of the head prominently convex; ocelli large, far apart, placed behind the posterior line of the eyes. Rostrum of medium length, stout, the second and third joints arcuately expanded, the basal joint not exceeding the bucculæ in length; bucculæ narrow and long; antennæ of five joints, the joints moderately short, the second joint longer than the third, the fourth and fifth long-ovate, subequal. Pronotum subquadrate, wider than long, the sides more or less obliquely narrowing anteriorly, remotely ciliated, the anterior margin deeply sinuated to receive the head, destitute of a collum, or only having a thickened edge on that part. Prosternum raised, broadly grooved, the lateral flaps narrow and short. Ostiolar canal flat, of medium length, set on an oblique and acute scale. Anterior tibiæ but moderately expanded, the exterior margin with a few long spines; posterior tibiæ long and rather straight. Scutellum triangular, longer than wide, narrow at tip, and contracted just before the tip. Corium a little convex, of medium width, the costal margin broadly curved, with the edge thickened before the middle, and remotely ciliated; the posterior margin obliquely truncated, with the

outer angle a little produced. The ventral submargin very remotely ciliated.

This genus was not sufficiently characterized by Mr. Dallas to mark its distinctness from *Cydnius* Fieber and its allied genera. The characters here cited include those given by Dr. Stål in his Hemiptera Africana, and will abundantly serve to separate the genus from *Cydnius* Fieber. The types of the genus *Cydnius* will thus be *C. flavicornis* Fab. and *C. nigrita* Fab., both European species. Modifications of the pleural pieces of both these species, and the long ostiolar canal terminated by an excavated bulla, added to the characters given by Dr. Fieber, will distinguish the genus from all others thus far described. I regret that the *Cydnidae* of the collections in this country are too few to enable me to gauge the minor groups with precision. This can only be done by working over a full series of both sexes of the principal forms from various parts of the world.

Æ. communis, new sp.

Moderately broad-oval, almost ovate, a little convex above, chestnut brown, or rufo-piceous. Head flattened in front, smooth, polished, almost impunctate, short and blunt, hardly emarginate in front of the tylus; the submargin with remote, short teeth and fine bristles, the margins abruptly recurved; lateral lobes with a few broad, flat, oblique wrinkles, each side with two or three coarse punctures, before the eye with a broad fovea, and near the angle next the tip of the tylus with a smaller fovea; tylus very distinct, almost flat, before the middle with about two transverse, impressed lines; base of head humped, narrow. Rostrum reaching behind the intermediate coxæ, ochereous, or pale ferruginous; the basal joint longer than the bucculæ. Antennæ ochereous; basal joint stout, about as long as the second, the second and third quite slender, the third very short; fourth and fifth moniliate, long-subovate. Pronotum subquadrate, moderately flat, the sides a little obliquely narrowing anteriorly, the edge reflexed, coarsely punctate and remotely ciliate; the anterior angles subacute and the margin outside of them curved inward; the anterior margin deeply sinuated, a little sunken each side of the sinus, then a little humped behind the eyes, and on the margin with two large sunken points; surface minutely and very obsoletely punctate behind the sinus and on each side anteriorly, then coarsely, remotely so on the transverse line; posterior margin moderately steep, a little arcuated, the intra-humeral depressions shallow, humeri convexly elevated. Legs very pale rufo-castaneous, the spines of the tibiæ long and sharp, dark piceous. Pleural pieces highly polished. Corium broad, coarsely punctate in rows, the punctures of the disk finer, almost obsolete; the costal margin thick, set with six very coarse pits, each carrying a bristle; embolium triangularly widened behind the base, the flap closely embracing the metapleura; membrane slightly tinged with brown. Venter polished, the

exterior margin with a series of remote, long, slender bristles; the posterior edges of the segments each side with a few very minute teeth, the penultimate and last segments transversely wrinkled, the latter with a few indistinct punctures.

Length 6-7 millimeters. Width of pronotum 3-4 millimeters.

Inhabits Cuba. Sent from Havana by Prof. Felipe Poey, and from the interior of the island by Mr. Charles Wright; also, from near Saint John's River, Florida, by Mr. E. Norton.

Form *b*.—Piceous black, a little narrower anteriorly, the head a little more rounded, and more distinctly emarginated in the middle of the clypeus, and the sides of the pronotum sinuated and more hairy. Obtained near Orange Springs, Florida, by Miss Modeste Hunter, and in Dallas County, Texas, by Mr. G. W. Belfrage.

The genus is represented by numerous species, both from South America and Africa.

RHYTIDOPORUS, new genus.

Oval, aspect of *Cydnus* Fieber. Head bluntly rounded in front, the tylus extending to the tip, the lateral lobes flat, obliquely and obsoletely wrinkled, a sunken point each side of tylus anteriorly, and a larger one next to the eye; margins thick, reflexed, the submargin grooved, armed with small erect teeth and fine bristles; base of the head prominent, convex, sunken each side; ocelli small, placed behind a line parallel with the base of the eyes, and a little nearer to them than to each other. Antennæ of medium length; the second joint shorter than the third. Bucculæ shorter than the throat, narrow, a little wider posteriorly. Rostrum of medium length; the basal joint as long as the head; the second longest, compressed, arched; third subequal to the first; fourth slender, shortest. Prosternum convexly elevated, the center broadly scooped out, the side-flaps slender, narrow, waved. Pronotum wider than long, almost flat, the anterior lobe a little more convex; lateral margins a little oblique, moderately curved inward at the anterior angles, the angles subacute, curving with and fitting against the eyes; transverse line very shallow, placed far back; posterior margin almost straight, the exterior angles steep, subrectangular; the humeri tubercularly prominent. Ostiolar canal less than half the length of the episternum, fusiform; the tip depressed, scooped out, and subacute, connected with a flat, ligulate piece which runs outward to the submargin. Anterior tibiæ very slightly expanded, the outer edge with only five or six small spines. Scutellum long, very narrow at tip. Corium moderately wide, the costal margin a little arcuated, thickened and widened from the base to behind the middle, having one setigerous puncture; posterior margin concave.

R. indentatus, new sp.

Pale rufo-castaneous, oval, remotely and slenderly ciliate. Head flat, moderately bluntly rounded, the outer margin broadly rufescent, the

teeth fine, piceous, the bristles fine; wrinkles of the lateral lobes indistinct and flat, the surface with a very few obsolete, minute punctures; tylus percurrent, slightly convex, depressed behind the middle. Antennæ pale ochereous or ferruginous; first joint stout, reaching a little beyond the margin of the head; second slender, shorter, a little shorter than the third; the third increasing toward the tip, subequal to the fourth; the fourth and fifth fusiform, the latter longest. Rostrum extending to the intermediate coxæ, pale ochereous. Pronotum highly polished, subquadrate, wider than long, the sides a little obliquely narrowing anteriorly, remotely ciliated, widely deflected over the pleuræ, more or less tinged with rufous on the sides and posteriorly; anterior margin moderately emarginated, the collum obsolete, with an indented point each side and next the anterior angles; anterior lobe a little convex, impunctate, excepting on the sides, the transverse line feeble, placed far behind the middle, set with a few fine, remote punctures, and with a few fine punctures behind it; posterior margin almost straight, hardly sinuated near the humeri, the latter a little prominent, the angles nearly rectangular. Scutellum flat, longer than wide, contracted before the tip, the tip narrow, depressed, bearing a few indistinct punctures; the surface coarsely, very remotely punctate, excepting on the base; the suture next the frenum very minutely punctate. Legs ochereous, or pale rufo-flavous, the tarsi paler yellow; femora with two rows of setigerous punctures on the under side. Corium with fine, scattered punctures around the sides and ends; costal margin with one setigerous pit near the base; the sutures more coarsely, evenly punctate; membrane tinged with brown. Sides of the posterior margins of the ventral segments minutely rastrated and denticulated.

Length $5\frac{1}{2}$ - $6\frac{1}{2}$ millimeters. Width of base of pronotum 2- $2\frac{1}{2}$ millimeters.

Inhabits Cuba, and has been collected in various parts of the island, by Prof. Poey and Mr. Charles Wright. Southern Florida, Dr. E. Palmer.

CRYPTOPORUS, new genus.

Subquadrate-oval. Head wider than long, a little bluntly rounded, flat, with two or three obsolete wrinkles each side, a pit near the tip of each lateral lobe, a less distinct one next each eye, and the posterior surface each side sunken; margins much reflexed, toothed and ciliated; the tylus a little shorter than the lateral lobes, and the lobes curved almost in contact in front of it. Antennæ short and stout, the basal joint barely reaching the anterior margin; second joint slender, scarcely as long as the third, the third subconical, a little shorter than the fourth; fourth and fifth subfusiform, nearly equal, longer than the third. Bucculæ long, narrow, rough, inclosing the whole of the basal joint; rostrum of medium length, second joint longest, a little compressed, third longer than the fourth. Prosternum raised and grooved, the lateral plates short, a little arched. Pronotum transverse, subquadrate, a little

obliquely narrowing anteriorly; anterior margin moderately emarginated, destitute of a collum, indented each side of the head; lateral margins densely fringed; posterior margin subtruncate, feebly sinuated next the humeral angles. Scutellum a little longer than wide, narrow at tip. Ostiolar canal very short, consisting of only a narrow ridge running out not more than one-fourth the length of the episternum; the anterior margin of the meta-episternum composed of a flat piece, ligulate, running outward to the tip, and widening there; the ostiole is oval, and situated at the point of contact of that piece and the canal. Costal margin of the corium closely pitted, and fringed with bristles. Anterior tibiæ wide, very distinctly ridged and sulcated, and many-spined.

C. compactus, new sp.

Subquadrate-oval, blackish-piceous, with the margins of the corium more or less tinged with rufous. Head deep black, flat, highly polished, impunctate, but with indications of minute rugosities in places; wrinkles of the lateral lobes obsolete and abbreviated; fossæ very distinct; sides of the tylus almost straight, the apex very slightly narrowed, blunt; base of the head convexly elevated. Antennæ short and stout, pale, or moderately dark piceous; second joint shortest and narrowest. Rostrum ferrugino-piceous, stout, reaching to the intermediate coxæ. Pronotum wider than long, a little narrowing anteriorly, the lateral margins reflexed, densely clothed with long, ferruginous pubescence; the surface highly polished, irregularly punctate on the sides, and obsoletely on and behind the transverse line; posterior half with a few transverse scratched lines; fossæ near the anterior angles small but distinct; humeral angles a little convexly prominent, the sinus next them almost obsolete. Scutellum very feebly convex, the surface a little uneven, deeply, but hardly coarsely, punctate; the submarginal suture deep, closely and very minutely linearly punctate; the tip rugulose and much depressed. Corium minutely punctate, but coarsely on the sutures, the surface highly polished, rufous on the costal area and inner margin of the clavus; the costal margin very thick, having coarse punctures to beyond the middle, which are close set and carry ferruginous bristles; membrane faintly tinged with brown, and with a few piceous thick places on the nervures. Legs rufo-piceous; the spines black; the tarsi ferruginous; the posterior coxæ are very much prolonged exteriorly, and flattened, and acutely ovate at the outer end. Venter polished, minutely rugulose exteriorly and on the connexivum, and a little wrinkled on the last two segments.

Length 5 millimeters. Width of base of pronotum scant 4 millimeters.

Brought by Captain Julich from Galveston Island, Texas. It is a most interesting, compact, little species, which seems to be tolerably common in the region cited.

Thus far no specimens have been secured in the more interior parts of the State, although some of those counties have been pretty thoroughly examined.

PANGÆUS Stål.

Oval, elliptical, or subquadrate-oval. Head widely rounded, the lateral lobes flat, obliquely wrinkled, with a distinct pit next each eye, and one each side not remote from the tylus; submargin with stiff bristles, but no teeth; tylus wide and long, depressed at base, as long as the lateral lobes, bounded in common with them by the reflexed margin. Ocelli on or behind the posterior line of the eyes, separated farther from each other than from the eyes. Antennæ moderately stout, and not very long; the fourth and fifth joints subfusiform, about equal, each longer than either of the preceding ones. Bucculæ as long as the throat, narrow, and almost straight, the basal joint of the rostrum inclosed by them; second joint compressed, arched, longest; the third longer than the fourth. Pronotum subquadrate, wider than long, narrower in front than at base, the anterior margin deeply sinuated, the margin proper with a thick percurrent collum, which runs more slenderly to the anterior angles; lateral margin with a few bristles; the surface a little convex, with the transverse, impressed line placed a little behind the middle. Ostiolar canal ligulate, or subfusiform, about one-half the length of the episternum, attached to a scale which runs farther outward and tapers to a slender point. Anterior tibiæ moderately expanded, armed on the outer edge with long, curved teeth. Scutellum a little longer than wide, sensibly narrowed at tip. Costal margin a little expanded, grooved, set with less than six bristle-carrying pits; posterior margin of the corium almost obliquely truncated, the outer angle a little prominent, acute.

1. *P. bilineatus*.

Cydnus bilineatus Say, Journ. Acad. Phila., iv, 315, No. 1.

Æthus bilineatus Dallas, Brit. Mus. List, Hemipt., i, 119, No. 20.

Pangæus bilineatus Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 9.

Cydnus femoralis H.-Schf., Wanz. Ins., v, p. 98, fig. 548.

Oval, coal-black, highly polished; head bluntly rounded, strongly margined, in some specimens with a very minute emargination in front of the tylus; generally the tylus comes up fully to the front, and fills the space at the apex of the lateral lobes; submargin with remote, erect bristles; surface of the lateral lobes uneven and obliquely wrinkled, the pits near the eyes and those near the front distinct; the tylus with four or five shallow transverse furrows anteriorly; base of the head prominently elevated, convex, polished, impunctate; ocelli large, amber-yellow or reddish. Antennæ yellowish-piceous, stout; the second joint a little longer than the third. Bucculæ minutely and obsoletely rugulose, a little depressed on the side of the middle; rostrum pale rufo-piceous, reaching between the intermediate coxæ. Pronotum moderately obliquely narrowing toward the front; the anterior angles a little prolonged and exteriorly a little curved inward; the lateral margins remotely ciliated, the edge reflexed, but the sides widely arching down

over the pleuræ; surface moderately convex on the anterior lobe, flatter posteriorly, the transverse line distinctly impressed, irregularly punctate, terminating before the submargin in a distinct fovea, the surface behind the line and near the lateral margins irregularly punctate; the exterior suture with a series of remote, coarse punctures, and remotely ciliated; anteriorly and posteriorly destitute of punctures, particularly next the hind margin; humeri a little prominent, a little prolonged forward in a ridge, exterior to which the side is high and steep. Legs rufo-piceous; the anterior tibiæ moderately expanded; the outer edge with about ten rather long, curved spines; the upper surface transversely furrowed; the tip with three or four long, straight spines, and the inner margin near the apex with a long, slender, oblique one; posterior tibiæ long, slightly curved, closely set with long black spines; tibiæ ochreous or ferruginous. Scutellum a little convex at base, depressed behind the middle, coarsely, remotely punctate from behind the base almost to the tip, the lateral submarginal line deeply impressed, finely punctate. Corium of medium width, the surface irregularly rugulose, finely remotely punctate, and with coarser punctures on the inner seams on and near the clavus; the costal margin with three or four pits carrying bristles; membrane a little brownish. Venter smooth, impunctate, the posterior edges of the segments each side with very minute teeth; the connexivum uneven, irregularly indented.

Length 7-8 millimeters. Width at base of pronotum $3\frac{1}{2}$ - $4\frac{1}{2}$ millimeters.

Inhabits Massachusetts, Connecticut, New York, Pennsylvania, Maryland, and the Southern States as far west as the middle of Texas. One specimen from Matamoras, Mex., agrees with the form as seen in the Atlantic region. It is also the *Æthus robertsoni* of Fitch's MSS., from Indian Territory, as I know from an examination of a specimen in his collection, as also from the determination of Dr. Signoret, to whom Dr. Fitch sent specimens.

It is of importance to record that this species varies very much in some of its structural features. In a few specimens, which were normal in other respects, the margin of the clypeus was scalloped each side of the middle, and emarginated in front of the tylus. The second and third joints of the antennæ are sometimes equal; at others, either may be longer than the other. The ostiolar canal and the plate to which it is attached vary in length and width, and are often ragged on the posterior margin. Two specimens have been examined by me, which had the ostiolar piece of one side normal, and on the opposite side long, triangular, and jagged. Usually, there are but three pits and bristles on the costal margin, but occasionally there are four, and in one specimen I noticed five.

2. *P. rugifrons*.

Cydnus rugifrons H.-Schf., Wanz. Ins., v, p. 97, fig. 547.

Oval, piceous-black. Head a little broadly rounded in front, the exterior margin broadly recurved, remotely ciliated; the surface flat, but

a little raised on the middle, irregularly and obliquely wrinkled; the pits of the submargin, three in number each side, smaller than that of the middle, the one next the eye largest; base of the head prominent, convex, smooth, impunctate, the adjoining surface scooped out, and a little wrinkled anterior to the ocelli. Antennæ pale, castaneous or ferruginous, the second joint slender, and not quite as long as the third; fourth and fifth longer, subequal. Rostrum pale castaneous, reaching not quite to the intermediate coxæ; the basal joint a little shorter than the throat; the second joint moderately compressed, a little widened and arched, longer than either of the others; third joint a little compressed and widened, longer than the fourth; the fourth more slender, shortest. Bucculæ dark piceous, a little roughened, longer than the basal joint of the rostrum, and inclosing it. Pronotum rather more convex than in the preceding species, the sides a little more narrowing anteriorly, remotely ciliated, the anterior angles not so much prolonged, the exterior margin gently curving toward them; anterior margin less deeply and not so squarely emarginated as in the preceding species, the collum-like rim flat, with a distinct rim on the middle of the margin; transverse line deeply impressed, with few and fine punctures, the pit at each end of the line small, round, but distinct, the sides with a very few fine punctures, and a very few only behind the middle; humeral angles convexly ridged, the sides exterior to them steep, with short but distinct sinuses on the posterior margin. Scutellum narrow at tip, the surface distinctly, irregularly, and a little coarsely punctate from near the base to the tip, the tip depressed and a little rugulose; the transverse, impressed line at base minutely punctate. Legs rufo-castaneous, the tarsi ochreous; anterior tibiæ a little expanded, armed on the outer edge with about eight slender spines. Corium a little rufo-piceous, obsoletely rugose, a little coarsely punctate at base and on the basal parts of the sutures, the disk almost impunctate, and the base and apex of the costal area finely but closely punctate; costal margin at base with three setigerous pits; membrane brownish, extending beyond the abdomen. Venter rufo-piceous, highly polished, impunctate; the posterior edges of the segments each side of disk as far as to the connexivum with minute teeth; the center of the margin of the penultimate segment with a small depression carrying minute, rastrate lines; the connexivum with a few minute tubercles on each segment.

Length $5\frac{1}{2}$ –6 millimeters. Width of base of pronotum 3– $3\frac{1}{2}$ millimeters.

From South Carolina and Georgia.

In one specimen, the rastrated impression on the edge of the penultimate ventral segment is not apparent.

A specimen from South Carolina, agreeing with the typical form in other respects, has the rostrum extending to the posterior line of the intermediate coxæ. This species bears close resemblance to the dwarfed males of the preceding one.

3. *P. discrepans*, new sp.

Broader, and more quadrate than either of the preceding species, the corium longer, and the membrane much smaller and shorter. Deep black, highly polished; the head transverse, blunt, broadly rounded, remotely ciliate; the surface flat, broadly depressed each side, rugose, unevenly punctured and obsoletely wrinkled; the pits next each eye present, the others obsolete; anterior margin broadly reflexed, emarginated more or less distinctly in front, the lateral lobes curving in front of the tylus, the tylus tapering at tip; base of head a little convexly elevated, roughened each side; the ocelli dark, minute, and placed very far back. Antennæ piceous at base, pale ochereous from the tip of the third joint to the tip; second joint slender, much longer than the third; the third shortest, increasing in thickness toward the tip; the fourth and fifth long-ovate, the fourth longer than the fifth, and subequal to the second. Bucculæ a little shorter than the head, a little arched, punctate, and rugulose, inclosing the basal joint of the rostrum. Second joint of rostrum long, subequal to the third, very much compressed, arched, widened; fourth joint short and slender; rostrum reaching not quite to the intermediate coxæ. Pronotum a little wider than long, the sides curving inward a little at the anterior angles, the angles short, the submargin remotely ciliated, the edge distinctly recurved; surface moderately convex, highly polished, uneven and depressed behind the middle; the anterior lobe more convex, rough and closely punctate each side, more finely punctate near the angles; the transverse line interrupted in the middle, remotely, coarsely punctate, and with a group of punctures behind the disk; anterior margin moderately sinuated, the collum-like margin obsolete on the middle, but defined there by a curved series of coarse punctures; the surface depressed in front of the humeri, the humeri slightly prominent, and the sinus adjoining them very short and shallow. Lateral flaps of the prosternum slender, abbreviated, a little arcuated. Legs piceous, a little tinged with rufous; the anterior tibiæ moderately expanded, armed on the outer margin with about eight long stout spines. Ostiolar canal with a slender carina from the base to near the tip. Scutellum transversely, convexly elevated near the base, and convex behind the middle, coarsely, remotely punctate on the disk; the tip narrow and very finely, obsoletely punctate; the lateral margins with a line of very coarse punctures, which begin in a groove behind the base, and then continue without the groove from behind the middle to near the tip; the transverse line at base very deep, minutely punctate. Corium minutely, obsoletely punctate, on the disk very remotely, and on the sutures very coarsely so; the posterior margin almost truncate, the outer angle blunt and scarcely prominent; costal margin with six or seven setigerous pits. Membrane quite short, slightly tinged with brown. Venter highly polished, impunctate, excepting a transverse line of coarse punctures next the suture of the basal segment; posterior edges of the segments each side with very minute teeth;

connexivum depressed, tuberculate, and wrinkled, the exterior submargin remotely ciliate.

Length 7-8½ millimeters. Width of base of pronotum 3½-4¼ millimeters.

From near Fort Cobb, Indian Territory, by Dr. George H. Horn, and from San Diego, Cal., by William Holden; also inhabits Texas and Mexico.

4. *P. margo*.

Æthus margo Dallas, British Museum Catal. Hemipt., i, p. 116, No. 12.

Pangæus margo Stål, Hemipt. Mexicana, Stettiner Ent. Zeit., xxiii, p. 95, No. 47.

Moderately long-oval, piceous-black, polished, sometimes tinged with rufous on the base of pronotum, front of head, and on the costal area. Head longer than wide, remotely ciliated with fine bristles, broadly depressed around the front of clypeus, the margins strongly recurved; surface of the lateral lobes uneven, minutely and obsoletely rugulose, the usual broad wrinkles obliterated; pits present each side near the middle, one in the exterior angle near the eye, and another on the inner margin of the eye near its middle; the pits setigerous; tylus as long as the lateral lobes, a little narrower at the apex, the lobes curving against its tip but not meeting in front of it; the depressed lines bounding it become almost obliterated where it rises behind the middle, and then become expanded and deepened at its base; ocelli large, placed on a line with the base of the eyes; base of head moderately convex, smooth. Antennæ ferruginous, the second joint a little shorter than the third. Rostrum ferruginous, or pale castaneous, reaching to the intermediate coxæ; the basal joint a little shorter than the bucculæ and almost inclosed by them; the bucculæ dull, minutely rugulose; second joint long, moderately compressed, a little arched; the third feebly compressed, a little widened, about of the same length as the second; the apical joint shortest, not very slender. Pronotum a little wider than long, the sides oblique, decidedly narrowing toward the front, sparingly ciliated, the surface moderately convex, the transverse line deeply indented, sharply separating the anterior lobe, remotely punctate, and the punctures scarcely forming a disconnected series from those which extend back upon the posterior lobe, and across its width to the submargin; on the sides the punctures are massed, extending from before the humeri to the anterior angles, and invading an arcuated impression, which runs forward from the pit at the end of the transverse line; disk of the anterior lobe impunctate, but with a shallow, longitudinal, impressed line in front; the marginal stria very distinct, and with a few obsolete pits in its bounding line; humeri distinct, impunctate, the sinus adjoining small, shallow. Scutellum convexly prominent near the base, the immediate base with the impressed line minutely punctate; surface coarsely, remotely punctate, somewhat in transverse, irregular lines almost to the tip; tip posteriorly with a few fine punctures; the lateral marginal line deep, long, with faint vestiges of pits

in its deeper part. Prosternum wide, the margius narrow, abbreviated in front. Legs rufo-piceous; the anterior tibiæ rather wide, armed on the outer edge with about nine not very long piceous spines; tarsi ferruginous. Corium tinged with rufous, particularly on the costal area; the sutures coarsely punctate, the costal area and the base and apex of the discoidal area finely punctured and minutely uneven, the disk with only vestiges of punctures, which are placed very wide apart; membrane of medium length, a little brownish. Venter very smooth, remotely ciliated exteriorly, with the posterior edges of the segments exteriorly very minutely denticulated.

Length 7-9 millimeters. Width of base of pronotum $3\frac{1}{2}$ -5 millimeters.

From Mexico. One specimen from Arizona.

The head is longer and less bluntly rounded than in *P. bilineatus* Say, to which it is the most closely related. All the specimens seen by me, one of them a type sent to me by Dr. Signoret, agreed in having three setigerous pits on the costal margin of the corium. I have alluded to setigerous pits on the head of this species, while I have not done so in the descriptions of either of the other species. This is owing to the fact that, although I had fresh specimens before me in some cases, none of them exhibited the bristles here described.

5. *P. piceatus*.

Pangæus piceatus Stål, Hemipt. Mexicana, 1862, xxiii, 95, No. 48.

Oval, almost ovate, pale castaneous, or piceous, polished. Head longer than wide, depressed anteriorly, the margin broadly recurved, hardly bluntly arcuated, remotely ciliated; the lateral lobes longitudinally channeled in two places, and with a few oblique striæ, the pits obsolete; tylus reaching the tip of the head, narrowed at the apex, the cheeks not quite meeting in front of it, its middle convexly elevated. Antennæ stout, the basal joint thick, not reaching to the margin of the head; the second very slender; subequal to the first; third much longer, increasing in thickness toward the tip; fourth and fifth about equal, scarcely longer than the third. Rostrum ferruginous, reaching to the intermediate coxæ; the second joint compressed, a little arched, somewhat longer than the first. Pronotum a little wider than long, the lobes well separated by the deep transverse line, each a little convex, the line punctate, and with only a few punctures behind its middle, remaining surface impunctate; lateral margins obliquely narrowing toward the front, very remotely ciliated; the humeri distinct, convexly ridged, the sinus next to them almost obsolete. Scutellum a little longer than wide, narrow at tip, feebly convex; the depressed line at base minutely punctate, the surface almost as far as the tip and the impressed lateral line coarsely, remotely punctate. Legs pale rufo-piceous; the anterior tibiæ moderately expanded, armed on the outer margin with about eight long, slender spines. Corium a little uneven, impunctate, excepting on the base and basal portions of the sutures; costal edge with only one or two setigerous pits; membrane faintly brownish. Ostiolar canal broad, obliquely striated next to the tip. Venter paler, smooth, impunctate.

Length 5 millimeters. Width at base of pronotum 3 millimeters.

Inhabits Mexico. One specimen from Arizona.

This species resembles our *Rhytidoporus*, but the generic characters given above will abundantly serve to separate it.

The descriptions of the following species, unknown to me otherwise, are here included to complete the group as far as the literature of the subject is known to students in America.

Probably when specimens of them are properly examined, they will prove to belong to the present genus, in which, for the present, we place them with a query. No doubt, most, if not all, of them will yet be found in our western Territories and in Texas.

5. *P. ? fusiformis*.

Æthus fusiformis Walker, British Museum Catal., pt. i, p. 158, No. 20.

"Black, fusiform, slightly convex and shining, with hardly any bristles. Head hardly punctured, transversely and very slightly rugulose, about half the breadth of the thorax. Eyes bright red. Antennæ less than half the length of the body; first joint red at tip; second a little longer than the third; fourth much longer than the third; fifth a little shorter than the fourth. Thorax with a few large punctures along each side, and with an indistinct transverse furrow, which is obsolete on each side and is accompanied by a few large punctures. Scutellum with a few large punctures, its breadth at the base much shorter than its length. Legs robust; tibiæ with stout spines. Fore wings dull, thinly and minutely punctured, more largely punctured along the hind border; membrane piceous."

Length of the body $5\frac{1}{2}$ lines.

Inhabits Orizaba, Mexico.

6. *P. ? fortis*.

Æthus fortis Walker, British Museum Catal., pt. i, p. 151, No. 21.

"Black, robust, elliptical, shining, slightly convex, beset with stout bristles along the sides of the head and of the thorax. Head more than half the breadth of the thorax, almost smooth, except some oblique striæ on each side in front. Eyes black. Rostrum reddish. Antennæ tawny, about one-third of the length of the body; joints from the second to the fifth slightly and successively increasing in length; third and fourth joints blackish, except toward the tips. Thorax almost smooth, with a distinct transverse furrow very near the fore border, and with an indistinct longitudinal furrow, which extends from the transverse furrow to one-third of the length. Scutellum thinly punctured, very much longer than its breadth at the base. Legs thick, and with stout spines; tarsi reddish. Fore wings smooth, with two striæ near the costa and two near the hind border; membrane white, hyaline."

Length of the body $3\frac{1}{4}$ lines.

Inhabits Oajaca, Mexico.

7. *P. ? tenuis*.

Aethus tenuis Walker, *ib.*, i, p. 151, No. 22.

"Black, elliptical, shining, nearly flat, a few long bristles on the sides of the head and of the thorax. Head nearly smooth, about half the breadth of the thorax. Eyes black. Rostrum reddish. Antennæ piceous, about one-third of the length of the body; joints from the second to the fifth about equal in width. Thorax nearly smooth, with two slightly curved, transverse furrows, one very near the fore border, the other across the middle; a slight longitudinal furrow extending for a short space hindward from the first transverse furrow. Scutellum with a few punctures, much longer than its breadth at the base. Legs piceous, stout. Fore wings almost smooth, with two striæ near the costa and two near the hind border; membrane brown."

Length of the body $2\frac{3}{4}$ lines.

Inhabits Orizaba, Mexico.

MELANÆTHUS Uhler.

Long-oval, or elliptical; the margins of head, pronotum, and corium, as well as those of the venter, fringed with remote bristles. Head semicircular, the margins slenderly recurved, ciliated, but destitute of spinous teeth; tylus as long as the lateral lobes; base of the head broad, not scooped out each side; bucculæ almost percurrent, widened at the posterior end; rostrum reaching almost or quite to the intermediate coxæ; the basal joint as long as the bucculæ; the second longest, a little longer than the third; third longer than the fourth; the fourth subequal to the basal one. Antennæ moderately stout and long; the basal joint stouter than the second, but not so stout as the fifth, a little narrowed at tip second more slender, either longer or shorter than the third; third thicker toward the tip; fourth longer; fifth longest, and subfusiform like the preceding. Pronotum transverse, very feebly convex, the lateral margins straight or nearly so, with the edge recurved; the anterior margin broadly sinuated, the posterior margin subtruncated. Scutellum longer than broad, acutely narrowing toward the tip; the tip narrow, acutely rounded, overlapping the inner angle of the corium. Exterior area of the corium broad, depressed; the costal margin curved inward toward the tip, leaving the connexivum exposed posteriorly; the posterior margin moderately oblique, feebly arcuated; the exterior angle a little produced. Legs normal, the anterior tibiæ very moderately compressed. Ostiolar canal long and slender, running outward about two-thirds the length of the episternum, broad and rounded at tip.

1. *M. robustus*, new sp.

Intensely black, shining, tolerably broad, almost flat above. Head disk-like, broad, depressed around the front, very coarsely, confluent punctured; the margin almost regularly semicircular, the edge trenchant, elevated; the tylus rugulose. Ocelli small, black, placed near the

eyes on a line much behind them. Occiput smooth on the basal line, broadly a little convex. Antennæ rufo-piceous, darker on the middle of the segments; second joint a very little shorter than the third. Rostrum ferruginous, or pale rufo-piceous, reaching almost to the intermediate coxæ; the second joint longest, very slightly compressed, pubescent. Pronotum smooth, transverse, a little narrowed anteriorly, curving toward the anterior angles, which are angularly rounded; the surface coarsely, closely punctured, obsoletely, remotely so on the disk, obsoletely transversely impressed, each side with a roundish or oblong faint impression; the anterior submargin with an arcuated line of punctures, the margin itself impunctured; posterior margin subtruncated, the edge abruptly decurved, just interior to the humeri a little impressed; the humeri a little roundedly elevated; the lateral angles rectangular. Disk of the propleuræ, and prosternum, coarsely punctured, the other parts polished, impunctured. Sides of the prosternum elevated, continuing almost to the apex of the second rostral joint; running obliquely inwards from the anterior angle is a short, slightly elevated carina. Scutellum broad, reaching beyond the line of the tip of the fourth ventral segment, remotely coarsely, posteriorly finely, punctured; the tip narrow, faintly impressed, reaching a little beyond the inner corner of corium. Corium sometimes tinged with rufous, polished, distinctly closely punctures, those of the disk finer, more obsolete; membrane milk-white, tinged with brown at base. Embolium grooved, punctured. Venter deeply punctured on the sides and behind; genital segment densely punctured. Connexival edge wide, thin, the submargin widely depressed. Female.

Length $3\frac{3}{4}$ millimeters. Width of pronotum 2 millimeters.

Hab.—Maryland, near Baltimore, December 24, under a stone; Andover, Mass., Mr. Sanborn.

2. *M. picinus* new sp.

Oval, rufo-piceous above, more narrowly rounded both before and behind than in the preceding species. Head a little more bluntly rounded in front, the edge very narrowly, but more abruptly recurved; the surface slightly convex, minutely punctured, obsoletely wrinkled; the submargin remotely ciliated, having two sunken points on each cheek, and a sunken point next each eye; the tylus percurrent to the tip, faintly wrinkled, carried farther back than in the preceding. Antennæ ferruginous, not so stout as in the preceding; the basal joint a little narrowed at tip; second subequal to the third, but not as stout; fourth and fifth longer, subequal. Rostrum not quite reaching to the intermediate coxæ, ferruginous or pale piceous; the second joint longest, a very little compressed. Pronotum piceous-black, broader than long, proportionately longer than in the preceding species; the sides a little more narrowed obliquely toward the front, remotely ciliated, and more broadly rounded at the boundary of the anterior angles; anterior margin deeply sinuated,

with two round, sunken points each side near the anterior edge; the surface a little roundedly declining each side, the disk almost flat, anteriorly impunctured; behind the middle with fine, remote, elongated punctures, minutely rugulose; each side coarsely, closely punctured, obsoletely longitudinally impressed, and with a larger sunken point in the midst of the punctures; transverse line obsolete, or absent; posterior margin abruptly decurving, smooth, impressed just interiorly to the humeri; humeri a little elevated, convex. Scutellum longer than broad, acutely narrowing toward the tip, hardly sinuated; the base roundedly, transversely elevated; at the base of this elevation an acutely impressed, slender, punctured line; behind the elevation, the surface is a little depressed, each side with the submarginal groove coarsely punctured; surface faintly rugulose, coarsely, remotely punctured, more finely and obsoletely so at tip; the tip acutely rounded, faintly impressed, the lateral edges a little upturned. Corium rufo-piceous, the elevated seams black; distinctly, a little remotely, punctured, obsoletely so upon the disk and costal space, excepting the base of the latter, which is distinctly punctured; the sutures each side of discoidal field finely distinctly punctured in lines; the posterior margin rather bluntly oblique, the exterior corner a little bluntly prolonged; costal margin curving inward toward the tip. Membrane hardly half as long as the corium; white, very faintly tinged with brown. Legs dark piceous, or rufo-piceous, normal; the anterior tibiæ with few spines; tarsi testaceous, or pale ferruginous. Venter smooth on the disk; the sides minutely wrinkled, and, together with the genital segment, closely punctured, the last ventral segment transversely minutely wrinkled. Connexivum tolerably broad, flattened, the edge treuchant. Embolium long, tapering to a slender point, broadly, longitudinally impressed, minutely rugulose, with a few punctures near the base.

Length 3-3½ millimeters. Width of pronotum barely 2 millimeters.

Hab.—Pennsylvania, in May. A single specimen was kindly given to me by Prof. S. S. Haldeman. I obtained a second specimen while collecting with Dr. F. E. Melsheimer, in York County, Pennsylvania.

3. *M. spinolæ*.

Æthus spinolæ Signoret, Ann. Soc. Ent. France, 1863, p. 545, 12.

Elongate-oval, piceous-black, polished, the sides almost parallel. Head convexly inclining in front, the margin more triangularly rounded than in either of the preceding species, the edge not apparently recurved, remotely ciliated; the tylus broad and long, a little longer than the lateral lobes, faintly rugulose; the cheeks faintly rugulose, each side near the front margin with a sunken point, and near each eye two smaller approximate sunken points. Antennæ ferruginous or pale piceous; second joint the most slender, a little longer than the third; the third a little stouter, shortest; fourth a little longer than the second; fifth longest. Rostrum ferruginous, scarcely attaining to the middle coxæ; second

joint longest, slightly compressed; third a little longer than the fourth; the fourth shortest, slender. Pronotum almost twice as broad as long, finely punctured along the sides and posteriorly, very little narrower before, the lateral margins a little curved inward toward the anterior angles, the edge recurved; the anterior angles subacute, each having a minute sunken point adjoining the margin; each side of the situation of the anterior margin is a similar sunken point. Just interior to the humeral angles is an impression which runs forward to before the middle, and bears a number of coarser confluent punctures. Legs dark piceous, or a little rufo-piceous; the anterior femora with a minute protuberance below, near the apex, minutely spinulose; anterior tibiæ very slightly compressed, moderately spinous, the posterior pair long and slender; tarsi testaceous, or ferruginous. Scutellum long, acutely narrowing, the tip acutely rounded, minutely punctured, the lateral impressed line slender, shallow, distinctly punctured; the base convexly elevated transversely, almost impunctured, its base with a deeply impressed, transverse, slender, punctured line. Corium about three-quarters of the length of venter, not as broad as in the preceding species, finely, distinctly punctured, the impressed sutures with rows of somewhat larger punctures; costal margin very slightly curved at tip; the posterior margin more acutely oblique than in the preceding, straight, the outer tip not produced, very acutely rounded; membrane whitish, not half as long as the corium, with two or three very indistinct nervures. Venter smooth, shining, very minutely punctured; the connexivum longitudinally broadly impressed, remotely ciliated, the edge sharp and thin.

Length $2\frac{1}{2}$ –3 millimeters. Width of pronotum $1\frac{1}{2}$ millimeters.

Hab.—Cuba and Chili, Dr. Signoret.

I am indebted to the kindness of Dr. Signoret, of Paris, for a pair of specimens of this interesting little species.

4. *M. elongatus*.

Melanathus elongatus Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 14.

Deep black, shining, elongate-oval, the sides very parallel. Head semicircular, a little convexly rounded on the cranium, densely punctured, remotely punctured at base; submargin broadly depressed, remotely ciliated, the margin recurved; tylus very short, reaching as far as the tip of lateral lobes, a little cylindrically elevated, minutely rugulose; each side of tylus and adjoining each eye with a small sunken point. Antennæ stout, dark piceous; the joints paler at base and tip, the second joint most slender, shorter than the third; the third enlarging to the tip, a little shorter than the fourth; fifth longest. Rostrum not quite reaching to the intermediate coxæ, rufo-piceous; the second joint longest, a little compressed; the third a little shorter; fourth shortest. Pronotum subtrapezoidal, fully twice as broad as long, the lateral margins anteriorly very slightly oblique, more suddenly rounded at the

anterior angles; the edge recurved, remotely ciliated; anterior margin much less deeply emarginated than in either of the preceding species; the anterior part of disk convexly a little elevated, polished, minutely rugulose; the remaining surface coarsely punctured, not far from the posterior margin, with a deep, transverse, impressed line, connecting with a faintly impressed, coarsely punctured line running forward from just interior to the humeri; at the outer ends of the former impression are two indented more or less distinct dots; posterior margin truncated, the edge narrowly but abruptly decurved; the lateral angles rectangular. Antepectus polished, having a few small punctures; the prosternum a little carinated; the interior edge of the pleural piece also raised. Mesosternum distinctly carinated. Legs dark piceous; posterior tibiæ long and slender;—the anterior legs broken off. Scutellum extending not quite two-thirds the length of the venter, acutely narrowing toward the tip, with a transverse hump at base, and a narrower, lunate impression behind the hump; polished, minutely punctured; the lateral impressed lines broad, shallow, roughly punctured; the tip narrow, acutely rounded, a very little projecting over the membrane. Corium a little broader posteriorly, the exterior apical margin more suddenly curved inward than in the other species, the posterior margin moderately oblique, a little convexly curved near the inner angle, the outer angle very blunt, a little prolonged; surface obsoletely punctured, the sutures distinctly punctured in rows. Membrane pale brownish, hardly half as long as the corium; with three or four very indistinct nervures. Venter polished, slightly convex; the sides, connexivum, and genital segment minutely roughened and punctured; the connexivum broadly depressed, the edge prominent, trenchant.

Length $3\frac{1}{2}$ millimeters. Width of pronotum $1\frac{3}{4}$ millimeters.

Hab.—California. A single damaged female, sent to me by Henry Edwards, esq.

5. *M.?* *subglaber*.

Ethus subglaber Walker, British Museum Catal., i, p. 150, No. 17.

“Black, elliptical, shining, slightly convex. Head thickly punctured, more than half the breadth of the thorax, with a few short bristles. Eyes piceous. Antennæ piceous, less than half the length of the body; first joint and tips of the following joints tawny; joints successively increasing in length. Thorax with rather large punctures, with a few short bristles, and with a distinct transverse furrow across the whole breadth. Scutellum acute, punctured like the thorax; its length rather more than its breadth at the base. Legs rather robust; tibiæ with stout spines; tarsi tawny. Fore wings punctured like the thorax, with two striæ near the costa; membrane pale cinereous.

“Length of the body $1\frac{3}{4}$ lines.

“North America. E. Doubleday.”

The description is short, and probably not sufficiently distinctive.

Perhaps, when a fuller series of these small species has been amassed, it will be possible to recognize this form.

Nothing short of actual examination of the type will enable us to know precisely to what genus this insect belongs. As all the minute forms thus far collected, which approach the characters given above, pertain to the genus *Melanæthus*, we infer that this one will prove no exception to the general rule.

LOBONOTUS, new genus.

Elongate oval, but greatly widened in front, and with the head very long, narrow, and almost triangular. Head much longer than wide, triangularly rounded in front, the margin barely reflexed, the lateral lobes not depressed, but slanting toward the outer margin, as in many of the *Pachycoridae*; tylus narrow, long, raised a little above the lateral lobes, and forming the apex of the head; the submargin destitute of spines, but probably bristly (in perfect specimens); eyes almost inclosed by the protracted front angles of the pronotum. Rostrum very long and slender, the bucculae nearly as long as the throat, inclosing the basal joint, and obliquely widening posteriorly; the basal joint shortest; second joint slender, a very little compressed, very long, but shorter than the third; the third very long, slender, much longer than the second; fourth very slender, a little shorter than the second. Antennæ moderately long, slender; the basal joint stout, not reaching the apex of the head; second joint slender, longer than the third; third a very little stouter, and becoming thicker toward the tip. Pronotum much wider anteriorly than at base, the anterior margin very deeply sinuated to receive the head, the sides anteriorly forming long and wide lobes, the outer margins of which curve bluntly toward the head; the transverse line broad and shallow; the lateral margins bald, the edge slenderly recurved; posterior margin subtruncated. Prosternal groove deep, with steep sides, the marginal flaps arched, but not very broad. Anterior tibiae very moderately depressed, and armed on the edge with but very few spines. Ostiolar scale placed far out on the episternum, near its outer margin, broad, rounded on the outer margin, acute at the inner end, and with the osteole placed at that point. Scutellum quite long, acute, not sinuated next the tip. Corium long and narrow, the costal margin a very little curved, the edge destitute of setigerous pits; membrane short, narrow, and with few nervures.

L. anthracinus, new sp.

Deep black, shining, a little tinged with rufous on the hemelytra; head long, triangularly rounded, sloping in front and on the sides, closely, rather coarsely punctate, the base strongly convex, destitute of punctures; ocelli small, placed near the eyes and behind the line of their base; eyes large, brown, almost inclosed by the prominent angles of the pronotum. Rostrum reaching beyond the basal segments of the venter; ocherous, slen-

der; bucculæ dull black, minutely scabrous, and densely, minutely punctate. Antennæ piceous, pale on the edge of the incisures; the second joint longer and more slender than the third; the basal one shorter and stouter than either. Under surface of the head a little convexly prominent, roughly punctate. Pronotum highly polished, closely, a little coarsely punctate, but with a large impunctate callosity each side of the anterior lobe; sides obliquely widening anteriorly, produced anteriorly into rounded lobes, which extend almost to the front of the eyes; transverse line broad, the center broadly sunken; posterior margin very faintly curved, the humeri distinct, and the sinus narrow, longitudinal. Pleural pieces and sternum uneven, dull, rugose, and coarsely, irregularly punctate. The coxæ and tumid areas of the epimera polished and rufo-piceous. Legs rufo-piceous, the spines black, and the tarsi ferruginous. Scutellum coarsely, closely punctate, a little convex at base, and a little depressed beyond the base; the basal angles each with a round, bald, polished spot. Corium tinged with rufous, densely and coarsely punctate at base and on the sutures, but more finely and obsoletely so posteriorly; the costal edge thin, closely and copiously punctate; the embolium long, smooth, longitudinally, broadly channeled; costal area narrow, at base quite slender and elevated; posterior margin bluntly oblique, faintly waved, the outer angle a little prominent; membrane white, scarcely reaching the tip of the abdomen. Venter deep black, polished, almost smooth, and obsoletely punctate on the disk and middle line, closely and roughly punctate on the sides; sides of the posterior edges of the segments minutely rough; the connexivum depressed, the edge broadly compressed and very thin.

Length 5 millimeters. Width of base of pronotum 2 millimeters.

Collected in McLennan County, Texas, by G. W. Belfrage.

This is the most singular and aberrant of all the forms of our *Cyd-nidæ* yet discovered. Its head resembles that of *Eurygaster* and others of the less thick forms of the *Pachycoridae*, while the slender form of its scutellum, hemelytra, and body suggest analogies with some of the black species of several genera of the Rhyparochromid *Lygæidæ*. Thus far only two specimens, both females, have been secured.

Tribe 2.—SEHIRINI.

Femora, exclusive of the anterior pair, terete, subfusiform; tibiæ with fewer and shorter spines, the anterior pair not flattened; tarsi stouter, the second joint more slender than the basal one.

SEHIRUS Amyot et Serv.

Ovate, flattened above. Head long-semicircular, the lateral lobes thin, oval, broadly upcurved, a little longer than the tylus, not meeting in front of it, but leaving a narrow emargination between their tips; the edge very narrowly recurved; the submargins neither ciliated nor spinous. Tylus gradually narrowing near the tip. Antennæ rather

long and slender, the basal joint shortest, stouter than the second; second more slender, a little shorter than the third; third gradually enlarging to the tip, pubescent; fourth and fifth longer, subfusiform, pubescent, slenderly attached, the fifth a little the longest. Bucculæ not as long as the head, becoming a little higher behind, and subrectangularly terminated. Rostrum extending to the intermediate coxæ; the basal joint as long as the bucculæ; the second and third longer, subequal; the fourth subequal to the basal joint, slender. Pronotum rather flat, subtrapezoidal (in our species, triangularly narrowing toward the fore end); the transverse impressed line apparent; the lateral margins thick, recurved. Prosternal lateral carinæ obsolete; the mesosternum with a slightly elevated middle carina. Anterior tibiæ a little broadened at the tip, on the inner side of which is a short, broad groove; the inner edge with a very few, almost prostrate, short spines, the outer edge and tip with more numerous, longer spines. Odoriferous plate lanceolate, slightly curved, running two-thirds way toward the outer edge of the pleura, depressed; the osteole large, situated at the inner end of the plate. Scutellum convex at base, longer than wide, acutely narrowed toward the tip; the tip narrowed, bluntly rounded, depressed; the frenum lying close against the margin, almost percurrent. Posterior margin of corium very bluntly obliquely directed, subtruncate, feebly sinuated adjoining the inner angle. Membrane at base thickened; with about five nervures, two of which are forked at tip. Edge of connexivum thickened, compressed, a little decurved.

S. cinctus.

Pentatoma cincta Palisot de Beauvois, Ins. Afr. et Amér., p. 114, pl. viii, fig. 7.

Cydnus lygatus Say, Heteropt. New Harm., p. 10, 1.

Sehirus albonotatus Dallas, Brit. Mus. List, i, p. 127, 2.

Sehirus cinctus, Stål, Hemipt. Afr., i, p. 29 (note).

Blue-black or pitchy black, shining, rather broad-ovate. Head long, rounded and bilobate in front, the lateral lobes curved upward, the surface sunken on the middle of each; coarsely, confluent punctured, the base convexly raised, smooth, impunctured; lateral edges recurved, trenchant; ocelli brown, remote from the eyes, but still more remote from each other; eyes large, brown, half surrounded by the raised margin of the pronotum. Antennæ black, slender; the basal joint stout, shortest; the second joint rufescent; apical joint longest. Rostrum blackish-piceous, reaching to the intermediate coxæ. Pronotum flattened on the disk; the callosities coalescing, convex, forming the anterior lobe, smooth, impunctured; the remaining surface, excepting the posterior margin and raised lateral white edge, deeply, somewhat remotely punctured; lateral submargin shallowly grooved, the posterior part of it impunctured; humeri acutely prominent, the posterior margin interiorly to them a little impressed; transverse impression broad, not reaching the lateral margins; the lateral margins obliquely ap-

proaching the head, anteriorly a little curved; the anterior angles a little rounded. Pectus deep black, polished, coarsely punctured on the disks of the areas; the odoriferous apparatus dull black. Legs piceous-black; the outer face of all the tibiæ with an abbreviated white streak; the bristles yellowish; tarsi piceous. Scutellum polished, remotely, coarsely punctured on the middle, each side, and some transverse series posteriorly confluent punctured; frenum and extreme tip piceous, the latter a little impressed, broadly rounded. Corium coarsely, regularly punctured, the punctures a little more remote and shallow on the posterior part of disk; the costal margin white; near the outer angle is a sublunate, smooth, white spot; posterior margin subtruncate, faintly sinuated adjoining the inner angle; membrane brown, the base running toward the inner angle thickened; the nervures numbering about five, sometimes two of them are forked at tip. Venter polished, moderately convex, densely, finely punctured each side and behind, including the depressed submargin of the connexivum; the disk impunctured; the edge of the connexivum smooth, white as far as the third segment, sometimes white all the way to the base.

Length 5-7 millimeters. Width of base of pronotum $2\frac{1}{2}$ - $3\frac{1}{4}$ millimeters.

Hab.—Almost all of the United States, as also Canada and Mexico.

Specimens occur with no spots on the corium, with the spots reduced to mere points, or with a spot only on one wing-cover.

Hundreds of specimens of these insects have passed through my hands, and I have thus had abundant materials for work in this species. The result of these examinations induces me to believe that we have only thus far discovered one species in North America.

The males usually have a smaller emargination between the lobes of the head, although the form of these parts varies in both sexes. The males are most frequently destitute of the white spots of the hemelytra, but occasionally the females also lack them.

Subfamily ASOPINÆ.

PERILLUS Stål.

P. claudus.

Pentatoma clauda Say, Journ. Acad. Phila., iv, 312, No. 2.

One specimen from the vicinity of Colorado Springs; also a few from the region near Denver, collected by Mr. B. H. Smith. The pale variety is the one thus far found most common in Eastern Colorado. In the darker specimens, the ground-color is a rich red, and the black markings are often tinged with violet and indigo.

Evidently, the pale variety would be better protected by its agreement with the sand-color of the plains on which it occurs, and perhaps this is the reason why it is so much more abundant in such places. The darker variety would be better protected in the red surfaces of the Triassic regions, and in places where the soil is stained by oxides of iron. Its enemies, such as the *Phrynosoma*, the various species of

Sceloporus, *Cnemidophorus*, etc., are sharp-sighted and ready, and doubtless the pattern of marking and colors are just such as to place it in closest harmony with its surroundings. It is not unknown in Kansas, and all the specimens that I have yet seen from that State are larger than those from Eastern Colorado; while others from New Mexico and Arizona have been large, like those from the vicinity of Laramie.

PODISUS Stål.

1. *P. modestus*.

Arma modesta Dallas, British Mus., List Hemipt., i, 101, No. 13.

Podisus modestus Stål, Enumeratio Hemipt., i, 51, No. 13.

A few specimens were swept by me from bushes in Beaver Brook Gulch and in Clear Creek Cañon during the early part of August. The specimens were of the usual pale yellow color, marked and punctate with red, and with the black vitta of the membrane and spots of the connexivum clearly defined and very apparent.

2. *P. spinosus*.

Arma spinosa Dallas, British Mus. List Hemipt., i, p. 93, No. 7.

Podisus spinosus Stål, Enum. Hemipt., i, 51, No. 12.

One specimen from near Pueblo, Colo. This region near the Arkansas River, except in its alkaline soil, resembles the river-bottoms and lowlands adjacent to creeks in the country southeast of Baltimore. The first insects that I there saw flying, and most of those which I swept from the bushes and plants, were such as I was accustomed to find common near my home; but away from the vine-clad river-bed, the fauna was quite different. There the Sunflowers, *Mentzelias*, *Euphorbias*, and other flowers of the plains, yielded another set of insects; and although many of these were different from those I had found near Denver, yet some of the same kinds were present, of such forms as were the most widely distributed.

This species did not occur on the plains proper, but was swept from a bush in the bed of the river, at a point where there had been an overflow into a depression of the surface.

LIOTROPIS, new genus.

Broad-oval; the pronotum wide and gently sloping toward the anterior margins, with the lateral angles wide and lobate. Head depressed, narrow; the lateral lobes almost lamellar, separated by a cleft in front of the tylus; tylus acute at tip, much shorter than the lateral lobes; ocelli placed near the eyes and behind the line of their base; antennæ slender, the basal joint not reaching the tip of the head, the second joint shorter, and the third very much longer than either of the others. Bucculæ very narrow, a little shorter than the head, sinuated at base; rostrum starting at the base of the lamellar cheeks, slender, not broadly depressed, the basal joint inclosed by the bucculæ; second joint slender, a little compressed, longest, reaching to the base of the prosternum;

the third wider and a little shorter; fourth wide, a little shorter than the third. Pronotum very short and wide, sublobate at the lateral angles. Ostiolar canal starting at about the end of the first third of the episternum and running through the second third, broad at base, with the ostiole at that point widely open and grooved, tapering rapidly, and terminating in a slender carinate line. Scutellum broad and short, the tip wide and bluntly rounded. Posterior margin of the corium long, obliquely rounded; membrane with seven or eight longitudinal nervures.

L. humeralis, new sp.

Pale testaceous, or clay-yellow, tinged with orange; form broad-oval, with very prominent lateral angles. Head long and narrow, lamellate, broadly rounded, deeply cleft in front, slenderly margined with black, remotely punctate with red or brown, the punctures a little confluent on the vertex, but leaving a nude line on the tylus and an oval spot between the eye and ocellus, the spot bounded with a black line; tylus very much shorter than the lateral lobes, very remotely punctate, and with a short line of punctures each side, its apex acutely tapering at tip. Under side of head with a short black line in front of each eye; the tooth on the base of the antennæ stout, rufous, black at base on the upper side. Antennæ rufous; the basal joint stout, fusiform, a little longer than the second; the second very short; the third longer than the two preceding together; fourth and fifth subequal, each a little shorter than the third. Rostrum rufous, reaching between the middle coxæ, piceous at tip. Pronotum very short, very wide, testaceous, punctate with red and black, the punctures confluent in large spots near the outer sides and a little confluent in transverse rows on the disk; anteriorly each side of the middle with a round black spot, and the posterior lobe clouded with brown; humeral lobes produced, triangularly rounded, tinged with rufous, the edge posteriorly black; lateral margins deeply sinuated anteriorly, pale, with a very small tooth at the anterior angle, and before it some faint traces of serrations; humeri tubercular, the latero-posterior margins broadly sinuated; pleural pieces generally very coarsely punctate. Legs pale yellow, the tibiæ and tarsi tinged with ochreous. Scutellum testaceous, a little coarsely punctate with pale brown, the punctures placed in uneven, somewhat transverse rows; next the margin each side posteriorly with a blackish cloud, and sometimes a fainter one next the tip; the sides feebly sinuated, the apex wide and broadly rounded. Corium wide, coarsely, remotely punctate with black, with a few bald spots on the disk and on the costal area, the base and inner angle tinged with red; costal margin broadly bowed from a little way behind the base to the tip; embolium rufous, unevenly punctate; membrane a little bronzed. Tergum rufous, the connexivum orange, with a small black spot at the outer and posterior angle of each segment; venter pale yellowish, remotely punctate; anal segment of the female with a short black line each side on the posterior margin.

Length $6\frac{1}{2}$ –8 millimeters. Width between the tips of angles of the pronotum $4\frac{1}{2}$ – $5\frac{1}{4}$ millimeters.

From Eastern Massachusetts, near Charlestown, Andover, and Lynn. Beaten by myself from small oaks at Egg Harbor, N. J., in August; and, during the same month, also obtained from bushes near Manitou, Colo.; Maryland, June 28 and September 30, on *Carya*; also in Georgia.

This beautiful little species resembles the genus *Euschistus* in that part of the group represented by *E. tristigma* Say. It also forms a connecting link between the *Asopinae* and the group represented by the genus *Euschistus*, having the lobate head and narrow rostrum of the latter, with the general structure of the former. As it roams so widely, and over a multitude of plants and trees, we believe it to be carnivorous, like its brethren of the genus *Podisus*. The place of its occurrence near Manitou was in the valley, where the surface was well overgrown with small oaks and a great variety of bushes, adjacent to the Fountain Creek.

Subfamily HALYDINÆ.

PRIONOSOMA Uhler.

P. podopioides.

Prionosoma podopioides Uhler, Proc. Entom. Soc. Phila., 1863, ii, 364.

A single specimen occurred to me while sweeping the bushes near Golden, Colo., in August. Specimens have been sent to me from Denver by Benjamin H. Smith. It inhabits Arizona, Nevada, and California.

Subfamily PENTATOMINÆ.

NEOTTIGLOSSA Kirby.

1. *N. undata*.

Pentatoma undata Say, Heteropt. New Harmony, 8, No. 17; Complete Writings, i, 319, 17.

Common in Massachusetts, Illinois, Minnesota, etc. One specimen occurred to me in Clear Creek Cañon in August.

This species was previously referred by me to the *Neottiglossa trilineata* Kirby. The latter, however, seems to be a species sufficiently distinct from the preceding to justify its separation.

2. *N. trilineata*.

Pentatoma (Neottiglossa) trilineata Kirby, Fauna Boreali-Amer., iv, 276, pl. 6, fig. 6.

Aelia trilineata Dallas, British Museum List Hemipt., i, 224, No. 6.

Inhabits Dakota, British Columbia, Canada, Nebraska, and the region of the Mackenzie River.

It differs from the preceding in being larger and more robust and blunt anteriorly, the head entirely black and more coarsely punctate, the venter more widely black, and the femora much more invaded with black. A single specimen was sent to me from the vicinity of San Francisco by James Behrens.

This species has much the appearance of *Apariphe intermedia* Fieber of Europe, but it does not belong to that genus.

MELANOSTOMA Stål.

M. sulcifrons.

Melanostoma sulcifrons Stål, Enum. Hemipt. ii, 18, No. 2.

This odd little Pentatomid has recently been found in very remotely separated regions of the United States: first in Texas and Indian Territory; then in the valley of the Arkansas River; also in Georgia; in New Mexico; and last summer, in July, I swept numerous specimens of it from weeds in a pasture-field sixteen miles southeast of Baltimore.

COSMOPEPLA Stål.

C. carnifex.

Cimex carnifex Fab., Ent. Syst. Suppl., 535, No. 162.

Cosmopepla carnifex Stål, Enum. Hemipt., ii, 19, No. 1.

I obtained one specimen in the region of the Arkansas River, near Pueblo, by sweeping weeds with my net. It is common in certain sections of Texas, in Indian Territory, in Kansas, in Missouri, and in the Atlantic region.

Its nearest neighbor, the *C. conspicillaris*, belongs to the more mountainous regions, and occurs particularly on the west of the Rocky Mountain Ranges.

MORMIDEA Amyot et Serv.

M. lugens.

Cimex lugens Fab., Syst. Ent., 716, No. 98.

Mormidea lugens Stål., Stettiner Ent. Zeit., xxiii, 103, No 73.

It occurred to me while I was sweeping the weeds in the vicinity of Cañon City, Colo.; also inhabits Texas and the Indian Territory, near Cheyenne, and in many parts of the country east of the Rocky Mountains from the Red River country to the vicinity of Quebec, and thence along the Atlantic coast to Florida, and even into Cuba and Mexico.

EUSCHISTUS Dallas.

1. *E. servus.*

Pentatoma serva Say, Heteropt. New Harmony, 4, No. 5.

Euschistus servus Stål, Enum. Hemipt., ii, 26, No. 19.

From the vicinity of the Arkansas River in Colorado, August. Common in Texas and the Southeastern United States.

E. variolarius.

Pentatoma variolaria Palisot-Beauvois, Ins. Afr. et Amér., 149, pl. 10, fig. 6.

Pentatoma punctipes Say, Journ. Phila. Acad., iv, 314, No. 5; Complete Writings, ii, 241, No. 5.

Euschistus variolarius Stål, Enum. Hemipt., ii, 26, No. 22.

A single specimen from near Denver, August 18.

CHLOROCHROA Stål.

C. sayi.

Chlorochroa sayi Stål, Enum. Hemipt., ii, 33, No. 6.

Near Golden, Colo., August 6.

TRICHOPEPLA Stål.

1. *T. semivittata*.

Pentatoma semivittata Say, Heteropt. New Harmony, 9, No. 21.

Pentatoma pilipes Dallas, British Mus. List Hemipt., ii, 247, No. 37.

Trichopepla semivittata Stål, Enum. Hemipt., ii, 34, No. 1.

From the vicinity of the Arkansas River in Colorado, August 10, swept from weeds.

2. *T. atricornis*.

Trichopepla atricornis Stål, Enum. Hemipt., ii, 34, No. 2.

A single specimen from northeast of Denver, August 18. This species is broader and more regularly oval than the preceding, but it belongs more particularly to the north and west of North America than that species. Specimens were collected in the vicinity of the Yukon River and in the Mackenzie River region by Robert Kennicott; others occurred near Lake Winnipeg, in California, in Illinois and in Wisconsin.

PERIBALUS Muls.

P. limbolarius.

Peribalus limbolarius Stål, Enum. Hemipt., ii, 34, No. 1.

Peribalus modestus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 396.

This species was moderately common in the nymph stage, upon several kinds of flowering plants, on August 6-8, in Beaver Creek Gulch and in Clear Creek Cañon. A few days later, I found the imago on plants near Colorado Springs and at Manitou; on August 11, I took several specimens while sweeping the plants in the mouth of the Arkansas Cañon.

It varies somewhat in the amount of black upon the two last joints of the antennæ; in the presence, or not, of black upon the acetabular caps; and in the blackish reticulation upon the corium. The membrane is either bronze or almost hyaline.

HOLCOSTETHUS Fieber.

H. abbreviatus.

Holcostethus abbreviatus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 397.

I found a few specimens of the nymph, August 6, in Beaver Brook Gulch. A fine imago, from near Salt Lake, Utah, was given to me by Mr. S. H. Peabody.

THYANTA Stål.

1. *T. rugulosa*.

Pentatoma rugulosa Say, Heteropt. New Harmony, 7, No. 16.

This beautiful little species was moderately common in Clear Creek Cañon and in Beaver Brook Gulch, August 6-8. It occurred upon the wild gooseberry, and upon several kinds of bushes which grew near the running streams. Several spots in the latter locality consisted of loose blackish soil, which supported a rank vegetation, and it was upon this that these and some other *Hemiptera* were most abundant.

2. *T. custator*.

Cimex custator Fab., Syst. Rhyng., 164, No. 43.

Pentatoma calceata Say, Heteropt. New Harmony, 8, No. 19; Complete Writings, i, 320, No. 19.

Pentatoma custator H.-Schf., Wanz. Ins., vii, 96, fig. 771.—Dallas, British Mus. List Hemipt., i, 25.

Thyanta custator Stål, Enum. Hemipt., ii, 34, No. 2.

One specimen from near Manitou, Colo., August 16. The specimens that I have thus far seen from Eastern Colorado have been of a pale sickly green, with the yellow or rufous of the pronotum not very distinct.

3. *T. perditor*.

Cimex perditor Fab., Entomologia Systematica, iv, 102, No. 90.

Thyanta perditor Stål, Enum. Hemipt., ii, 34, No. 1.

One specimen from near Pueblo, Colo., August 10. The form from Eastern Colorado has a shorter lateral tooth to the pronotum than that of Mexico and the West Indies. Several specimens from Arizona vary in the length of these processes, but in none are they so long as in those from Cuba and San Domingo. In Western Hayti, they occur quite abundantly in the neglected and weedy parts of gardens. A few specimens were obtained by myself in that country from the Palma Christi, or castor-oil plant. In the tropics, they acquire their richest green ground-color with the bright carmine band upon the pronotum.

MURGANTIA Stål.

M. histrionica.

Strachia histrionica Hahn, Wanz. Ins., ii, 116, fig. 196.

Murgantia histrionica Stål, Enum. Hemipt., ii, 37, No. 4.

This widely distributed pest of the vegetable garden is now sufficiently common in Colorado to be of serious injury to the farmers. I found specimens near Denver in the region of irrigation, and also near the city of Golden, August 6. Dr. Packard also took specimens at the latter locality on July 3. No specimens occurred to me south of Denver. Perhaps the reason why I did not find it elsewhere was owing to the fact of the first brood being over, and the time had not arrived for the appearance of the second brood. I swept the weeds on the cultivated grounds west of Colorado Springs, and also in the valley of the Arkansas River near Pueblo, and from the vicinity of Cañon City up to and in the Grand Cañon of the Arkansas, but I did not meet with specimens in either of those places.

BANASA Stål.

B. calva.

Pentatoma calva Say, Heteropt. New Harmony, 7, No. 13.

Rhaphigaster catinus Dallas, British Mus. List Hemipt., i, 232, No. 25.

I obtained the larva in Clear Creek Cañon August 6, and Dr. Packard found the imago near Blackhawk, Colo., on July 2.

Subfamily CHARIESTERINÆ.

CHARIESTERUS Laporte.

C. antennator.

Coreus antennator Fab., Syst. Rhyn., 198, No. 33.

Genocerus dubius Say, Heteropt. New Harmony, 10.

Chariesterus mastus H.-Schf., Wanz. Ins., vii, 3, fig. 681.

Chariesterus antennator Dallas, Brit. Mus. List Hemipt., ii, 510, No. 1.

One specimen occurred to me at Manitou, upon a small oak-tree, August 13. It often occurs upon bushes in the Atlantic region, in localities adjoining open woods, and about groves of trees in the low meadows. When fresh and not weather-beaten, it is thickly powdered beneath with a white mealy substance. Occasionally, it occurs upon the Golden-rod, in the pollen and flowers of which it deeply buries itself, so as to be almost out of the reach of sight. Its gray ground-color and white covering do not, however, afford it any protection from the entomological collector who examines flowers on their under sides.

Subfamily COREINÆ.

MARGUS Dallas.

M. inconspicuus.

Syromastes inconspicuus H.-Schf., Wanz. Ins., vi, 14, fig. 570.

Margus inconspicuus Stål, Stettiner Ent. Zeit., xxiii, 303; Enum. Hemipt., i, 184, No. 1.

One specimen from near Manitou, August 13. It ranges northward from Mexico into California, Arizona, New Mexico, and specimens have been sent to me from Denver (probably collected in that vicinity) by B. H. Smith. It varies much in depth of color and markings, and somewhat in the breadth of its outline.

CHELINIDEA Uhler.

C. vittigera.

Chelinidea vittiger Uhler, Proc. Entom. Soc. Phila., ii, 366.

Chelinidea vittigera Stål, Enum. Hemipt., i, 180.

One specimen from beneath a mass of Prickly-pears on the hill-side near Colorado Springs, August 10.

CATORHINTHA Stål.

C. mendica.

Catorhinta mendica Stål, Enum. Hemipt., i, 187, No. 2.

Obtained by Dr. Packard near Golden, Colo., July 3, 1875. Probably the season for this insect was over when I reached Golden in August, as I failed to find specimens of it by any of the methods usually adopted in collecting.

ANAŒA Amyot et Serv.

A. tristis.

Cimex tristis De Geer, Mémoires, iii, 340, pl. 34, fig. 20.

Coreas ordinatus Say, Journ. Acad. Phila., iv, 318, No. 2.

Anasa tristis Stål, Hemipt. Fabr., i, 56, No. 3.

Taken beneath rubbish on one of the farms a few miles west of Denver, Colo., August 18. It was not common there, and I failed to find specimens in any of the other places which I visited during my stay in Colorado.

Subfamily ALYDINÆ.

ALYDUS Fab.

1. *A. eurinus*.

Lygæus eurinus Say, Journ. Acad. Phila., iv, 324, No. 5.

Alydus ater Dallas, Brit. Mus. List Hemipt., ii, 478, No. 30, ♀.

This is not *Alydus eurinus* Stål (Enum. Hemipt., i, 213, No. 3), but is the most closely related to *A. calcaratus* Linnæus of Europe. A single specimen was collected by Dr. Packard near Manitou, Colo., July 15. Several specimens obtained near Denver were given to me by Mr. B. H. Smith.

2. *A. pluto*.

Alydus pluto Uhler, Hayden's Survey of Montana, 404, No. 2.

One specimen occurred to me west of Denver, August 9.

MEGALOTOMUS Fieb.

M. quinquespinosus.

Alydus 5-spinosus Say, Journ. Acad. Phila., iv, 323, No. 4.

Alydus cruentus H.-Schf., Wanz. Ins., viii, 100, fig. 858.

Megalotomus quinquespinosus Stål, Enum. Hemipt., i, 214, No. 4.

Collected by Dr. Packard in the American Fork Cañon, Utah, on July 22.

Subfamily BERYTINÆ.

NEIDES Latr.

1. *N. spinosus*.

Berytus spinosus Say, Amer. Entom., i, pl. 14.

Neides trispinosus Hope, Catal. of Hemipt., ii, 24.

Not uncommon in the valley of the Arkansas east of Cañon City, August 11. It occurred in places slightly wooded, where wild grape-vines abounded.

2. *N. muticus*.

Berytus muticus Say, Heteropt. New Harmony, 13.

Neides decurvatus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 402.

Several specimens were found by me in Clear Creek Cañon at the entrance to Beaver Brook Gulch, August 7. They were flying in the bright sunlight, and might easily have been taken for *Tipulidæ*.

Subfamily PSEUDOPHLEGINÆ.

DASYCORIS Dallas.

D. humilis.

Dasycoris humilis Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 403.

One specimen from near Golden, Colo., August 6.

Subfamily RHOPALINÆ.

HARMOSTES Burm.

1. *H. reflexulus.*

Syromastes reflexulus Say, Heteropt. New Harmony, 10, No. 1.

Harmostes costalis H. Schf., Wanz. Ins., ix, 270, fig. 992.

Harmostes virescens Dallas, Brit. Mus. List Hemipt., ii, 520, No. 1.

Harmostes reflexulus Stål, Enum. Hemipt., i, 220, No. 4.

A few specimens occurred to me while I was sweeping the weeds on the hills west of Denver on August 5, and also beyond Cañon City, August 11; also, at Colorado Springs, August 16.

2. *H. serratus.*

Acanthia serrata Fab., Ent. Syst., iv, 75, No. 32.

Harmostes perpunctatus Dallas, Brit. Mus. List Hemipt., ii, 524, No. 3.

Harmostes serratus Stål, Hemipt. Fabr., i, 67, No. 1.

One specimen from Manitou, July 15, collected by Dr. Packard.

AUFEIUS Stål.

A. impressicollis.

Aufeius impressicollis Stål, Enum. Hemipt., i, 222.

Swept from the bushes on the suburbs west of Denver, August 18. It was not common, and I did not meet with it in any other place. Some of the more mature specimens are powdered beneath with a white mealy substance.

CORIZUS Fallen.

1. *C. hyalinus.*

Lygæus hyalinus Fab., Entom. Syst., iv, 168, No. 115.

Rhopalus truncatus Fieber, Europ. Hemipt., 234, No. 4.

Corizus hyalinus Stål, Hemipt. Fabr., i, 68, No. 2.

Corizus viridicatus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 404.

This species is very widely distributed in Eastern Colorado; at least that is the case with the variety which I described under the name of *viridicatus*. It lodges in the flowers of various weeds and flowers, and seems to be common upon the plains, foot-hills, and parks in the mountains. It was less abundant in Clear Creek Cañon, but was found everywhere west of Denver, around Colorado Springs, and near Manitou. It lived singly in the crowns of small flowers in Manitou Park, and was common upon weeds in the Arkansas Valley and near the mouth of the cañon of the Arkansas from August 4 to 19. I failed to find it on the plains near Bijou. Dr. Packard found it at Golden July 3, and on Arapahoe Peak, 11,000 to 12,000 feet above sea-level, on July 1.

2. *C. lateralis*.

Coreus lateralis Say, Journ. Acad. Phila., iv, 320, No. 4.

Corizus lateralis Signoret, Ann. Soc. Ent. France, sér. 3e, vii, 97, No. 36.

Swept from weeds on the low hills near Colorado Springs August 18.

3. *C. nigristernum*.

Corizus nigristernum Signoret, Ann. Soc. Ent. France, sér. 3e, vii, 100, No. 41.—
Stål, Enumeratio Hemipt., i, 225, No. 20.

One specimen obtained by Dr. Packard from near Golden July 3.

LEPTOCORIS Hahn.

L. tricittatus.

Lygæus tricittatus Say, Journ. Acad. Phila., iv, 322, No. 2.

Leptocoris tricittatus Stål, Enum. Hemipt., i, 226.

Although very common in Arizona and California, I did not find many specimens in Colorado. It was not until August 11, at Cañon City, that I met with it, and then only at the roots of Cacti and Yuccas. Dr. Packard found it in the American Fork Cañon, Utah, on July 22. One specimen from Cañon City lacks the discoidal red vitta of the corium.

Family LYGÆIDÆ.

LYGÆUS Fab.

L. reclinatus.

Lygæus reclinatus Say, Journ. Acad. Phila., iv, 321, No. 1.

Lygæus (Graptolomus) reclinatus Stål, Enum. Hemipt., iii, 107.

This species, although dwelling upon the *Asclepius*, is found scattered over the plains in many places and in a less degree upon the high peaks of the mountains in Colorado. I met with it almost everywhere, from Denver to Cañon City, August 6 to 18. Frequently after the rain-storms it would be found hidden beneath chips and rubbish on the ground, in the cañons and on the mountain-sides, and sometimes it was stowed away with various other insects among the roots of Yuccas, near Colorado Springs and Manitou. One specimen was swept from weeds growing close to a bunch of *Asclepius* in the mouth of the Arkansas Cañon.

Dr. Packard collected it near Boulder, June 27; on Arapahoe Peak, 11,000–12,000 feet above the sea, July 1; at Manitou, July 15; on summit of Pike's Peak, 13,000 feet, July 14; Garden of the Gods, July 13; and on Gray's Peak, about 14,000 feet altitude, July 7.

MELANOCORYPHUS Stål.

M. facetus.

Lygæus facetus Say, Heteropt. New Harmony, 13, No. 2.

Melanocoryphus facetus Stål, Enum. Hemipt., iv, 113, No. 9.

A few specimens were swept by myself from Yuccas near Denver; but they were most common near Colorado Springs August 13–17, and were generally in shelter beneath dried dung, chips, stones, or about the roots of Yuccas. Sometimes, after a rain, or snow-storm, accompanied by high

winds from the mountains, insects of several orders would be found crowded together around and under the roots of grasses and similar plants, as well as under small stones, etc. Many *Diptera* and *Hymenoptera* were thus collected in company with the Beetles and *Hemiptera*.

Subfamily NYSIINÆ.

NYSIUS Dallas.

1. *N. californicus*.

Nysius californicus Stål, Eugenie Resa. Hemipt., 242, No. 56.

Found sparingly on weeds in moist places, as well on the plains as in the cañons and parks. I swept specimens from flowers on the west of Denver, in Clear Creek Cañon, near Manitou and Colorado Springs, and more abundantly near Cañon City. A few specimens occurred singly on a low composite pale whitish flower in Manitou Park, August 14. Dr. Packard collected it near Golden, July 3.

2. *N. angustatus*.

Nysius angustatus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 406, No. 2.

It occurred to me in great abundance upon tall weeds in cultivated grounds, near Denver, at Golden, in Manitou Park, and near Cañon City, August 6-18. Dr. Packard found it near Golden, July 3.

Subfamily CYMINÆ.

ISCHNORHYNCHUS Fieb.

I. didymus.

Lygæus didymus Zett., Vet. Akad. Handl., 1819, 71, No. 20.

Ischnorhynchus didymus Stål, Enum. Hemipt., iv, 124, No. 1.

This is a common European insect, but it is now to be found sparingly all over the length and breadth of the United States. I collected one specimen near Denver and another near Cañon City.

CYMUS Hahn.

C. luridus.

Cymus luridus Stål, Enum. Hemipt., iv, 126, No. 1.

One specimen was swept by me from weeds in the vicinity of the Arkansas River, east of Cañon City, August 11. It is a common species in many parts of the Atlantic region.

Subfamily GEOCORINÆ.

GEOCORIS Fallen.

1. *G. bullatus*.

Talda bullata Say, Heteropt. New Harmony, 18, No. 2.

Collected around the roots of weeds on the foot-hills and plains west of Denver, August 18. The very pale varieties of this species occur upon the light-colored sand; those from the cañons and mountain altitudes are darker. Full series of these varieties are needed to settle the

synonymy of this species and its allied forms. Some links pointing to a connection with *G. pallens*, *borealis*, and *discopterus* have already been procured, and doubtless still others will occur when closer attention is given to collecting them. Occasionally, they may be swept with the net from low bushes and weeds near woods and streams, on the hill-sides, and in the mountains; and elsewhere they will be found near the roots of plants and among small stones in sandy places. The darker-colored ones affect the dark sandy loam formed by the grinding currents of the rapid streams in the cañons and gulches.

2. *G. uliginosus*.

Salda uliginosa Say, Heteropt New Harmony, 19, No. 3.

Ophthalmicus niger Dallas, Brit. Mus. List Hemipt., ii, 586, No. 9.

Ophthalmicus lateralis Fieber, Wien. Entom. Monats., v, 271, No. 9.

This is the commonest species found in the Atlantic region. It occurs on the ground in dark loamy spots, in woods and near streams, often in places exposed to the sun, and around the roots of *Solanum carolinense*.

Only a very few specimens have thus far been brought from the region near the Rocky Mountains. I obtained one specimen from Denver, August 5.

3. *G. decoratus*, new sp.

Narrow-subovate; prevailing color black, polished. Head wider than the pronotum, the eyes obliquely very prominent, brown, large; face deep black, very closely and finely punctate, the apex of the tylus and cheeks pale yellow; antennæ slender, black, the joints terminated with white, the apical joint dusky; rostrum reaching to the posterior coxæ, piceous-black. Pronotum transverse, very slightly narrower in front, the sides of the anterior margin obliquely truncated, with the angles scarcely rounded, black, very coarsely punctate, almost flat, the anterior edge and a small spot on its middle, the lateral margin, the humeral angles broadly, and a large spot on the middle of the posterior margin ivory-like and pale yellow; callosities transverse, impunctate, highly polished, and deep black. Sternum and pleural pieces deep black, the latter polished, less coarsely, but densely, in part confluent, punctate; a quadrangular spot above each acetabular cap, the osteole and the apexes of the coxæ white, gular collum white; femora blackish-piceous, testaceous at tip; tibiæ dusky at base, the remainder and the tarsi paler, with the tip of the apical joint and the nails piceous. Scutellum black, coarsely and moderately closely punctate, the margins, particularly at tip, tinged with testaceous. Hemelytra pale yellowish, punctate with brown, and with a brown cloud on the disk posteriorly, and two brown streaks on the posterior margin; membrane short, white. Abdomen black, very minutely punctate and pubescent.

Male generally paler, with more whitish-yellow on the front of the face; the whole basal half of pronotum pale; the legs yellow, pointed

with brown; and the margins of the meta-pleura more widely white; antennæ sometimes whitish.

Length to tip of venter 3-4 millimeters. Width of base of pronotum 1-1½ millimeters.

I collected a few specimens in Clear Creek Cañon, August 3, in warm, sunny spots in the dark sand.

Subfamily PACHYGRONTHINÆ.

ÆDANCALA Amyot et Serv.

O. dorsalis.

Pamera dorsalis Say, Heteropt. New Harmony, 17, No. 8.

Ædancala dorsilinea Amyot et Serv., Hemipt., 258, pl. 12, fig. 6.

Found in the valley of the Arkansas near Cañon City. It seems to be rare there, unless the season was too far advanced for its appearance. On the eastern side of the continent, it appears to be single-brooded, and is rarely found later than in the early part of summer.

Subfamily MYODOCHINÆ.

PTOCHIOMERA Say.

P. puberula.

Ptochiomera puberula Stål, Enum. Hémipt., iv, 153, No. 8.

One specimen from near Denver, August 8.

LIGYROCORIS Stål.

L. sylvestris.

Cimex sylvestris Linn., Fauna Suec., 256.

Ptochiomerus diffusus Uhler, Proceed. Boston Soc. Nat. Hist., 1871, p. 9.

Pamera contracta Say, Heteropt. New Harmony, 16, No. 2.

One specimen from near Manitou, August 15. Although usually common in the places which it frequents, I was disappointed in failing to find more than this single specimen. It occurs under such varied climate and physical conditions as to make it a good subject for study in determining the kind and amount of change brought about in this type of structure by such influences. In Europe, it is found, in its more northern range, in Sweden and Finland, and, in its central and southern range, in Austria, Central Germany, Switzerland, and France. Thus, as in North America, it extends over several degrees of latitude, including varieties of altitude, and accordingly being subjected to contrasting conditions of climate and temperature.

MYODOCHA Latr.

M. serripes.

Mydochus serripes Oliv., Encyc. Méthod., viii, p. 106.

Mydocha petiolata Say, Heteropt. New Harmony, 19.

One specimen from the valley of the Arkansas River, east of Cañon City, August 11. These insects are usually abundant in the places which they select, and although I met with many spots which in the

Atlantic region would have been favorable for them, in this instance I was rewarded by the finding of only a single specimen.

On the eastern side of the continent, it extends from Maine to Florida, and thence westward through Texas into Mexico.

HERÆUS Stål.

H. insignis.

Heræus insignis Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 407.

From near Golden, Colo., at the mouth of the Clear Creek Cañon, August 7.

The orbicular anterior lobe of the pronotum is quite remarkable in this insect. In that respect it is quite unlike either of its congeners, and in a degree repeats the form of pronotum seen in *Araphe* H.-Schf. Specimens occasionally occur with a chestnut-red pronotum, but the fully matured individuals have that part black, and more or less tinged with grayish.

TRAPEZONOTUS Fieber.

T. nebulosus.

Lygæus nebulosus Fallen, Monog. Cim., 65, No. 7.

Pamera fallax Say, Heteropt. New Harmony, 17, No. 6.

Trapezonotus nebulosus Fieber, Europ. Hemipt., 190.

Moderately common at Denver, and a few specimens were swept from plants in Beaver Brook Gulch, August 6. It varies very much in the breadth of its outline, and somewhat in the distinctness and breadth of the whitish markings of the scutellum and hemelytra. The species is common in many parts of Europe.

EMBLETHIS Fieber.

E. arenarius.

Cimex arenarius Linn., Fauna Suec., 955.

Emblethis arenarius Fieber, Europ. Hemipt., 198, No. 2.

Quite common in Eastern Colorado, as well upon the plains and foothills as in the mountains. I found it near Denver, and also in Clear Creek Cañon, August 6. Dr. Packard obtained a specimen upon the summit of Arapahoe Peak, 13,000 feet above the level of the sea, on July 14.

Subfamily HETEROGASTRINÆ.

HELONOTUS Uhler.

H. abbreviatus.

Helonotus abbreviatus Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 47.

Two specimens collected in Clear Creek Cañon, August 6. One individual is more slender and paler than usual; but, as I possess several specimens showing intermediate characters, it should probably not be regarded as a new species.

This insect lives on the red clover, and sometimes occurs in these fields, in the vicinity of Baltimore, in swarms of untold numbers. It is generally coated with a white powder, which easily rubs off, and sometimes it is covered with the pollen of the flowers over which it runs.

Family PHYTOCORIDÆ.

MONALOCORIS Dahlb.

*M. filicis.**Cimex filicis* Linn., Syst. Nat., ii, 718, No. 20.*Acanthia filicis* Wolf, Icon. Cim., 46, tab. 5, fig. 43.*Bryocoris filicis* Kolenati, Meletemata Entom., ii, 129.*Monalocoris filicis* Fieber, Europ. Hemipt., 237.—Douglas and Scott, British Hemipt., 279, pl. 10, fig. 2.

One specimen from the mountains adjoining Clear Creek Cañon, August 6. It was swept from a small fern which grows in damp places among the rocks high up in the mountains near Beaver Brook.

BRACHYTROPIS Fieber.

*B. calcarata.**Miris calcaratus* Fallen, Hemipt. Suec., 131, No. 5.*Brachytropis calcaratus* Fieber, Europ. Hemipt., 241.

Near water, in weedy places, on the outskirts of Denver, Colo., August 4.

TRIGONOTYLUS Fieber.

*T. ruficornis.**Miris ruficornis* Fallen, Hemipt. Suec., i, 133, No. 8.*Trigonotylus ruficornis* Fieber, Europ. Hemipt., 243.

Some specimens of the normal type occurred upon weeds and grass in damp situations near Denver, and also on the hills near water a few miles west of Denver.

MIRIS Fieber.

*M. instabilis.**Miris instabilis* Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 50.

The yellow variety occurred upon the weeds near water in the suburbs of Denver. A beautiful green variety, strongly marked with fuscous, was collected from rank-growing plants in Beaver Brook Gulch, August 6.

PHYTOCORIS Fallen.

1. *P. nubilus.**Capsus nubilus* Say, Heteropt. New Harmony, 22, No. 10.*Phytocoris nubilus* Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 51.

A single specimen from near Denver, August 4.

2. *P. inops*, new sp.

More slender than *P. nubilus*, and more regularly elliptical, with the sides of the pronotum more oblique and not sinuated. Color pale ash-gray or light brown; the legs and antennæ very slender. Head long, triangular anteriorly, pale yellow, spotted with brown, the cheeks margined with brown, and the tylus with a reddish-brown spot, the upper surface clothed with grayish hairs; bucculae dark brown; rostrum reaching the middle of the venter, slender, distinctly compressed at base, pale yellow, tinged with brown near the base and at tip, the basal joint much longer than the head, the second and fourth longer,

subequal, the third about equal to the basal one. Antennæ very slender, setaceous, long, the basal joint cylindrical, not thicker toward the tip, and very indistinctly thickened near the base, about as long as the head and pronotum united, pale yellow, mottled and obliquely banded with brown, and dark fuscous at tip; the second joint one grade more slender, evenly filiform, a little more than twice the length of the first, brown, banded at base and on the middle with pale yellow; following joints very slender, shorter, dark brown, the base of third pale. Pronotum gray or pale brownish, sprinkled and spotted with darker brown, clothed with hoary pubescence (or sometimes with the hairs ochereous), having the wavy posterior submargin marked with a black line, the center of which is triangularly emarginate and connected with a longitudinal impressed line, the margin depressed and whitish; column whitish or pale yellow, marked each side with light brown; humeral angles a little prominent; sternum and middle of venter whitish almost to the tip, the pleural pieces and sides of venter fuscous, or paler brown, the latter and sometimes the two or three last segments mottled with brown. Legs and coxæ pale yellow, long and slender; the femora spotted with brown in uneven series, particularly near the tip; the fore and middle tibiæ thrice banded, and the posterior tibiæ mottled with brown; tarsi more or less brownish, with the tip darker, including the nails. Hemelytra lichenated, on a pale ground, with gray, fuscous, or greenish; the costal margin, nervures, and apical margin with brown interrupted lines; clothed with almost prostrate grayish or yellowish pubescence; membrane fuscous or brown, marbled with pale yellowish or white, the veins ferruginous. Tergum pale brown, more or less clouded with dark brown.

Length to tip of venter 5-6 millimeters. Width of base of pronotum 2 millimeters.

This is an exceedingly neat species of *Phytocoris*, of which I found specimens on small plants in Beaver Brook Gulch, next to Clear Creek Cañon, on August 6. It is quite common in Eastern Massachusetts, in Lower Canada, in Rhode Island, New Jersey, Texas, and Maryland. In the vicinity of Baltimore, I have swept it from umbelliferous plants in damp situations, and on dates ranging from June 26 to September 19. When at rest, it looks so much like some of the species of the Neuropterous genus *Psocus* that on one or two occasions I had nearly passed it by, mistaking it for that insect.

The less mature examples are of a paler, more ferruginous brown, marked with pale yellow and darker brown; and varieties occur in the South which have lead-colored or bluish markings near the tip of the corium.

LOPIDEA Uhler.

L. media.

Capsus medius Say, Heteropt. New Harmony, 22, No. 11.

Plentiful at Denver, Golden, Colorado Springs, and in the valley of the Arkansas near Cañon City, August 5 to 18. It occurred most fre-

quently upon the wild-rose bushes. Still, I did not find it upon the rose bushes in Clear Creek Cañon, although I swept them with much assiduity, and obtained various other insects therefrom.

HADRONEMA Uhler.

H. militaris.

Hadronema militaris Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 412.

One specimen from Clear Creek Cañon, well up on the mountain-side, August 6.

Dr. Packard collected one specimen on July 2 at Blackhawk, Colo. It seems to be a mountain-loving species, and did not occur to me on any of the lower levels on which I used the net.

LYGUS Hahn.

1. *L. lineolaris.*

Capsus lineolaris Palisot-Beauv., Ins. Afr. et Amér., 187, pl. xi, fig. 7.

Almost as common in the cultivated districts of Colorado as it is in the Eastern United States. Dr. Packard found it at Golden, July 3; at Blackhawk, July 2; in the American Fork Cañon, Utah, July 22; and very common in gardens at Salt Lake City, July 25. I found it myself, in August, around Denver, near Golden, in the vicinity of Colorado Springs, and near Cañon City.

2. *L. annexus.*

Lygus annexus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 413.

It occurred in small numbers in the mountains and cañons wherever I went. In Beaver Brook Gulch, it offered several very distinctly marked varieties, which I did not find elsewhere. Generally, the ground-color was pale olive or yellowish, marked with black or fuscous. Pale varieties were quite common near Denver on a species of *Euphorbia* with white-margined leaves.

Dr. Packard obtained it at Denver, July 28, and at Idaho, Colo., July 6.

CALOCORIS Fieber.

C. rapidus.

Capsus rapidus Say, Heteropt. New Harmony, 20, No. 4.

Capsus multicolor H. Schf., Wanz. Ins., viii, 19, fig. 795.

One specimen from near Pueblo, Colo., August 10. Dr. Packard collected it in the American Fork Cañon, Utah, July 22.

RESTHENIA Amyot ET Serv.

R. confraterna.

Resthenia confraterna Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 411.

One specimen from Beaver Brook, August 6, and another collected by Dr. Packard at Idaho, Colo., July 6.

LABOPIDEA, new genus.

Ovate, hairy, with the head broader than the pronotum, and the outer margins of the hemelytra strongly curved. Head transverse, triangular,

with the eyes subglobose and almost pedunculate; the face prominently convex, almost vertical in front, curving inferiorly; the tylus prominent; superior cheeks almost vertical, broad triangular, with the apex placed inferiorly; lower cheeks placed in large part behind the upper ones, thickened, blunt at the lower end; bucculae slenderly lunate, concave inside, as long as the throat; rostrum short and stout, inserted on a line running direct from the base of the antennae; occiput with a carinate collar, which is convexly elevated on the middle, and with an incised line bounding it in front; antennae stout, about as long as the pronotum and body united, the basal joint about as long as the head, a little thickened beyond the base, second joint very long, less stout than the basal one, cylindrical, the two apical joints a little more slender. Pronotum transverse, the sides oblique, narrowing anteriorly, the anterior angles rounded, anterior margin moderately concave, with the callosities broad, bilunate, each lobe convex behind, and with the space uniting them concave behind. Femora broad, compressed; hind tibiae very long. Scutellum triangular, the three sides almost equal, and the surface very feebly convex. Hemelytra short and wide, with the costal margin broadly accuated posteriorly, with the cuneus very large and broad, and the membrane short and attached to the inner side at the end of the corium.

L. chloriza, new sp.

Pale, clear-green, densely pubescent. Head yellowish; face with a blackish circle in front, which is interrupted above; each side of vertex with a dark-brown dot, and the base of tylus, the suture at the tip of lower cheeks, and the eyes dark piceous. Antennae pale piceous, paler on the basal joint. Rostrum reaching to the intermediate coxae, tinged with piceous at the ends of the joints and on the apex; the basal joint a little longer than the throat, the second a little longer. Pronotum narrower in front than behind, trapezoidal, the sides oblique, the posterior margin straight and the anterior one a little concave; surface green, somewhat yellow anteriorly, with a dark dot each side of posterior division, and a brown curved line bounding each lobe of the callosity posteriorly. Under side whitish-green, or very pale yellow, with a black spot at the base of the anterior coxae, and one above; also a faint duskiess at base of the other coxae. Legs bright yellow, or a little greenish, the tarsi somewhat infuscated at tip, and the nails piceous. Scutellum faintly tinged with yellow, closely coated with whitish hair. Corium green, unevenly punctate, the punctures shallow, and sometimes confluent, those of the claws coarser; the surface polished, but closely invested with pale, almost erect pubescence; membrane white, with a faint cloud of fuliginous outwardly. Tergum black on the disk, the broad connexivum and the apex orange, the disk smooth, and all the remaining surface invested with remote prostrate hairs, venter polished, remotely pubescent, yellowish, but a little obscured at base.

Length to end of abdomen $4\frac{1}{2}$ –5 millimeters. Width of pronotum $1\frac{3}{4}$ millimeters. Width across hemelytra $2\frac{1}{4}$ millimeters.

Collected in the American Fork Cañon, Utah, by Dr. Packard, on July 22.

This is a robust and hairy species, built much after the pattern of the genus *Labops*, but with less prominent and not fully pedunculate eyes. Doubtless many other equally interesting Phytocorids yet remain to be discovered in the cañons, parks, and on the foot-hills of the Rocky Mountain regions. They should be looked for as the different kinds of flowers begin to bloom. In the valley of the Arkansas, the grape grows luxuriantly, and when that is in bloom several species may be obtained from it, as in Texas and in the Atlantic region.

LABOPS Burm.

L. hesperius.

Labops hesperius Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 416.

One specimen from the mountain-side near Gray's Peak, August 6. I swept it from some bushes growing among the rocks, but the most assiduous labor failed to secure other specimens.

MACROCOLEUS Fieber.

M. coagulatus, new sp.

Apple-green; the color in the pronotum and hemelytra appearing as if coagulated, leaving the ground, in patches, bare and pale; the form normal, moderately robust. Head transverse, pale green, clothed with whitish pubescence and minute scales; the base with a stout, transverse carina, a little indented in the middle (σ), less elevated (ρ), with an impressed line bounding it in front; tylus quite prominent; the face a little more contracted in the male than in the female. Antennae yellowish, moderately slender, the length a little more than that of the head; pronotum and claws united, the basal joint stouter than the second, second of uniform thickness throughout and a little more than three times the length of the basal joint; third a little shorter than the second, and slightly more slender; fourth almost as thick as the third, and but little longer than the basal joint. Rostrum reaching upon the intermediate coxæ, slenderly tapering and very acute, green at base, yellow beyond, and blackish-piceous at tip. Eyes brown, oval, inclining to reniform, prominent, placed a little obliquely. Pronotum transverse, moderately flat, green in patches, the anterior half yellowish, clothed with white pubescence and scales; alar spots large, separated in the middle by a depression; anterior margin short; the posterior margin long, with very angular shoulders; the lateral margins very oblique, with the edge carinate, the deflexed side depressed in, and, like the other pleural pieces, smooth, pale, and bald. Legs pale, yellowish-green, the tips of tibiae and the tarsi obscured, the tip of the last joint and the nails piceous. Scutellum pale green, smooth, feebly convex. Hemelytra green in coagulated patches on a paler ground; the corium and

clavus with a few scattered blackish punctures, closely whitish pubescent; membrane hyaline, with a large faint cloud near the apex, an obscure smoky spot on the loop of the nervure, and a darker spot exterior to the end of the areole; sometimes with the latter only, or with most of the membrane smoky; the nervure green. Wings clear hyaline. Abdomen pale green, more or less tinged with yellow, polished, remotely pubescent.

Length to tip of abdomen 3 millimeters. Width of pronotum $1\frac{1}{4}$ millimeters.

Beaten from the wild gooseberry and other bushes in Clear Creek Cañon, August 7.

The wing-covers are much longer than the body, the corium long and acutely angular, and the membrane is long and full. The male has a broad genital lobe on the left side, which is a little convexly arched, slightly angular on the upper end and bristly; next to this is a cup-shaped organ, and beneath this a longer, cushion-shaped piece. Perhaps, when these organs are unrolled, they may show teeth or processes on their inner edges.

TINICEPHALUS Fieber.

T. simplex.

Tinicephalus simplex Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 417.

A neat little green insect, which occurs on various kinds of plants in the vicinity of the mountains west of Denver in July and August.

It is one of the several forms belonging to the Rocky Mountain region, which, while generically different, so closely resemble each other as to make it difficult to discriminate the species. My materials are at present too incomplete and imperfect to enable me to designate them all; but, upon the receipt of clean specimens of both sexes, it will be comparatively easy to give their true characteristics.

STHENAROPS, new genus.

Outline similar to that of *Calocoris bimaculatus* Hoffg., elongate, almost parallel-sided, with the pronotum short campanulate as seen from above. Head wider than the front of pronotum, incisedly constricted at base, the front almost vertical, and excepting the tylus and cheeks, nearly square, with the center like convex shield, the back part of vertex flattened, and bounded behind by an arched, stout, carina; eyes large, globosely oval, each placed on a prominent base, a little oblique; face indented at base of tylus, convex, contracting inferiorly; the tylus very prominent, curving downward and backward, the superior cheeks broad, nearly vertical, triangularly rounded at tip, the inferior cheeks longer, prominently elevated like a ridge, subfusiform. Rostrum short and stout, the basal joint broad and compressed, geniculate, a little longer than the head; throat concave. Antennæ long and slender; the basal joint longer than the head, feebly curved, cylindrical; second very long, of uniform thickness throughout; third thinner and a little shorter;

fourth a little more slender, as short or shorter than the basal joint. Pronotum a little wider than long, broadly a little convex, the sides rounded off, the lateral margins concave; posterior margin arcuated, the anterior margin concave; callosities large, convex, transverse, bounded behind by an impressed line, separated in the middle by a transverse indentation. Legs stout, the thighs compressed, posterior tibiæ very long; basal joint of tarsi shorter than the second. Scutellum almost equilateral, the surface even, very feebly convex. Hemelytra flat, the costal margin strongly carinate, almost straight.

1. *S. chloris*, new sp.

Pale green, or greenish-white, elongate, pubescent. Head long, five-angled, almost vertical, pale green, polished, clothed with sparse, long, whitish pubescence; center of the vertex posteriorly with a short black line, indented in front, which connects with a subquadrangular black ring bounding the inflation of the cranium; face black, highly polished, the superior cheeks green; space beneath, before, and above the eyes also green; throat and base black. Eyes brown. Bucculæ margined with green. Rostrum testaceous, reaching to the back of the posterior coxæ, the third and fourth joint piceous. Antennæ as long as the hemelytra including the membrane, black or piceous, with the two last joints dusky; basal joint a little shorter than the width between the eyes; second joint as long as from the front of cranium to the base of the pronotum; the third a little shorter; fourth shortest. Pronotum transverse, green, yellow anteriorly, clothed with erect, long, whitish pubescence, the middle longitudinal line a little depressed, and sometimes having a few black points anteriorly; each side of middle with a round black dot; anterior angles obliquely rounded, the posterior ones prominent, with the margin behind them arcuated. Scutellum bright green, sparsely clothed with white hairs, the basal middle with a black spearhead-mark. Sternum black; the deflected propleura green, polished; the other pleural segments blackish, margined with white. Coxæ more or less dusky, but green at tip; legs green, the tibiæ at the tip and the tarsi piceous, the nails black. Corium and clavus apple-green, sometimes a little sprinkled with black, obsolete rugulose, moderately clothed with white, long, oblique, pubescence; membrane smoky, paler at base, the nervures greenish; wings smoky. Venter black, broadly greenish-white each side of disk, neatly clothed with silky pubescence, the segments more or less margined with white.

Length to tip of venter 3-3 $\frac{1}{4}$ millimeters. Width of pronotum 1 $\frac{1}{2}$ millimeters. Length of hemelytron 3 $\frac{3}{4}$ millimeters.

An elegant little Capsid, of which I found a few setting singly upon the flowers of a slender pale Composite, growing in Manitou Park, August 14. Another specimen was swept from some weed in the vicinity of Colorado Springs, in the low grounds near the Fountain Creek.

2. *S. malina*, new sp.

Larger and more slender than the preceding species, with longer an-

tennæ; deep green, highly polished, very sparingly pubescent. Head curved posteriorly, with the neck more defined than in the preceding species, greenish-yellow, indented on the vertex, the transverse carina a little arched, with the surface in front of it a little depressed; middle of cranium with a roundish, large, black shield, which connects with the black color of the face; the whole face, under side, and base of the head polished black; tylus abruptly elevated, prominent, a little scooped out each side, not impressed at base, pubescent at tip; eyes brown, prominent. Rostrum reaching upon the intermediate coxæ, greenish; the last joint piceous; the basal joint very broad, rounded at tip; bucculæ pale. Antennæ as long as the entire hemelytra; pronotum and vertex conjoined, black, excepting the basal joint, which is green excepting the black tip and under side next the tip; the basal joint longer than the width between the eyes; second very long; third a little shorter, dusky; fourth scarcely shorter than the first, also dusky. Pronotum campanulate, longer than wide, obsolete rugose, yellow anteriorly, clothed with white, remote pubescence, with a large, round, black spot each side, the surface distinctly sloping toward the sinuated sides; posterior margin feebly convex, the lateral angles subacutely prominent, with the margin behind them almost sinuated. Scutellum green, feebly convex, with a slightly depressed black spot near the middle at base, from which a blunt faint carina runs backward to the tip. Propleura with a large black spot reaching to the base of the coxæ; sternum dull blackish, and sometimes also the greater part of the meso- and meta-pleuræ. Coxæ green, a little dusky at base; legs green, or greenish-yellow, the tips of tibiæ and tarsi and the nails piceous. Hemelytra clear, deep green, remotely whitish-pubescent, remotely punctate, with a blackish streak on the disk of the corium; costal margin thick and prominent; membrane black or blackish, with the basal margin and the nervures pale greenish; wings blackish. Tergum black, shining; venter blackish, or with the outer margins pale, the whole surface minutely sericeous pubescent. Genital segment of the male pale piceous or yellow, the right side with a long triangular lamina extending obliquely toward the left and terminating in a long slender hook, which curves far backward.

Length to tip of venter 4-5 millimeters; to tip of membrane 5-7 millimeters. Width of base of pronotum $1\frac{1}{2}$ -2 millimeters.

Inhabits Eastern Massachusetts, New York, Pennsylvania, Maryland, in places with long grass, in June; Ohio, Southern Illinois, and Texas. Fragments of a male, a little stouter than usual, were brought from the borders of Russian America, in the far northern part of the British possessions. Missouri, C. V. Riley.

ORTHOPS Fieber.

O. scutellatus, new sp.

Form of *O. pellucidus* Fieber. Greenish-yellow when fresh. Head yellow, smooth, highly polished, impunctate; tylus black and connecting with a long black spot, which runs back to near the base of vertex;

basal carina pale, nearly straight, narrower in the middle, and in front of this point is a faintly impressed longitudinal line; eyes dark brown, the throat and the suture between the cheeks blackish. Buccalæ black, the rostrum reaching to the posterior coxæ, greenish-yellow, with a small piceous tip. Antennæ moderately thick, yellow, tinged with piceous, the two apical joints darker, the base of third pale; second joint largest, about as long as the pronotum, the third a little longer than the basal one, and more slender than the second; fourth shortest. Pronotum with a regular curving slope toward the sides and front, smooth, polished, coarsely punctate, with a small black are behind each callosity, a brownish cloud across the base, and a longitudinal, black, short stripe on the deflexed, punctate sides; surface a very little pubescent; posterior margin arcuated, the edge sharp, and faintly recurved; sternum blackish, the meso- and meta-pleuræ dull black, margined with yellow. Coxæ and legs greenish yellow, the knees and tips of tibiæ tinged with brown, and the apex of the tarsi with the nails piceous. Scutellum pale yellow, black at base, indistinctly and very minutely punctate, transversely rugulose, minutely pubescent. Corium dull yellow or yellowish-green, with a large brown cloud at tip and the whole clavus brownish, distinctly and closely finely punctate, minutely pubescent, the costal margin brighter yellow; cuneus dull yellow, margined behind with brown; membrane with a cloud at tip, the nervures and a tinge at base brown. Venter bright yellow, highly polished, impunctate, minutely pubescent, with a streak of brown each side, extending from the base, but not reaching to the tip.

Length to tip of venter $3\frac{1}{2}$ -4 millimeters. Width of pronotum $1\frac{1}{2}$ millimeters.

Beaten by myself from bushes in Clear Creek Cañon, August 7. It occurred singly, but was not at all rare. My short stay in that locality prevented me from collecting them in large numbers.

MEGACÆLUM Fieber.

1. *M. fasciatum*, new sp.

Long-oval, yellow, stout, minutely and closely pubescent. Head broad and stout, five-angled, blunt, vertical, brownish-yellow, impunctate, broadly, obsoletely channeled transversely in front of the slender basal carina; vertex convex; tylus moderately prominent, curving inferiorly; face paler or orange, sometimes tinged with rufous; throat and buccalæ rufous. Rostrum reaching to the posterior coxæ; basal joint red, a little longer than the throat; remaining joints yellow, the second longest. Antennæ stout, reddish-yellow, paler at base; second joint a little longer than the pronotum, becoming slightly thicker toward the tip; third thicker than the preceding, and about one-third shorter; fourth thick, a little longer than the basal one. Pronotum short, minutely rugulose and obsoletely punctate, polished, pale chestnut-brown, more or less tinged with rufous; the lateral margins very oblique,

rounded off, destitute of a carina; the posterior margin a little arcuated, declivously rounded, with the lateral angles prominent, subtubercular, acute. Propleuræ punctate, rugulose, tinged with rufous; meso- and meta-pleuræ impunctate, dull rufous. Coxæ and legs yellow, the tibiæ tinged with rufous. Scutellum chestnut-brown, yellow at tip, finely pubescent, closely, minutely punctate, feebly rugulose. Corium and clavus yellow, with a brown transverse spot at base, omitting the outer margin, and a larger band extending from the middle to the tip obliquely, and omitting the forward part of the costal margin and the basal suture of the cuneus, but covering the cuneus; the surface minutely, evenly, deusely rugulose and punctate, and finely whitish pubescent; abdomen rufous or pale brown, finely pale pubescent; membrane dusky, pale at base.

Length to tip of venter 2-2 $\frac{1}{4}$ millimeters; to tip of membrane 2 $\frac{1}{2}$ -3 millimeters. Width of pronotum 1 $\frac{1}{4}$ -1 $\frac{1}{2}$ millimeters.

Two specimens were swept by me from bushes near Manitou, August 13. It occurs also in Texas; Missouri; Illinois, near Rock Island; in York County, Pennsylvania, in June, on hickory. In Maryland, it belongs to the central faunal district, and may be found in July, sometimes abundantly, on the *Carya alba* Mich. It varies very much in the depth and distinctness of the colors, and in the size of the brown bands of the hemelytra. The specimens from Colorado are lighter but more clearly colored than the average of specimens from Maryland. One specimen from Manitou, July 16, collected by Dr. A. S. Packard, jr.

PLAGIOGNATHUS Fieber.

P. obscurus.

Plagiognathus obscurus Uhler, Fifth Ann. Rep. U. S. Geol. Surv. for 1871, 1872, p. 418.

Found in the American Fork Cañon, Utah, by Dr. Packard, on July 22.

Comparison with sufficient series of the European species may show that this is only a form of one of them. It agrees in many respects with *P. bohemani* Fallen, belonging to Switzerland and other parts of Central Europe, but the only specimens of that species in my collection are too much damaged to admit of full comparison.

PÆCILOSCYTUS Fieber.

P. sericeus, new sp.

A little less robust than *P. unifasciatus* Fab., with the sides of the hemelytra straighter. Clay-yellow, more or less tinged with brown or rufous, the upper surface, excepting the head, minutely and closely scabrous, finely punctate, golden sericeous pubescent. Head almost vertical, gently curved in front; eyes large, dark brown, the tylus curving down, prominent, with the incision of the base and sides very deeply cut, black or piceous, highly polished, narrowing inferiorly; the surface yellow, smooth, golden pubescent with a series of oblique wrinkles, colored brown, each side of a central, longitudinal, low ridge; vertex and cheeks

with some small brown streaks. Bucculæ orange-yellow; labrum piceous or black, the rostrum extending to the base of the posterior coxæ, bright yellow, with the tip or one or both of the last joints piceous. Antennæ dusky yellow or pale piceous; the basal joint thickest, piceous or black; the second very long, palest, piceous at base and tip; third more slender, a little darker at tip, more than one-half as long as the second; fourth still more slender, shorter than the third, but longer than the basal one. Pronotum wider than long, moderately convex; the sides obliquely arcuated, not carinated; the outer angles a little humped, and the surface adjoining postero-interiorly a little impressed; the posterior margin a little arcuated, the edge sharp, but faintly decurved; callosities bounded behind each by a brown, impressed arc, and with a brown indented point in the center of each; the submarginal surface frequently with a brown broad streak, or with a cloud and a darker streak in the anterior angle; deflexed sides pale yellow, scabrous and sericeous pubescent, generally with one or two brown spots (but sometimes without them); sternum and pleuræ more or less dusky, pubescent. Legs and coxæ yellow; the femora a little darker, crossed with two or three brown oblique bands, those of the posterior femora darker and jagged; sometimes with the knees a little brown; tips of tibiæ, two last joints of the tarsi, and the nails piceous. Scutellum with the posterior part of the disk a little raised, sinuated each side, brighter yellow, transversely wrinkled, the base brown in the middle and on each side. Corium pale dull yellow, clearer on the costal area, golden sericeous pubescent; the clavus, except at base and a long cloud on the disk extending to the apex, brownish; cuneus red, excepting on its margins, which are pale yellow; membrane pale smoky, margined at base and inward by a thickened fuscous edge, the inner continuation of this edge yellow, base pale, the nervules pale yellow, with the smaller areole sometimes dark brown. Venter yellow or reddish-yellow, polished, minutely pubescent, the disk with a large black area, and the outer submargin with a series of short black lines running from the base to the penultimate segment; the exterior margins of the posterior segments are oblique, and give the angles prominence, making the segments appear serrate.

Length to tip of venter 3-5 millimeters; to tip of membrane 5-6 millimeters. Width of pronotum 2-2½ millimeters.

Collected by me at Colorado Springs, while sweeping the weeds near the Fountain Creek, August 16.

It is a very variable and common insect in many parts of North America, extending from Quebec to Southern Florida, thence west into Texas and New Mexico. In Maryland, it may be met with from the first of June till the end of October, and it lives upon violets, weeds, and herbs in low grounds. I have found it in York County, also, in similar situations, and upon *Ambrosia*.

Specimens of both sexes occur with a few coarse and deep punctures on the base of the head in front of the occipital carina, and very often

the black lines of the venter are replaced by a broad continuous dark stripe, running the whole distance from the base to the tip. A marked feature in the structure of the female is the large size of the last ventral segment, which is broadly and deeply emarginated to admit the ovipositor. Each lobe of this is triangular, with the apex truncated, and on the tergal aspect the sides are very high, giving the segment the appearance of being hollowed out.

Specimens from the mountains of Georgia and North Carolina are sometimes very pale, with only a trace of rose-color in the cuneus, and with but faint indications of the brown markings of the upper and lower surfaces and bands of the thighs.

PAMEROCORIS, new genus.

Contour of the longer forms of *Anthocoris*, but with the pronotum and head closely imitating *Ozophora* and *Ligyrocoris* of the family *Lygwidae*. Head horizontal, long-conical, constricted behind the eyes, compressed and tapering before the eyes; the eyes large, suborbicular, prominent, almost as wide as the vertical thickness of the head; the vertex convex between them, the carina connecting the base of the eyes obsolete; tylus oblique, a little arcuated, prominent, occupying the whole width of the tip of the head; superior cheeks flat, ligulate, running parallel to the tylus behind it, and almost reaching to its tip; the inferior cheeks very small, sunken, placed obliquely behind the end of the superior ones. Antennæ longer than the body with the hemelytra; the two first joints stout, the basal one a little longer than from the eye to the tip of the tylus, tapering at base; the second cylindrical, a very little shorter than the corium and cuneus together; third and fourth much more slender, filiform, each longer than the basal, the fourth a little longer than the third. Rostrum long and very slender, reaching to behind the posterior coxæ; basal joint a little longer than throat, a little stouter than the second; second joint longer than the basal; third still longer; fourth a little longer than the basal one. Pronotum campanulate, wide at base, narrow anteriorly, contracted in front, and with a narrow collum on the anterior margin; lateral margins sinuately carinate; anterior lobe convex, the callosities separated by a short, longitudinal groove; posterior lobe slanting toward the transverse impressed line; the posterior margin is concavely sinuated, and the postero-lateral angles produced, long and narrow. Prosternum a little depressed, the sides carinately elevated, converging to an acute angle between the anterior coxæ. Scutellum longer than wide, acute at tip, at base transversely elevated, and behind this there is a transverse impressed line. The sides are deeply sinuated and the edge slenderly carinate. Coxæ long, stout, compressed, the anterior ones longest and stoutest; femora compressed, slenderly channeled on the inner and outer faces, posterior pair longest; the tibiæ very slender; tarsi long, the basal joint longest, the intermediate one very short, the apical one shorter than the

basal. Hemelytra flat, scarcely wider posteriorly, the costal margin carinately raised, a little arcuated; cuneus long-triangular, very slender at tip; membrane long. Abdomen narrow.

P. anthocoroides, new sp.

Piceous-black elongate-elliptical. Head smooth, dull, impunctate; the eyes dark brown, margined at base with paler; the facets very large; cheeks and tip of tylus rust-red; antennæ yellow, more or less infuscated, the basal joint black or piceous, with a pale tip, the two apical joints dusky. Rostrum pale yellowish, more or less piceous at tip. Pronotum dull black, sparsely pubescent, a little polished on the elevated disk of the anterior lobe; the lateral margins very oblique, and with the marginal line wavy; the posterior side almost twice as wide as the anterior one: the posterior lobe a little scabrous, obliquely depressed, the humeral angles distinctly produced, somewhat ligulate, and rounded at tip; the deflexed sides wrinkled. Coxæ pale yellow; the femora piceous or rufous, with the apex yellow; tibiæ and tarsi pale yellow, sometimes a little infuscated. Scutellum piceous or rufo-piceous, with a bright orange spot each side of the disk, and the acute tip pale yellow. Hemelytra yellowish-white, minutely scabrous, and sparingly, finely pubescent, infuscated at base, and with a large fuscous cloud extending from the middle to the tip; cuneus fuscous, with a roundish yellow spot at base; membrane smoke-brown or pale brown. Postpectus and venter dull rufous, the latter piceous on the middle; the genital pieces more or less orange. The hemelytra are sometimes fuscous, with a pale disk to the clavus, and a large pale spot on the middle of the corium.

Length to tip of membrane 3-3½ millimeters. Width of base of pronotum 1 millimeter or a little less.

A fragment of a specimen was in the little lot kindly given to me by Mr. B. H. Smith, collected in the vicinity of Denver, Colo. From Grimsby, Canada, a specimen was sent to me by Mr. J. Petit, and I have a specimen, collected by myself, from a strip of woods near Baltimore, on July 8. Another specimen (♂) is in the collection of the late Dr. T. W. Harris, which was collected by him in Eastern Massachusetts on the 20th July, 1831. This is the most interesting Heteropter which has yet been found in North America. While being an undoubted Phytocorid in its details of higher group value, it yet presents the features and some of the characters of both the *Lygaeidae* and *Anthocoridae*. As far as I have yet been able to examine the structure of the *Phytocordie* in their various stages of development, they have strongly impressed me as the great central group of the order, in which the characteristics of all the other groups may be found, with some other features which they hold entirely peculiar to themselves.

IDOLOCORIS Doug. and Scott.

I. agilis, new sp.

Form of *I. pallidus* Fieber; black, highly polished, impunctate, but very minutely rugulose on the upper surface. Head normal, deep black,

shining; the tylus a little prominent. Rostrum reaching upon the posterior coxæ, pale yellow, a little dusky at tip; the basal joint broad, compressed, longer than the head; second a little longer; third a little the longest. Antennæ long and slender, black; the apical joint yellow, with the base blackish; basal joint highly polished, thickest a little longer than the head; second cylindrical, almost as long as the head and pronotum united; third a little more slender, filiform, of about the same length as the preceding; the fourth of the same thickness as the third, a little longer than the basal one. Pronotum short campanulate polished, black, with a quadrate yellow spot on the middle, which sends forward a linear branch as far as to the margin; the collum constricted, whitish; callosities transversely oval, convexly elevated, with the line between them impressed; posterior lobe usually separated from the anterior one by a transverse impressed line, sometimes with an obsolete, impressed, longitudinal line on the middle; posterior margin concave, a little wider than the length of the pronotum; the humeral angles produced into slightly depressed lobes. Pleuræ black; the posterior ones more or less margined with yellow. Coxæ and legs yellow; the tip of tarsi and the nails pale piceous. Scutellum black, with a yellow spot each side of base. Hemelytra dusky hyaline, tinged with yellow, minutely, remotely, obsoletely punctate; tip of the clavus, inner margin, and posterior margin as far as a brown spot on the costa behind the base of cuneus rufous or pale brown; cuneus hairy, margined inwardly with ocherous, and with a yellowish-brown tip. Venter yellow, black at tip, minutely sericeous pubescent; tergum blackish, yellowish on the disk.

Length to tip of venter $3\frac{1}{2}$ –4 millimeters; to tip of hemelytra $4\frac{1}{2}$ –5 millimeters. Width of base of pronotum 1 millimeter or less.

A beautiful, graceful form, of which I swept several specimens from plants in Beaver Brook Gulch, August 7.

ORECTODERUS Uhler.

O. amœnus, new sp.

More slender than *O. obliquus*. Orange-fulvous, polished, not distinctly punctate; the hemelytra dull, excepting the long, cuneiform silvery streak running from the base of the corium. Head longer than wide, polished, narrowed behind the eyes, the width between the eyes scarcely less than the expanse of the collum; face moderately decurving; eyes reniform, oblique, blackish, very prominent. Antennæ moderately stout, rod-like, the basal joint constricted at its origin, the second joint very long, infuscated, of even thickness throughout. Rostrum reaching upon the venter, slender, infuscated. Pronotum subcampanulate, longer than wide, very narrow in front, finely polished, the posterior margin concave. Legs long and slender, the tibiæ and tarsi tinged with piceous. Venter highly polished, orange, a little infuscated, a little clavate posteriorly. Marginal lines of the corium all around and of

the clavus brownish; cuneus infuscated at tip, with a large white spot at base; the membrane smoky brown, paler at the basal angle.

Length to tip of venter $4\frac{1}{2}$ millimeters; to tip of hemelytra 6 millimeters. Width of pronotum $1\frac{1}{8}$ millimeters.

A damaged specimen was in the lot kindly given to me by B. H. Smith, collected in the vicinity of Denver, Colorado. Other specimens have been secured in New Mexico, Texas, and Illinois.

Family ANTHOCORIDÆ.

ANTHOCORIS Fallen.

A. musculus.

Reduvius musculus Say, Heteropt. New Harmony, 32, No. 6.

A few specimens were flying about in Beaver Brook Gulch, of which I secured a pair; and I swept a few others from plants growing on the steep side of the mountain in the midst of the pine woods. One specimen occurred on a vine of Clematis, which festooned a rock on the steep declivity of the upper part of this gulch, on August 6.

TRIPHLEPS Fieber.

T. insidiosus.

Reduvius insidiosus Say, Heteropt. New Harmony, 32, No. 5.

Anthocoris pseudo-chinche Fitch, Second Report New York, 295.

A few specimens occurred to me in the suburbs of Denver, August 5. No doubt, it has been introduced into the West with the raspberries, blackberries, and other small fruit. In Maryland, it is found upon the Ox-eye, Daisy, and on some other wild flowers, and in gardens sometimes abounds upon the small fruits, sucking their juices and giving the berries a nauseous taste.

Family ACANTHIADÆ.

ACANTHIA Am. et Serv.

A. lectularia.

Cimex lectularius Linn., Fauna Suec., 909.—De Geer, Mém., iii. tab. 17, figs. 9-15

Acanthia lectularia Amyot et Serv., Hemipt., 311, No. 1.

One specimen, collected by Dr. Packard in Salt Lake City, July 27. He reports them to be very abundant. I did not meet with specimens in any of the places where I stopped in Colorado.

Family ARADIDÆ.

ARADUS Fab.

1. *A. tuberculifer.*

Aradus tuberculifer Kirby, Fauna Bor.-Amer., iv, 278, pl. 6, fig. 5.

Collected by Dr. Packard near Idaho, Colo., July 6; one specimen found by myself on the mountain-side, far up the Beaver Brook Gulch, August 6.

2. *A. rectus*.

Aradus rectus Say, Heteropt. New Harmony, 29, No. 4.

One specimen from the mountains near Beaver Brook Gulch, August 6.

The most diligent search beneath loose bark and in the crevices of the bark of the pines and other trees, at lower levels, failed to detect other specimens. These two species evidently belong more particularly to the high mountains, and to the northern regions where the air is of corresponding rareness.

Family PHYMATIDÆ.

PHYMATA Lat.

P. erosa.

Cimex erosus Linn., Syst. Nat., ed. 12, ii, 718, No. 19.

Phymata erosa Amyot et Serv., Hemipt., 290, No. 2.

This species is now widely distributed over Western as well as Eastern North America. I did not meet with it in the mountains, but it was sufficiently common around the foot-hills and on the plains wherever man had settled and cultivated the ground. It was generally found prowling about upon the stems and flowers of the Euphorbias and Sun-flowers, trying to catch the bees and other insects which alighted there.

Family NABIDÆ.

CORISCUS Schrank.

C. ferus.

Cimex ferus Linn., Fauna Suec., 256, No. 962.

Nabis ferus Fieber, Europ. Hemipt., 161, No. 9.

Widely distributed in Colorado, as well in the mountains as on the plains and foot-hills; chiefly, however, in spots where the agency of man is to be seen. Foreign weeds have been introduced, and various plants have been encouraged by the wider distribution of seeds near the streams of water and on the routes of travel, and on these this species finds its home and food. In damp situations in Beaver Brook Gulch, in Clear Creek Cañon, everywhere in Denver City and around it at the lower levels, in the region of Colorado Springs and Manitou, near Cañon City, and in the valley of the Arkansas, it is quite common in August.

Dr. Packard collected it on June 27 at Denver, and at Salt Lake City in July. Slight differences in the amount of black and pattern of marking of the head and pronotum occur in the specimens from Colorado, just as in those from England and the continent of Europe. There is also some variation in the size and proportion of the various parts of the body, particularly in the width of the abdomen.

Superfamily REDUVIOIDEA.

Family REDUVIIDÆ.

Subfamily REDUVIINÆ.

SINEA Amyot et Serv.

S. diadema.

Reduvius diadema Fab., Genera Ins., 302; Ent. Syst., iv, 206, No. 46.

Reduvius raptatorius Say, American Entomology, ii, pl. 31.

Sinea diadema Stål, Enum. Hemipt., ii, 70, No. 1.

Swept from weeds in the suburbs of Denver, August 8. It did not occur in numbers, as in Maryland and other States. Roving about from place to place in fields and near woods, it ascends the Golden-rod and other plants, and seizes such insects as come within its reach.

DIPLODUS Stål.

D. luridus.

Diplodus luridus Stål, Stettin. Ent. Zeit., xxiii, 452.

Collected by Dr. Packard, July 13-16, at Manitou and in the Garden of the Gods. One specimen was found by myself near Colorado Springs, August 10.

Subfamily APIOMERINÆ.

APIOMERUS Hahn.

1. *A. flaviventris.*

Apiomerus flaviventris H.-Schf., Wanz. Ins., viii, 77, fig. 847.—Stål, Enumeratio Hemipt., ii, 98, No. 16.

Dr. Packard secured specimens of the brown variety on the foot-hills, at the mouth of Clear Creek Cañon, on July 3, and in the Garden of the Gods and at Manitou, July 13-15.

A larva of this species was swept by me from some bush in Clear Creek Cañon, near the mouth of Beaver Brook Gulch, August 7.

2. *A. spissipes.*

Reduvius spissipes Say, Journ. Acad. Phila., i, 199, No. 20.

Apiomerus spissipes Stål, Enum. Hemipt., ii, 98, No. 15.

One specimen from the valley of the Arkansas, near Cañon City, August 11.

Family SALDÆ.

Form oval or long-ovate. Head vertical, from above 5-angled, between the eyes broader than long; ocelli 2; the tylus prominent, cylindrical; superior cheeks short, obtuse; the bucculae long, broad, rounded plates, partly covering the base of the rostrum. First joint of antennae short, cylindrical; second the longest, cylindrical; the third and fourth generally a little fusiform, and more or less thickened. Eyes projecting prominently outward and backward. Pronotum trapezoidal, with the anterior side much the shortest, the posterior side the longest, and the

lateral margins oblique, with the edges recurved and the submargin depressed; the latero-posterior angles overlapping the base of the scutellum. Xyphus of the prosternum short, triangular; the prosternum short, projecting backward, like a lid, over the base of the anterior coxæ; the propleura with a roundish pit beyond the anterior angle of the prosternum. Mesosternum grooved, with the coxæ placed moderately close together. Metasternum deep-seated, the coxæ in contact at the base. Scutellum triangular, with the sides almost equal. Membrane with looped nervules, forming a transverse series of long areoles. Last ventral segment scale-like in the female, moderately short, rounded behind. Posterior coxæ very broad, free, formed for leaping; the posterior trochanters very long, acute, placed on the inner side of the base of femora; the posterior femora and tibiæ much longer than the others.

The posterior legs are thrown very far back by reason of the very large and long coxæ, and, together with the long femora and tibiæ, give them a great facility in vaulting into the air. They use their wings in connection with this motion, and generally alight several feet from the point of departure. Their motion in running over the ground is often sinuous, while rapid, and their selective adherence to the spots which best agree with their combination of colors may well shield them from the pursuit of enemies. Only one genus has thus far been reported from North America; but groups of characters may readily be found sufficient to divide it into several genera.

SALDA Fab. (auctor.)

Oval, ovate, or elliptical. Head vertical, or nearly so, contracted behind the eyes, the eyes reniform and very projecting outward; tylus thick, prominent, cylindrical; the upper cheeks short, obtuse, and the lower cheeks long, wide, and partly embracing the base of the rostrum. Ocelli large, central, placed near together. Rostrum reaching to or behind the intermediate coxæ; the first joint very short, the second very long. Antennæ long; basal joint shortest, more or less thickened toward the tip; second very long, thickened at tip; third and fourth subequal, longer than the basal one. Pronotum trapeziform, the sides oblique; callosities large, transverse, convex, strongly bounded by impressions on the sides and behind; anterior part, next the head, more or less constricted; the lateral submargin depressed; posterior margin concave, with the humeral angles more or less produced. Hemelytræ oval, the costal margin arcuated, the edge carinate, and the costal area foliated, particularly at base. Legs all of the same form, the posterior ones longest; tarsi, first joint very short, second longer than, or subequal to, the third; the claws slender, very long, curved. Prosternum quadrately cut out to fit over the coxæ, the xyphus triangular; mesosternum narrow, grooved; metasternum hidden by the coxæ, deep-seated, in the middle convexly elevated; connexivum of the tergum forming a broad, flat rim, sharply separated from the disk. Genital segment of the male much longer than that of the female.

A. *Membrane with five long areoles :*1. *S. signoretii*.

Salda signoretii Guerin, La Sagra's Hist. Nat. de l'île de Cuba, Hemipt., 401, pl 13, fig. 10.

Acanthia signoretii Stål, Enum. Hemipt., iii, 148, No. 1.

Oval, sand-yellow with black markings, or black with sand-yellow markings, all over minutely sericeous pubescent. Head more or less marked with black between the eyes and behind, omitting the amber ocelli and two spots on the vertex, or with only two small black spots on the vertex; gula with a broad black spot; the emarginated inner side of the eyes generally black. Antennæ yellow or pale piceous, the basal joint black beneath and at base; second joint blackish or dusky beneath; third and fourth sometimes blackish beneath, the latter almost as short as the basal one, the third longer. Rostrum reaching to behind the middle coxæ, piceous or black, with the basal joint pale. Face with a longitudinal groove, and the cranium with a few wrinkles and ridges. Pronotum wide, deeply concave behind, with the humeral angles drawn out obliquely into broad, flat lobes, with a little hump at the outer corner; surface finely pubescent, closely, finely, obsoletely punctate; with a dull black spot on the disk of the anterior lobe, which sometimes runs back narrower to the base, and on each humeral angle a black spot. Antepectus sand-yellow, but generally with the middle line of the sternum black; mesosternum, excepting its lateral lobes and posterior margin, black; metasternum also black. Legs sand-yellow, the coxæ more or less black, as also the apex of the tibiæ, and a band on the tips of the second and third tarsal joints; nails generally testaceous. Scutellum black, minutely punctate, finely pubescent, arcuately impressed before the middle and with a slight elevated hump each side, usually carrying a yellow spot; the apex acute, broadly yellow, or with two yellow, approximate spots, the lateral edges sometimes yellow. Corium sand-yellow, or whitish and yellow, minutely punctate and pubescent, marked with black or fuscous in very varying proportions, generally with a double black spot on the costal area before the middle, a similar spot behind the middle, and a smaller rounded one at tip; disk next the clavus and the clavus fuscous or blackish, the latter sometimes with a small yellow spot near the inner posterior angle, the former very often with a large yellow spot on the middle of the posterior margin, and often the margin itself yellow; membrane sand-yellow, sometimes clouded with fuscous, and with a short transverse black band at base, the nervures piceous, long, and nearly straight. Venter pale yellow, finely pubescent, more or less blackish at base, and streaked on the disks of the segments each side, and sometimes with a row of black points a little way from the lateral margin; the genital segments and ovipositor more or less blackish. The spots on the costal area are frequently wanting, or have only traces present; occasionally the tip of the slender cuneus is black. Generally the whitish spots at the apex of the discoidal area of the corium are present and very conspicuous.

Length to tip of venter 5-6 millimeters; to tip of membrane 6-7½ millimeters. Width of base of pronotum 2½-3 millimeters.

First obtained in Cuba; afterward in Sonora, Mexico; since then on the sea-coasts of Massachusetts, North Carolina, and Georgia. I have met with it in large numbers on the sea-coast of Worcester County, in Maryland, in July and August. It lives on the pale sands not remote from the beach, and the darker varieties may be met with running briskly over the gray or blackish sandy mud, neglecting the dry spots, but often swarming upon the moist places.

The genital segment of the male has a long, curved, acutely tapering appendage, and two shorter and straighter approximate ones in the middle, superiorly.

2. *S. ligata*.

Acanthia ligata Say, Heteropt. New Harmony, 34, No. 1.

Form the same as in the preceding, black, a little shining. Head a little narrower, black, with a yellow arc on the arched base; the margins of the orbits of the eyes, the cheeks, tylus, and collum of the throat more or less yellow; vertex with two impressed oblique lines converging before the ocelli, a short, longitudinal one outside of each ocellus, and a short, wide groove on the middle of the raised front; the front generally bounded beneath by a transverse yellow band. Rostrum reaching upon the intermediate coxæ, slender, piceous, the basal joint yellow, with its apex black. Antennæ piceous or black, the basal joint paler above, short and thick; the apical joint a little shorter than the third, but very much longer than the basal one. Pronotum transverse, moderately flat, with the anterior lobe, omitting the outer margin, very prominently convex, indented, and bounded by an impressed line; surface black, shining, exceedingly minutely punctate, very finely pubescent; the lateral margins white, abruptly recurved along their whole length, and a little concave; posterior margin deeply, concavely sinuated, with a yellow spot each side, and a smaller one in the protracted, obliquely truncated angles; the extreme outer angle with a short tubercular ridge. Antepectus black, broadly margined all around with whitish, minutely punctate and finely pubescent; remaining pectoral divisions dull black, finely pubescent; margin behind and outside with white, and with extero-posterior lobes also white. Coxæ black, terminated and margined with white; femora lineated, with black on the inside and outside, either throughout or in part; the knees and lines upon the tibiæ and their ends, the basal joint of tarsi, and the ends of the second and third joints also black; nails pale piceous. Scutellum black, very minutely punctate, finely pubescent; a short, linear, yellow spot on the margin, at the outer end of the transverse impression, and the acute tip with a more or less slender spot each side. Corium black, finely, closely punctate and pubescent; the costal margin, a longish double spot on the suture a little behind the base, a similar but larger spot on the middle, a third, either double or triple, near the apex, two or three smaller ones near and on

the posterior margin, and one near the inner angle of the clavus] yellow; the base of the costal margin is less expanded than in the preceding species; membrane blackish, with a transverse series of oblong, pale spots behind the base; the cuneus yellow, but black at base. Venter black, polished, very minutely punctate, remotely, finely pubescent, the segments margined behind and exteriorly with white. Male genital segment very closely set with long bristles, with still longer, very slender, strongly curved appendages, and with two short teeth on the middle superiorly. The other attachments are not disclosed in my specimens.

Length to tip of venter 4-5 millimeters; to tip of membrane $5\frac{1}{2}$ -6 millimeters. Width of base of pronotum 2-3 millimeters.

A sprightly species, which inhabits dark rocks in the beds of running creeks and brooks in the metamorphic region of Maryland; and of Eastern Massachusetts, near Waltham and West Cambridge, from May till October. It flies from rock to rock on such as are not covered by the water, and from its wariness and activity is quite difficult to capture.

Mr. Kennicott found specimens in Illinois; others have been sent to me from Ottawa, Canada, by Mr. Billings. Mr. Scudder collected it near Lake Winnipeg. Mr. Sanborn met with it on the Magalloway River in Maine, and on a brook near Andover, Mass. The Abbé Provancher sent me specimens from Port Neuf near Quebec, and Mr. Say's came from Indiana.

3. *S. confluens*.

Acanthia confluenta Say, Heteropt. New Harmony, 25, No. 5.

Acanthia confluens Say (emend. Le Conte), Complete Writings, i, 361, No. 5.

"Black; membrane of the hemelytra with a blackish band. Antennæ pale at base; head and thorax immaculate; corium with a large marginal spot before the middle, and another at tip, two small spots; membrane with fuscous nervures and a continuous, blackish, arcuated band on the middle; feet whitish, tarsi with blackish tips; thighs with an obsolete brown line; venter whitish at tip."

"Length to tip of hemelytra one-fourth of an inch.

"Inhabits the United States.

"The band of the membrane does not reach the inner margin. It is equal in size to *A. ligata*."

Unless this is a variety of *S. signoretii*, I am not acquainted with it. Some of the characters agree well with that species, but certain discrepancies separate it from any that I have yet seen.

Fuller series of these interesting insects are yet needed to do full justice to their relationships, and to settle their position in the scale of the *Hemiptera*.

4. *S. pellita*, new sp.

Broad-ovate, dull ochreo-testaceous or clay-yellow, above clothed with erect, moderately long, close, fuscous pubescence, which is longer on the head and margins of the pronotum. Face longer, more oblique

and less vertical than in *S. sphacelata*, the front less prominently convex, and the sutures not so distinct; vertex either dusky, or with a small, black spot on the middle, and with a narrow black base; its surface very flat and the eyes very large and prominent; the base of the head forming a distinct neck, which is broader than the diameter in front of the eyes. The tylus pubescent, but the cheeks and gula bald and whitish. Antennæ long, dusky, beset with long, dark hairs; the two first joints clay-yellow; the basal one stout, short, a little thicker toward the tip, second longest, feebly thickened on the extreme tip; third and fourth scarcely thinner than the second, the fourth a little shorter than the third, but not much longer than the basal joint. Rostrum reaching near to the middle of the posterior coxæ, pale at base, piceous at tip. Pronotum polished, transverse, clothed with long, erect, dusky pile, remotely punctate; the lateral margins oblique, with the edge broad, thin, recurved; the anterior angles blunt, but almost rectangular; the collum slender but distinct, blackish; anterior lobe high, very convex, dusky in front, and bordered by a deeply impressed, piceous line, having a few coarse punctures across the middle, and remote finer punctures in the impressed lines; pleuræ pale, finely sericeous pubescent; sternum paler, bald, darker posteriorly; the impressed arc in front of the anterior coxæ piceous. Coxæ pale yellow; legs dark luteous, with dusky hairs; thighs somewhat pointed with brown; the tibiæ with a piceous tip and spines, and the tips of the tarsal joints piceous, the nails paler piceous. Scutellum a little convex at base, polished, pubescent, a little punctate on the base and middle, which are also more or less infuscated. Corium broad, pale luteous, closely, obsoletely punctate, erect, pubescent; the base of costal margin expanded and broadly rounded, the costal area very wide, the sutures and outer margin brownish; membrane paler, the nervures long and rather straight, piceous, bounding five large areoles. Venter highly polished, clothed with long, pale pubescence, minutely and obsoletely punctate. The membrane is not conspicuously distinguished at first sight from the corium, and the latter when held up to a strong light appears flecked and dotted with brown. The disk of the venter is occasionally a little infuscated. Male genital appendages apparently like those of the preceding species. Occasionally there is a series of brown dots on the venter near the connexivum.

Length to tip of venter 4-5 millimeters. Length to tip of membrane $5\frac{1}{2}$ - $6\frac{1}{4}$ millimeters. Width of base of pronotum $1\frac{1}{2}$ -2 millimeters.

Very abundant near the sea-coast of Eastern Massachusetts. Near Chelsea, July 9; and near Charles River, in the vicinity of Newtonville.

The posterior angles of the pronotum are obliquely protracted, flattened, obliquely truncated, and with a slight convexity next the outer angle.

5. *S. sphacelata*, new sp.

Elliptical, dusky, testaceous, dull, clothed above with minute, close,

appressed, fuscous pubescence. Head stout, obliquely curving, almost vertical, pale tawny, inscribed with black on the vertex and with a black spot behind, the base convex; clypeus longitudinally indented at the base of the tylus; front with an indented, oblique, brown line each side, and the usual impressed line in the middle; basal margin of the eyes and an impressed line bounding the quadrangular bed of the ocelli blackish; ocelli honey-yellow. Rostrum reaching upon the base of the posterior coxæ, slender, yellowish, becoming piceous toward the tip. Antennæ stout, setose, pale flavo-piceous, more or less dusky, particularly on the last two joints, the basal pale, short, thickened toward the tip; second joint very long and slender, faintly thicker at tip; fourth much longer than the basal and a little shorter than the third. Pronotum transverse, closely punctate, short, the sides very oblique, broadly reflexed; the anterior margin truncate, with a slender collum extending along its entire length, the anterior angles rectangular; the posterior margin concavely a little sinuated, with the outer angles moderately lobed, truncated at the end, and a little folded, and bounded on the inner side of the fold by an impressed short line; the anterior lobe moderately convex, variegated with black, transversely impressed, and with a few coarse punctures in the impression; the impressed line environing the lobe sharply defined, brown, and set with small punctures. Prosternum whitish, a little inscribed with piceous, finely sericeous pubescent; mesopleuræ black, sericeous pubescent, more or less bounded and invaded with tawny; metapleuræ tawny, sericeous pubescent. Coxæ a little piceous at or near the base; legs tawny; the femora more or less dotted with brown, pubescent; the apex and spines of the tibiæ and the ends of the tarsal joints dark piceous; nails pale piceous. Scutellum finely, closely punctate, yellow, blackish on the base and disk, finely sericeous pubescent. Corium pale, dull clay-yellow, remotely sericeous pubescent, paler at base and tip, a little more coarsely punctate; the costal margin broadly arcuated at base, the expansion there wide and thin; costal area broad, pale, infuscated on the inner side, sutures, and nervures; centers of a few of the outer, discal, and apical areoles whitish, with dusky nervules; the clavus dusky; membrane pale, dull testaceous, with strong, slightly curved, piceous nervules, inclosing five long areoles. Venter pale, obsoletely punctate, closely invested with pale, minute, prostrate pubescence.

A variety of the male is more dusky on the hemelytra, has the disk of the venter (excepting the edges of the segments) piceous, and irregular series of brown dots on the sides. The male genital segment is long, semi-oval, densely set with long hairs.

Length to tip of venter 4-5 millimeters; to tip of membrane 5-6 millimeters. Width of base of pronotum $1\frac{3}{4}$ -2 millimeters.

This species is exceedingly abundant on the discolored sandy and marshy brown spots of the tide-water districts of Eastern Massachusetts and Maryland. Some of these tracts of country are no longer within

the reach of the tide, although they were at a former period ; but still these insects remain there, although apparently in diminished numbers. The salt mud seems to afford them the conditions best suited to their development, and on such spots they may be found in all stages of development and in unnumbered multitudes. As far as I was able to collect them (which was difficult because of their activity and close resemblance to the soil), I found the males to be in the proportion of two to fifteen females. Yet I do not think that this would be the full proportion if we were able to collect them exhaustively over a locality in which they occurred of average abundance.

Specimens were collected by me at Newtonville, Chelsea, Lynn, and Braintree, Mass., in July; also on Sinepuxent Beach, Maryland, in July and August.

Specimens have been found also in Cuba, by Prof. Felipe Poey, which were smaller than the average of those from the United States.

An individual from San Diego, Cal., has the scutellum black, excepting only some small marks of yellow on the sides, and the punctures of the scutellum are coarser than those of the pronotum. Its length is only $4\frac{1}{2}$ millimeters, and the width of the pronotum is $1\frac{3}{4}$ millimeters.

6. *S. hirta*.

Acanthia hirta Say, Heteropt. New Harmony, 34, No. 2.

"Brownish, darker before. Body densely hairy, dull yellowish-brown or fuliginous; head a little darker at base; thorax blackish before the transverse line. Scutel blackish. Hemelytra conspicuously hairy, with dull yellowish spots, as well on the membrane as on the corium. Pectus a little varied with; the remaining inferior surface, including the feet, immaculate.

"Length to tip of hemelytra under one-fourth of an inch."

"This species may be recognized by its more obviously hairy vesture; its color is also paler than usual in this genus. Inhabits Indiana."

I have tried to reconcile some of the varieties of the two preceding species with this description, but all of them fail to fit it. Accordingly, it has here been placed separately until actual acquaintance shall settle its identity.

B. Membrane with four areoles :

a. Membrane almost confused with the corium; pronotum in front almost conical, the anterior lobe longer than the posterior one :

7. *S. coriacea*.

Salda coriacea Uhler, Fifth Ann. Rep. U. S. Geog. Surv. for 1871, 1872, p. 421, No. 2.

Form similar to that of *S. littoralis* Linn., but much narrower, very elongate-ovate, black, highly polished, minutely shagreened. Head oblique anteriorly, distinctly shagreened, sericeous pubescent, the base moderately wide, slightly convex, forming a distinct neck; ocelli honey

yellow, lacking the raised chevron in front of them, and having traces only of the oblique grooves and central line; front moderately flat, the tylus prominently raised, polished, bald, cylindrical; the labrum much broader, acutely angular at tip, a little longer than the tylus, and of the same testaceous color, or both black. Eyes large, prominent, brown, placed very obliquely. Rostrum reaching to the posterior coxæ, piceous, paler at base and tip. Antennæ black, remotely bristly, the first two joints often paler above; the basal joint stout, increasing in thickness beyond the base; the second joint more than twice as long as the first, a very little enlarged at tip; the third and fourth longer than the basal, subequal, the third a little thicker, both slender on the ends. Pronotum subcampanulate, narrow, very much rounded in front, the lateral margins flattened and a little reflexed, but tapering very slenderly in the direction of the collum, before reaching which it turns downward and fades out; the anterior lobe very narrow, but strongly convex, indented on the middle and constricted in front, more or less golden pubescent, and punctate in the depressed lines; the posterior lobe flattened, transversely a little wrinkled, shagreened, and somewhat pubescent; the posterior margin deeply concavely sinuated, the humeral angles produced, broad, flat. Scutellum densely shagreened, sparingly pubescent, a little convex at base, and depressed before the tip. Prosternum either black, or broadly margined each side behind with white, and, together with the disks of all the pleural pieces, pubescent and rugulose. Coxæ terminated with piceous or testaceous, the femora pale piceous or yellowish, darker at the knees, and sometimes with a few brown dots on the sides; tibiæ yellow, infuscated at tip, and with the spines piceous; tips of the tarsal joints dusky or piceous, with the nails paler. Hemelytra highly polished coal-black, remotely set with shallow punctures, faintly golden pubescent, the costal margin strongly arcuated, at base broadly expanded, and a little upturned, the edge recurved, and the area very broad, the upturned margin continued tapering to near the tip of corium; the clavus bounded on the inner submargin and outer suture by impressed punctate lines; membrane almost as thick as the corium, black, tinged with piceous, sometimes with about three pale brownish spots in the longer areoles. Venter brilliant black, closely, minutely punctate, coated with sparse, fine pubescence. The hemelytra are wider at base than the pronotum, and they gradually widen in their curve posteriorly.

Length to tip of venter 5-6 millimeters; to end of membrane 6-7 millimeters. Width of base of pronotum scant to full 2 millimeters. Full width across the corium 3-3½ millimeters.

The greatest number of specimens thus far acquired have been from Eastern Massachusetts. Mr. Sanborn collected several near Andover; Mr. Scudder secured one in the vicinity of Lake Winnipeg; Robert Kennicott found it in British America, near Mackenzie River; other specimens have been sent to me from Northern Illinois; and the Museum of

Comparative Zoölogy has specimens from British Columbia, collected July 14. The genital segment of the male is wider than long, almost gibbous, with the central attachments stout, curved toward each, and the exterior appendages long, slender, and overlapping each other when at rest. A specimen, the original type, was taken at Ogden, Utah, and another by B. H. Smith in the region of Denver. The nymph, from Massachusetts, has the usual 2-jointed tarsi, is broader and relatively flatter than the imago, and much resembles, particularly in the form of the abdomen, the common oriental cockroach.

8. *S. anthracina*, new sp.

Form of the preceding, but still more slender, the pronotum narrower and more convex, and the wing-covers very arched and decurving over the body like the shell of a terrapin. Deep, coal-black, shining. Head moderately narrow, minutely pubescent; the eyes very large, prominent, and oblique; face long, oblique, dull black, rugulose, with the impressed lines faint, and the shield of the vertex obsolete; base of head forming a distinct neck, coarsely shagreened and rugulose, a little flattened on top, rounded off posteriorly. Rostrum reaching to the posterior coxæ, piceous-black, paler at tip. Antennæ stout and long; the basal joint long, black, not much thicker and but little shorter than the third; second about twice as long, yellow, black at base, dusky, and a little enlarged at tip; third and fourth dusky, subfusiform, stout, the latter a little shorter than the third. Pronotum like the basal half of a funnel-very narrow anteriorly, sparingly sericeous pubescent, finely, obsoletely punctate and shagreened, the sides anteriorly compressed, the callosities obsolete, the transverse impressed line abbreviated at each end, punctate; the posterior margin concave, with the posterior angles produced, oblique; the lateral submargin a little flattened, coarsely shagreened, the edge reflexed, turned down anteriorly, and thinning out. Pectoral pieces rugulose in part, deep black. Legs yellow, the coxæ black or piceous, with the ends more or less yellow; anterior femora with a few brown dots, tip of tibiæ and last tarsal joint piceous. Scutellum coarsely, irregularly rugose, excepting the apex, which is nearly smooth. Hemelytra of almost equal thickness throughout, very convexly inflated, and decurving on the sides and posteriorly, slightly pubescent, polished, obsoletely, remotely punctate, the punctures of the deep sutures coarse and distinct; the membrane hardly distinct from the corium, the basal thick nervure obsolete. Venter polished, closely golden pubescent.

Length to tip of venter 4-6 millimeters; to tip of hemelytra $5\frac{1}{2}$ -7 millimeters. Width of base of pronotum $1\frac{3}{4}$ -2 millimeters.

Inhabits York County, Pennsylvania. Collected by the late Dr. F. E. Melsheimer, and by myself in the neighborhood of his farm.

9. *S. crassicornis*, new sp.

Still more slender than the preceding species, brassy-black, very highly polished, the upper surface with black erect pubescence.

Head long, anteriorly oblique, moderately long and narrow, the eyes very obliquely prominent; vertex a little rugulose, the front dull, somewhat shagreened and flattened; the tylus a little prominent, cylindrical, highly polished; the throat concave. Antennæ short, stout, the basal joint short, stout, black, yellow at tip; the second joint yellow, about as long as the third and fourth united, much more slender than either of the others, a very little thicker at tip; third joint much thicker, both third and fourth joints subfusiform, black, more conspicuously hairy equally thick, much longer than the basal one, the last a little longer than the preceding. Rostrum reaching to the tip of the posterior coxæ, rufo-piceous, paler at tip. Pronotum sub-campanulate, long and narrow, with the disk much elevated, very convex, occupying all of the surface excepting the very narrow posterior lobe, twice indented in the center, bounded behind and each side by a deep, transverse, coarsely punctate line, the posterior lobe consisting of only a slightly elevated linear tablet on the posterior margin, the margin proper moderately concave, the angles produced, acute; the sides deeply decurved, with the edge narrowly recurved, thinning out anteriorly, and bending down at the anterior end; the anterior margin truncate; the submargin with an impressed, punctate line. Scutellum strongly elevated at base, a little rugulose, deeply depressed on the middle and posteriorly. Legs and coxæ bright yellow, the femora faintly tinged with brown, and the tips of tibiæ and tarsi piceous. Venter black, minutely pubescent, the apex a little tinged with piceous. Corium and membrane coalescing, both coriaceous, long and narrow, convexly arched, deflexed on the sides, the part representing the membrane running off to an oblique rounded tip, with the nervures almost effaced.

Length to tip of venter $4\frac{1}{2}$ millimeters; to end of hemelytra $4\frac{3}{4}$ millimeters. Width of base of pronotum $1\frac{1}{4}$ millimeters. One specimen from the vicinity of the Saskatchewan River, collected by Robert Kennicott.

This is surely only the dimorph of the form with perfectly developed membrane. In the preceding species, parallel forms occur, the one with a distinct membrane and the other with the membrane thickened and almost as coriaceous as the corium proper; also, the bounding nervure is faint and almost obliterated, almost the same as in this form of *S. crassicornis*.

In the present specimen, the nervules of the membrane are very indistinct.

b. Membrane distinct from the corium; pronotum semilunately trapezoidal and wide:

10. *S. littoralis*.

Cimex littoralis Linn., Fauna Suec., 246, No. 915; Syst. Nat., 461, No. 14.

Salda littoralis Fieb., Europ. Hemipt., 147, No. 15.

Ovate, rather dull black, clothed above and beneath with closely

appressed yellow hairs, the head with a few distant, prominent, black hairs. Head moderately long, the eyes very prominent, the face oblique, carrying a few long, erect, black bristles; base of the head constituting a distinct neck, the throat concave; tylus in the middle and the ends of the cheeks generally yellow, but sometimes totally black; front moderately flat, triangularly emarginate at the base of the tylus, the labrum broad, with the lateral edge sharp, and with a median ridge. Rostrum reaching almost to the middle of the posterior coxæ (in one specimen, not extending beyond the intermediate coxæ), piceous-black, paler or yellowish at tip. Antennæ moderately long and slender, thickly clothed with fine, projecting, black hairs, a few of which are stouter; basal joint yellowish-brown above, dark at base, and beneath, with the basal two-thirds, blackish; second joint slender, dull yellowish, piceous at base and tip, a little shorter than the third and fourth united; third and fourth a little stouter, subfusiform, dusky black, subequal in length. Pronotum subtrapezoidal, the posterior lobe transversely flat, the anterior lobe convex, reaching two-thirds of the length, smooth, bounded by a deeply-impressed line each side and behind, its central fovea small; sides flattened, the recurved edge bending abruptly downward before reaching the collum; posterior third of disk finely crenate-punctate. Scutellum finely crenate-punctate, finely rugulose behind, the depression large, somewhat incurved and well defined. Legs dull yellow; the femora with short, yellow hairs, the anterior ones blackish on the outside, and the middle and posterior ones with two rows of brown dots on each of the outer and inner surfaces; tibiæ with short brown hairs and remote stouter black hairs; first and last joints of the tarsi blackish, the second joint and nails dull yellow. The tarsi are often soiled yellow, with blackish hairs, and with only traces of dusky on the ends of the first and last joints. Venter shining black, very minutely rugulose, clothed with fine sericeous, yellowish, prostrate pubescence, the posterior margins of the segments often pale piceous, and apex of the terminal segment yellow.

Hemelytra minutely scabrous, golden sericeous, appressed pubescent; generally with an oblong yellow spot near the end of the clavus; corium marked on the disk with a longitudinal series of four long yellow spots between the first and second nervules, and near the tip with one or two smaller spots placed more inwardly; costal margin broadly arcuated, turned up, the submargin depressed, broader at base; membrane pale brownish or dirty yellow, sometimes short, and almost confined to the inner length of the corium, the cuneus black and coriaceous, inclosing the outer side of the membrane; the areoles with a series of black spots across the middle, more or less blackish at base and tip, and the nervules deep black.

Length to tip of venter 5-6 millimeters; to end of membrane $5\frac{1}{2}$ -7 millimeters. Width of base of pronotum $2-2\frac{1}{2}$ millimeters.

Common in various parts of Europe, as well in the North as in the

South. In some parts of England, it inhabits the sea-shore. Specimens from the United States have thus far been collected only in Illinois and Utah.

11. *S. polita*, new sp.

Elliptical, highly polished, jet-black, very indistinctly punctate; the whole upper surface set with erect, remote, brown hairs. Head from above short, vertical in front and a little decurving, dull black, densely and irregularly scabrous and rugulose, the raised margin of the clypeus and the tylus ferruginous or pale piceous. Rostrum pale piceous, reaching between the intermediate coxæ; base of vertex a little convex, formed into a distinct neck, contracted on the occiput; eyes very prominent, brown, placed obliquely. Antennæ setulose, moderately long, stout, the two apical joints about as stout as the basal one; basal joint short, blackish-piceous, paler above; second joint much shorter than the two apical ones united; pale piceous or dull yellow; two apical joints dusky black, subfusiform, subequal in length, but much longer than the basal one. Pronotum subtrapezoidal, transverse, short, highly polished; the callosities forming the anterior lobe very convex, not reaching the sides, with a large, indented point in the center; the posterior lobe much shorter, arched, higher than the anterior one, deeply concave, the humeral angles long, broad, and flat, subtruncated, with an oblong tubercle near the outer angle; the impressed line around the callosities very deep-seated, punctate; lateral submargius broadly flattened rugulose, the edge recurved, decurving anteriorly. Pleural pieces dull black, obsolete and minutely punctate; the prosternum very short, scarcely covering the base of the coxæ. Coxæ black; femora dull yellow or ferruginous, the under side of the anterior pair piceous; tibiæ dull yellow, their tips, the tarsi, and nails piceous. Scutellum moderately convex, obsolete scabrous at base; the apical portion a little less prominent than the base, and the depression between them shallow; the surface faintly rugulose. Hemelytra flat, ferruginous, the clavus dusky black, and the costal area jet-black, polished, the whole surface minutely scabrous; the costal margin moderately arcuated, a little broadly and almost uniformly reflexed; membrane very long, pale dull yellowish, somewhat clouded basally, the nervules piceous, long, and almost straight. Venter black, highly polished, minutely punctate and pubescent; the genital segment and sometimes the posterior edges of the others testaceous. The costal margin is testaceous in two specimens, in which the black of that area is much reduced and limited to the posterior portion, inwardly.

Length to tip of membrane $4\frac{1}{2}$ – $5\frac{1}{2}$ millimeters. Width of base of pronotum $1\frac{1}{2}$ – $1\frac{3}{4}$ millimeters.

From San Diego, Cal. Kindly sent to me for examination by Dr. Hagen from the Museum of Comparative Zoölogy.

12. *S. stellata*.

Acanthia stellata Curtis, Ross's Second Voyage to the Arctic Regions, appendix lxxv, No. 24.

"Blackish sericeous; elytra with a pale spot at the center and several at the apex; legs ochereous. Black, clothed with very short shining hairs; thorax transverse, the edge beneath subochereous, as well as the center of the antepectus; scutellum rather large; elytra with the costa reflexed at base, a semitransparent spot at the base, another on the disk, and eight or nine arranged in a circle on the submembranous apex; margins of abdominal segments beneath ochereous, and forming a row of dots down each side; legs dirty ocher, somewhat freckled with piceous."

Length 3 lines.

"The head is wanting to the only specimen I have seen; it most resembles *A. zostera* Fabr., but it is very distinct from my examples of that insect. As some of its larvæ or pupæ were found, it is probably not uncommon in the polar regions."

The species has not been recovered by any one in North America, and it still remains unknown to students in this country.

13. *S. lugubris*.

Acanthia lugubris Say, Heteropt. New Harmony, 34, No. 3.

"Body black, subopaque. Head between the antennæ with three yellowish points; antennæ, first and second joints dull yellowish before, Thorax and scutel immaculate. Hemelytra immaculate on the corium, or with an obsolete dull yellowish point on the middle of the tip; membrane with two or three obsolete dull yellowish spots, inner margin and tip. Beneath with a yellowish spot before each of the anterior feet. Feet pale yellowish; tibiæ and tarsi more dusky; thighs, particularly the anterior and posterior pairs, with a more or less dilated black line toward their tips; coxæ black, the anterior pair yellowish at tip, remaining pairs slightly tipped with yellowish."

"Length to tip of hemelytra less than three-tenths of an inch."

"For this species I am indebted to Nuttall, who obtained it in Missouri."

This description suits most nearly a spotted variety of *S. littoralis* Linn. from Illinois; but, as I do not possess a specimen to which this description will rigidly apply, I must defer the reference until a later opportunity offers.

C. *Membrane very distinct from the corium* :

a. *Pronotum semilunate, depressed* :

14. *S. deplanata*, new sp.

Oval, robust, dull black, the upper surface remotely appressed, golden pubescent, and with a few erect, remote, brown hairs. Head from above

short and blunt, minutely, densely scabrous, the base forming a neck, a little convexly elevated, the eyes moderately prominent, brown; front almost vertical, a little oblique, closely golden pubescent, triangularly depressed before the ocelli, the face a little flattened; tylus much shorter than the labrum, they, and the ends of the cheeks and bucculae sometimes yellowish. Rostrum generally reaching upon the base of venter, but sometimes a little shorter, piceous-black, becoming yellow at tip. Antennæ very slender, black, pubescent and setaceous; the basal joint above and the second joint excepting the tip sometimes dull yellow, the former very short, not as long as the eye; second joint about twice as long, slender, much shorter than the last two united; third and fourth subequal, very slightly thicker than the second, a little subfusiform. Pronotum semilunate, short, depressed, dull black, minutely shagreened, but with the broad, thin, depressed lateral submargins more coarsely so, the margin a little turned up, but not abruptly reflexed; anterior lobe defined by a lunate, impressed, punctate line, hardly elevated, longer than the posterior lobe, and with a deeply indented point in the center; humeral angles broad, moderately prolonged, with a long tubercle next the outer angle; posterior margin deeply concave; the anterior angles rounded off, and the anterior margin with a narrow collum. Prosternum and pleuræ shining black, golden pubescent, somewhat rugulose in places, very minutely scabrous. Legs black or soiled yellow, pubescent, and with some long erect hairs intermixed; the femora when yellow more or less black beneath, and dotted with piceous on the two sides; tibiæ dull yellow, piceous at base and tip, with the spines piceous; tarsi soiled yellow, with the basal and apical joints or their apices piceous; nails very pale piceous. Scutellum large, almost flat, slightly depressed on the disk, densely scabrous, and on the apical part a little rugulose. Hemelytra dull black, almost flat, densely shagreened, and depressed golden pubescent; costal margin expanded and arcuated at base, the lobe upturned, and rapidly tapering to a termination behind the middle; corium marked with short, white or yellowish, linear spots, of which two are on the inner line of the costal area, a longitudinal series of about four near the outer side of the discoidal area, and two or three on the inner area, and a small spot near the inner angle of the clavus; membrane soiled white or yellow, with a cloud at base and tip, and about two transverse series of fuscous oval spots in the areoles, sometimes with the apexes of the areoles more or less blackish, the nervules blackish, and the outer areole broad-triangular. Venter short and broad, shining black, closely and finely clothed with prostrate yellowish pubescence.

Length to tip of venter $4\frac{1}{2}$ – $6\frac{1}{2}$ millimeters; to tip of membrane –8 millimeters. Width of base of pronotum $2\frac{1}{2}$ –3 millimeters.

Inhabits Maine; Massachusetts; New York; Maryland, in September. Texas; New Mexico; Missouri; Illinois; Michigan; Minnesota;

Mackenzie River Region, Robert Kennicott; Canada; near Saskatchewan River, and in the Province of Ontario.

Specimens occur which are destitute of white spots upon the corium and clavus. I found numerous specimens upon the mud of the black marshes of Brighton and Cambridgeport, Mass., in the month of July.

The remarks under *S. lugubris* Say, in my paper printed in Dr. Hayden's Bulletin, vol. ii, No. v, p. 67, belong to this species.

15. *S. interstitialis*.

Acanthia interstitialis Say, Journ. Acad. Phila., iv. 324, No. 1.

Ovate, dull black, closely bronze pubescent, with a few remote, erect, black hairs on the head, pronotum, and base of the hemelytra. Head from above broad and short, vertical, with a very short neck behind; the eyes large, brown, moderately projecting above the line of the vertex; base of head moderately convex, minutely shagreened, separated from the ocelli by a transverse impressed line; front almost flat, densely, minutely scabrous, the longitudinal groove obsolete; reflexed edge of the clypeus yellow or piceous; tylus a little prominent, slightly narrower inferiorly, yellowish, a little shorter than the labrum, bald; labrum broad, yellow, a little ridged on the middle line, with the sides sloping, the tip bluntly triangular and set with stiff hairs. Upper margin of the bucculæ yellow; rostrum reaching behind the end of the posterior coxæ, dark piceous, paler at tip. Antennæ slender; basal joint short and stout, dull yellow, with a black line beneath and sometimes obscure on the middle above; second joint a little shorter than the third and fourth conjoined, yellowish or pale piceous, darker on the middle, slightly thickened at tip; third and fourth subequal, dull black, each longer than the basal one, and stouter than the second, subfusiform. Pronotum lunate, densely coated with prostrate golden pubescence and with longer black hairs on the margins and before; lateral margins moderately and abruptly reflexed, the submargin broadly depressed, of uniform width throughout, minutely scabrous; surface generally minutely scabrous; the callosities forming a transverse ridge, sharply bounded by an impressed punctate line, which curves around the sides and stops at an indented point some distance behind the anterior margin; posterior margin deeply concave, the lobed humeral angles obliquely truncated and with a long tubercle near the outer corner. Scutellum feebly convex, closely minutely scabrous, lunately impressed, the apical division a little flattened, obsoletely rugulose, with the edge yellowish. Pectoral pieces polished, black, clothed with prostrate whitish pubescence, the prosternum slenderly margined with white. Legs dull yellow, generally with a black line on the under side of the femora and tibiæ; the femora often with piceous dots on the front and back faces; tibiæ tipped with piceous, with piceous spines, and sometimes with piceous spots or faint bands at the base of the spines; tarsal joints tipped with piceous and the basal joint entirely piceous, the nails pale piceous.

Hemelytra black, almost flat, minutely scabrous, with close, appressed, golden pubescence, and with longer, remote, black hairs exteriorly and basally; the costal margin moderately arcuated, with the edge abruptly, narrowly recurved, and black or rarely piceous; corium with four or five whitish oblong spots, of which there is a double one on the costal area behind the middle and a similar one near the tip, a large central one on the discoidal areole and a smaller one farther back; and at the tip of this areole, on the suture, is a larger triangular spot, or very small white spot behind a velvety-black one near the tip of the clavus; membrane dull whitish, dusky at base and tip, with black nervules, and across the middle a series of oblong blackish spots. Venter black or tinged with piceous (or sometimes pale brownish); the apical segment entirely, or only a broad margin, whitish.

Length to tip of venter 3-4 millimeters; to tip of membrane 4-5 millimeters. Width of base of pronotum $1\frac{3}{4}$ - $2\frac{1}{4}$ millimeters.

Inhabits Missouri, Mr. Say. Specimens in my own collection were taken at Saint Joseph, Mo., by Mr. E. P. Austin; by myself at Andover, Mass.; and near Baltimore, on the dark sand of a loamy spot near a brook, in May and June; also in Dakota, Nebraska, and Illinois. Some variation occurs in this form, such as the greater expanse of the white spot upon the apex of the corium, and of the pale colors of the prosternum and legs.

The references to other localities in my List of Hemiptera, published in Dr. Hayden's Bulletin, p. 67, must be expunged, as they refer to other forms, which, for the present at least, we are impelled to consider species.

16. *S. luctuosa*.

Salda luctuosa Stål, Eugénies Resa, Hemipt., 263, No. 123.

"Oval, blackish, moderately polished, having the form of *S. pallipes*, but the colors and markings similar to *S. littoralis*. Head black, clothed with fuscous hairs, with eyes somewhat broader than the anterior width of the pronotum; eyes moderately prominent. Antennæ somewhat more than half as long as the body, blackish-fuscous. Rostrum blackish. Pronotum three times as wide as long, anteriorly about one-half as wide as at the base, the posterior margin broadly sinuated, the sides scarcely arcuated with the margin, slenderly reflexed; blackish, clothed with somewhat depressed fuscous pile; the anterior lobe a little elevated. Scutellum blackish. Hemelytra blackish, sparingly clothed with prostrate pubescence, the costal margin at base somewhat expanded; membrane very distinct, infuscated, having four areoles. Beneath blackish. Legs obscurely fusco-testaceous, the tibiæ and tarsi somewhat paler, the former sparingly bristly."

Length ♂ 4 millimeters. Width of pronotum $1\frac{1}{2}$ millimeters.

"Inhabits San Francisco, Calif."

This is a translation of the Latin description given by Dr. Stål in the memoir quoted above.

It is as yet not in any of the collections of the entomologists or museums of the Eastern United States.

17. *S. coxalis*.

Acanthia coxalis Stål, Enum. Hemipt., iii, 149, No. 4.

"Black, shining, clothed with very short gray pubescence; the labrum, tylus, two small spots on the front of the head, the lateral margins of the pronotum slenderly from the base to beyond the middle, the front margin of the anterior acetabulæ, and the legs, pale yellowish. Hemelytra soiled-white, with fuscous nervures; the clavus, the inner margin, and base of the corium exteriorly with two longitudinal lines black, and next to the apex with pale spot. Coxæ and the extreme apex of the tibiæ black. Posterior margin of the segments and the posterior part of the sixth segment of the female whitish.

"Length ♀ $4\frac{1}{2}$ millimeters. Width of pronotum 2 millimeters. Width across the hemelytra $2\frac{1}{2}$ millimeters.

"Inhabits Cuba."

This species is also unknown to me. The above description is a translation of Dr. Stål's Latin one, from the paper cited above.

18. *S. pallipes*.

Salda pallipes Fab., Syst. Rhyng., 115, No. 12.—H. Schf., Wanz. Ins., vi, fig. 600.

Moderately long-oval, thickly clothed above with appressed golden pubescence, and fringed with almost erect pile. The head, fore part of the pronotum, and basal parts of the hemelytra with erect black hairs. Head from above short and blunt, the front nearly vertical, dull black, moderately flat, minutely granulated, clothed with appressed golden pubescence and some longer black erect pile; inferior margin of clypeus emarginated in the middle, thick, elevated into a slight ridge, yellow, smooth; tylus a little prominent, bald, narrowing inferiorly, and, together with the labrum, reddish-yellow; the latter a little longer, pubescent, infuscated at tip; rostrum reaching to the tip of the middle coxæ, piceous; antennæ black, with short hairs; the first and second joints more or less fulvous, black above and beneath. Ocelli black. Pronotum very transverse, minutely scabrous, the sides arcuated, flattened, the edge a little reflexed; the posterior margin very concave across the scutellum; the humeral lobes roundly produced; callosities occupying half the length, moderately prominent, the central fovea deep and transverse, the side-impressions obsolete, the bounding furrow deep; scutellum convex, the central depression deep, sharply defined behind; the base finely scabrous, the apical half rugulose. Hemelytra slightly convex; clavus black, the apex with a large or small wedge-shaped yellow spot; corium black at base, sharply distinguished from the rest of the pale yellowish surface; the basal one-third of the costal margin

rounded and a little broadly expanded and turned up, the margin black, and with a black spot at the apex; costal area with two long contiguous black spots, nearly forming a black streak, the second interrupted by a white dot; between the first and second nervures basally a black spot, with a broad ring of the ground-color around it; below this ocellus is a black spot; at the end of the second nervure is another black spot, sometimes extended to the inner angle; and beyond this nervure, on the disk, is a long black spot; nervures black, sometimes pale posteriorly, and occasionally destitute of the intervening black spots; membrane pale yellowish or white; the nervures piceous or black, excepting the exterior one, which is generally pale, with a black spot at its tip; across the middle is a series of oblong spots, and sometimes a larger one near the base of the third cell, the apical margin generally infuscated; sternum black, the prosternum slenderly margined behind with yellow; legs yellow, with fine, short, yellow hairs; the femora having two rows of brown points on the inner and outer faces, the under side with a blackish streak; tibiæ with black spines and apex, the anterior pair with a blackish line on the under side; apex of the last tarsal joint black, the nails pale brown; abdomen black or blackish, the posterior edges of the ventral segments whitish, that of the apical segments broadly whitish.

Length 3-5 millimeters. Width of pronotum $1\frac{1}{4}$ - $1\frac{1}{2}$ millimeters.

Dr. Stål reports this species to have been taken in Sitka. Specimens belonging to the Museum of Comparative Zoölogy, kindly sent to me for study by Dr. H. A. von Hagen, were taken at San Diego and Bard's Ranch, Cal. These specimens are larger than those from the Rocky Mountain region, of which many have passed through my hands, from various localities in Utah, New Mexico, etc. In the western suburbs of Denver, Colo., it may be met with in untold numbers on the dark, damp, sandy, and muddy soil, during the month of August. A few specimens occurred to me on dark, damp soil, next the stream of water running down the Beaver Brook Gulch, and also in similar spots in Clear Creek Cañon. I can find no characters to separate it from specimens which I collected in Hayti on the marshy banks of the Grand Anse River in May, nor from Cuban specimens received from Professor Poey. It occurs also in New Jersey and on the dark mud of the sea-coast of Maryland.

Dr. Packard collected it near Georgetown, Colo., July 8, at an elevation of 9,500 feet, and also near Salt Lake, Utah, July 27.

19. *S. reperta*, new sp.

Closely resembles *S. marginalis* Fallen. Deep, dull black, sparsely clothed with golden prostrate pubescence, and the head and pronotum with a few erect black hairs. Head above broad and blunt, the base forming a short neck; the surface minutely scabrous; eyes prominent, brownish, moderately oblique; front moderately narrow and flat, not

distinctly arched at base; the lower margin of the clypeus callous, feebly recurved, testaceous, black in the center; tylus and labrum forming an arched bridge, dull ochreous, the former a little concave on the sides inferiorly, the latter piceous at tip and a little pubescent. Rostrum reaching upon the intermediate coxæ, dark piceous, paler at tip. Antennæ moderately stout, clothed with pale, stiff hairs; basal joint dull yellow, black beneath; second piceous, paler at base and tip, not twice as long as the basal one, and a little thickened at tip; third and fourth dull blackish, subfusiform, subequal, each longer than the basal one. Pronotum transverse, subtrapezoidal, rather flat, with the sides very oblique, hardly curving; the submargin broadly depressed and gradually narrowing toward the front; the callosities feebly elevated, deeply and broadly foveate in the center, bounded by a deeply impressed line; the surface minutely and densely rugulose; posterior margin very slightly concave, with the humeral angles moderately produced, very broad, and with a large, low fold near the outer angle. Scutellum scabrous at base, minutely, transversely wrinkled on the apical half; the central impression lunate, distinct. Legs dull testaceous, very hairy, more or less marked with piceous on the femora, particularly beneath, on the tibiæ, somewhat in spots, the tips, spines, and the basal and apical joints of the tarsi piceous-black, the nails dull testaceous. Sternum and under side of the body shining black, minutely, closely whitish pubescent; the extreme edge of the prosternum and of the ventral segments and a broad end of the genital segment of the female whitish. Hemelytra deep black; the corium closely yellow and black pubescent, densely shagreened, the costal margin moderately arcuated, broadly and continuously flattened, recurved from the base to behind the middle; the costal area with a testaceous small spot behind the middle and two smaller parallel ones near the tip, the middle nervure with a spot near the base, and the middle areole with a larger spot at tip and two or three smaller ones near the tip; the clavus with a small yellow spot near the tip; membrane dull white, fuscous at base and with a broad cloud at tip, a transverse series of oblong fuscous spots across the middle and a spot at the tip of the exterior areole; the nervures piceous or black.

Length to tip of hemelytra 4-4½ millimeters; to tip of venter 3½-4 millimeters. Width of base of pronotum 1½ millimeters.

A few specimens from the Museum of Comparative Zoölogy, collected in Cambridge, Mass.

This is a robust little species, very closely related to *S. interstitialis* Say, and perhaps only a variety of it. But the different shape of the pronotum, with the other details, will at present serve to separate it.

20. *S. elongata*, new sp.

Long-elliptical, narrower anteriorly, dull black, clothed above with prostrate yellowish pubescence, and with a few erect black hairs on the head and pronotum. Head dull black, front very oblique, long and

moderately narrow, convex, forming an 8-sided tablet, which is bilobed above, grooved down the middle, and with the lower side-margins of the clypeus a little carinated, black; an oblong callous spot each side next the eyes yellow; tylus smooth, black, yellow at tip; labrum piceous, pubescent, yellow along the middle line; eyes brown, oblique, and very prominent; base of head convex, forming a rather long neck, densely, minutely granulated; tip of the lower cheeks orange; bucculae and throat dull black, minutely scabrous and whitish pubescent. Rostrum reaching behind the intermediate coxæ, blackish-piceous, paler at tip. Antennæ slender, as long as from the tylus to tip of clavus, piceous; the basal joint stouter, fulvous at tip; the second very long, much more than twice the length of the first, pubescent; third and fourth dull black, pubescent, slenderly subfusiform, subequal, each about two-thirds the length of the second. Pronotum subcampanulate, transverse, densely clothed with prostrate golden pubescence, the anterior part very narrow, with the sides steep, the callosities prominent, convex, rugose, deeply indented on the middle and obliquely so each side of it; posterior lobe about one-half as long as the preceding, deeply, squarely sinuated, the humeral angles obliquely prolonged, flattened, longitudinally sulcated, rugose; the sides broadly flattened, tapering anteriorly, the margin abruptly recurved, and fading out next the column. Pectus polished black, finely, prostrate, whitish pubescent; prosternum very slenderly margined with white. Legs dull testaceous, the femora more or less piceous beneath and on the front and hind surfaces; tibiæ with piceous knees, spines, and tip; tarsi dull testaceous, the basal and apical joints piceous, the nails dull testaceous. Scutellum coarsely, densely scabrous on the prominent base, the impression very distinct, arcuated; the apical division transversely rugulose. Hemelytra narrow, thin, very minutely scabrous, with a very few coarse punctures on basal and costal areoles; clavus black, golden pubescent, having a few coarse punctures and a wedge-shaped yellow spot next the tip, placed on a velvety-black spot; corium yellowish, the costal margin broadly arcuated, the base broadly flattened and turned up, the edge black; costal area broad and long, the base blackish, the middle with a quadrate spot, and near the tip a roundish one; nervures coarse and deep black; the inner areole black, with two yellow small spots next the outer margin and before the apex, and with a larger one at the inner angle; the central areole black at base, next a large yellow spot, and then black with three moderately large yellow spots, the last one is separated from the apical margin by a black line; membrane pale yellowish, blackish at base, with black nervules margined with blackish, and spots at their tips; a marginal blackish line on the apical two-thirds of the outer nervule, and with a transverse series of streaks; oblong spots on the middle of the areoles. Venter black, minutely sericeous pubescent; the middle of the disk and the posterior part of the genital segment yellowish; posterior margin of the segments pale piceous.

Length to tip of venter 5 millimeters; to tip of hemelytra 6 millimeters. Width of base of pronotum 2 millimeters.

One female, the type, is the only specimen that I have seen. It is from British Columbia, and belongs to the Museum of Comparative Zoölogy. It seems to be closely allied to the European *S. latipes* H. Schf.

21. *S. orbiculata*, new sp.

Almost circularly ovate, deep dull black when invested with the clothing, but shining black when rubbed; the upper surface invested with long, erect, golden and blackish, almost matted pubescence. Head wide, from above blunt and short; the front almost vertical, a little curved, clothed with erect black hairs and prostrate golden pubescence; front a little flattened; vertex with an indented point each side near the eye; ocelli small, pale piceous; base of head smooth, not obviously punctate, a little convex, forming a moderate neck; tylus very slightly prominent, shining, pale fulvous; lower edge of the clypeus fulvous, very slenderly recurved; labrum broad, fulvous, invested with pale yellow bristles. Rostrum testaceous, reaching upon the posterior coxæ. Antennæ short, moderately slender, the basal joint short and stout, testaceous; the second quite slender, pale piceous, testaceous at the base and piceous at tip, about twice as long as the basal one; it and the following joints with remote erect hairs; two last joints subequal, long, subfusiform, blackish, longer than the basal joint. Pronotum transverse, contracted at the collum, flattened, the sides oblique but arcuated, with the submargin moderately broadly flattened, of almost uniform width throughout, a little upturned, thick, a little turned in and widened at the posterior angles; posterior margin moderately deeply concave, the humeral angles produced, broad, short, scooped out; anterior lobe with the callosities feebly elevated, but not nearly extending to the lateral margin, the transverse line deeply seated; posterior lobe about one-third the length of the anterior one, indistinctly rugulose. Scutellum not distinctly punctate, short and wide, deeply lunately impressed on the middle, the surface beneath the dense pubescence polished, jet-black. Sternum jet-black, polished, finely whitish pubescent, the pieces of the mesopleura more or less white. Coxæ piceous, paler at tip; legs pale orange or fulvous, the spines and extreme tip of the tibiæ, the basal joint of tarsi, the end of the apical joint, and the nails piceous. Hemelytra flat, disk-like, the costal margin almost semicircular, narrowly flattened and upturned, pale yellow, not wider at base; corium velvety-blackish, densely coated with prostrate golden pubescence and with longer blackish hairs; costal area very wide, with a testaceous spot on the middle entering from the outer margin, and a similar one before the tip; nearly one-half of the posterior margin running from the outer angle testaceous, and the inner edge of the clavus very narrowly of the same color; disk with about four round bluish spots, and a similar spot near the apex

of the clavus; membrane fuscous, a spot at the inner angle, the inner margin, the posterior submargin, and an apical spot, four spots on the bases of the areoles, and four near their tips pale testaceous. Venter black, terminated with white, and closely invested with prostrate whitish pubescence.

Length to tip of hemelytra $3\frac{1}{2}$ – $4\frac{1}{2}$ millimeters. Width of base of pronotum $1\frac{1}{2}$ –2 millimeters. Width across hemelytra 2– $2\frac{1}{2}$ millimeters.

This neat and unusual form of *Salda* has a very wide range of distribution. It occurs in Eastern Massachusetts, Pennsylvania, New York, Illinois, and Texas, and the Museum of Comparative Zoölogy has specimens from Calaveras and San Diego, Cal.

22. *S. humilis*.

Acanthia humilis Say, Heteropt. New Harmony, 35, No. 4.

Elliptical, black, velvety, above closely invested with minute yellow prostrate pubescence; the eyes very large, prominent, round, brown, placed obliquely. Head at base, with a narrow neck, conforming to the width of the front of pronotum, black, dull, minutely scabrous; the front very narrow between the eyes, from above blunt, short, a little flattened, with two indented points each side and one in the middle; tylus slightly prominent, and, together with the labrum, pale ochereous or yellow, the ends of lower cheeks also ochereous. Rostrum reaching upon the posterior coxæ, pale piceous. Antennæ testaceous, slender, and moderately long; the apex of the second joint and all of the third and fourth joints blackish; the second joint about twice as long as the basal one and much more slender; the third and fourth slender, subequal; all but the basal one with erect hairs. Pronotum trapezoidal, transverse, very narrow in front, the sides oblique, a little prominent at the shoulders, the lateral margins very slenderly reflexed, decurved, and lost before reaching the anterior margin; the surface very minutely scabrous; anterior lobe moderately elevated, transversely indented on the middle, the impressed line distinct but not very deep; posterior division a little shorter, moderately flattened; posterior margin a very little sinuated, the humeral angles oblique, short, flat, the outer angles subacute, with an oblong tubercle placed next the outside. Scutellum long, moderately depressed in the middle and more deeply each side, coarsely scabrous at base, finely rugulose on the apical division. Pectus and sternum jet black, highly polished, closely covered with appressed, fine, white pubescence. Legs pale testaceous; the coxæ black, with white tips; femora broadly banded near the tip with fulvous; tibiæ piceous at tip, and with pale piceous spines; apex of the last tarsal joint black the nails pale piceous. Hemelytra velvety-black, minutely, densely clothed with black and golden pubescence, minutely punctate; the costal margin broadly arcuated, with the edge narrowly reflexed; the costal area broad, pale yellow or white, with a small, black, longish patch at base, another oblong, large spot behind the middle, against the inner

margin, and a trace on the outer margin, and the tip with a transverse black spot; nervures black; middle areole with an oval spot near the outer nervure, basally, a round one a little way behind this, a few specks behind the middle, a dot near the apex inwardly, and a dot near the inner tip of the clavus pale yellow; membrane pale yellow, a little clouded at base and on the apical margin, the apex with a piceous spot on the apex of the outer areole; nervures piceous; the areoles with a transverse series of oblong fuscous spots (sometimes the spots are interrupted, forming a partially double series). Venter black, clothed with prostrate white pubescence, the posterior margin of the segments slenderly piceous; the apical segment of the female broadly white.

Length to tip of hemelytra 3-3½ millimeters. Width of base of pronotum 1¼ millimeters.

Common in Maryland, within the limits of the metamorphic belt, upon damp sand formed by the disintegration of the rocks, near creeks and brooks, in June and July. It is also common in Northwestern and Northern Florida; and specimens have been sent to me from Texas, Illinois, and Pennsylvania. I have also collected it in Cambridge, Mass., and in the vicinity of Washington, D. C. It occurs likewise in Western North Carolina and in Georgia. It is of precisely the same form as *S. cineta* H. Schf. of England and France, agreeing with that species in most of its details, and, upon sufficient comparison, may prove to be the same species.

Family VELIIDÆ.

HEBRUS Curtis.

H. sobrinus, new sp.

Robust, brunneo-fuscous, beneath mostly blackish-piceous, with the sternum, coxæ, and legs testaceous. Head stout, not so long nor so tapering as in *H. pusillus* Fallen; the vertex and face very convex, at the tip thickly hairy. Antennæ dull testaceous, pubescent; the basal joint thickest, narrowed at base, longer than the second; the third longest, slender, of the same thickness as the succeeding ones. Under side of the head and bucculæ dull testaceous; the rostrum slender, reaching upon the venter, dull testaceous. Eyes dark brown, with few and coarse facets. Pronotum broader than long, flattened; the humeri well defined by a brown sulcus; impressed line between the lobes distinct, as also the three indentations upon the center, those each side less distinct; the surface very minutely punctate. Pleuræ darker, having a few, very remote, coarse punctures. Venter smooth, black-piceous, densely sericeous pubescent, margined with dull fulvous. Hemelytra pale brownish, minutely pubescent; the nervures thick, darker; the costal margin almost straight, a little incurved near the tip; membrane scarcely reaching the tip of the venter, pale, dull brown, slenderly margined with paler brown. Tergum fuscous, whitish, sericeous pubescent, the reflexed margins yellow.

Length scant 2 millimeters. Width of base of pronotum $\frac{3}{4}$ millimeter.

A few specimens occurred on the margins of ponds west of Denver.

Family HYGROMETRIDÆ.

HYGROTRECHUS Stål.

H. remigis.

Gerris remigis Say, Heteropt. New Harmony, 35, No. 1.

Collected by Dr. Packard, on July 10, in Denver; at Boulder, June 20; and at Manitou, July 15. It was found also by myself on the still water along the margins of Sloan's Lake; and it was very abundant also on the surface of the irrigating canal proceeding from the cañon of the Arkansas, in August.

LIMNOTRECHUS Stål.

L. marginatus.

Gerris marginatus Say, Heteropt. New Harmony, 36, No. 2.

Dr. Packard collected specimens of it near Manitou, July 15. It was seen by me on the surface of puddles in the western suburbs of Denver, in August.

LIMNOPORUS Stål.

L. rufoscutellatus.

Gerris rufoscutellata Lat., Gen. et Sp. Ins., iii, 134, No. 2.

It was collected by Dr. Packard, at Denver, July 28, and by myself on the surface of small ponds and puddles in the depressions of the plains west of Denver, August 8 and later.

Family NOTONECTIDÆ.

NOTONECTA Linn.

1. *N. insulata.*

Notonecta insulata Kirby, Fauna Bor.-Amer., iv, 285, No. 399.

Notonecta rugosa Fieber, Rhynchotog., 52, No. 7.

This species was quite common in several pools of water standing in hollows near the bed of creek on the outskirts of Denver, August 4 and 5. By the 18th of August, the inhabitants of these pools had gone, and the pools essentially dried up.

2. *N. undulata.*

Notonecta undulata Say, Heteropt. New Harmony, 39, No. 1.

Found in the same pools as the preceding, and at the same time, but much less abundant; also in Sloan's Lake, west of Denver. Larva, nymph, and imago likewise from the latter place, by Dr. Packard, July 10.

Family CORISIDÆ.

CORIXA, Geoff.

1. *C. subtilis.*

Corixa subtilis Uhler, Bull. U. S. Geol. Surv., vol. ii, No. v, p. 73.

A few specimens were met with in Sloan's Lake, on the highlands west of Denver, August 5.

2. *C. interrupta*.

Corixa interrupta Say, Journ. Acad. Phila., iv, 323, No. 1.

A few examples were taken in Sloan's Lake, on the highlands west of Denver, in July by Dr. Packard, and in August by myself.

3. *C. tumida*, new sp.

Pale fuscous, elongated, the whitish lines generally broader than the brown spaces; the surface very obsoletely rastrated on the pronotum, and not rastrated, but faintly uneven, on the clavus and corium. Head longer than wide, white, the vertex tumid, subconically rounded in front, with a blunt ridge along the middle line, which terminates in a carina anteriorly, and in an angular production of the occiput posteriorly; each side of this ridge is a line of coarse punctures, connecting anteriorly with some finer ones; next the inner margin of the eyes the surface is linearly impressed and finely punctate; the occipital margin carinately elevated, and having the angle next the eye depressed and punctate; front long, ovately excavated in its whole length, and in its width below the first third; a large elliptical fossa next the lower angle of each eye invaded by a group of coarse punctures. Pronotum of medium length, somewhat obliquely arcuated behind, pale yellowish, highly polished, with nine very slender, brown, complete lines, and about three shorter ones (sometimes with fewer full lines and more sharp ones); the first line interrupted in the middle; clavus margined with brown basally on the outer margin, and with a slender brown line on the inner submargin; the surface yellowish-white, with a few straight, very short, brown, slender lines at base, some connected with the inner margin and others with the outer margin; the brown lines behind the base slender, wavy, arranged in two series, each starting from the opposite margins, and along the middle coalescing in part, and forming a longitudinal, wavy line; corium highly polished, yellowish-white, the brown lines slender, wavy, forming generally about three transverse series, and coalescing posteriorly to form two longitudinal lines; the costal edge brown, with the epipleura whitish, and having the transverse nervure and a spot before the apex fuscous; membrane with vermiculate brown line behind the middle, more or less coalescing posteriorly. Legs yellowish-white, the posterior ones long, with the hindmost tarsi and tip of tibiæ piceous; palæ of the male very short, tinged with tawny, depressed near the tip, shaped like a shovel, with a round base, very obliquely truncated, leaving the tip quite acute, the inner margin with a few moderately long bristles; fore tibiæ compressed, a little incurved, longer than wide, the outer margins a little arcuated, the posterior submargin with an impressed line, and the anterior margin carinated. Tergum blackish, with the connexivum yellowish; venter blackish, with the surface very minutely, whitish pubescent; the posterior margins of the segments and the connexivum yellowish.

Length to tip of hemelytra 6-6½ millimeters. Width of base of pronotum 1½-2 millimeters.

The pronotum has a short longitudinal carina on the front of the disk.

Inhabits Sloan's Lake, west of Denver. Found there by Dr. Packard on July 10, and by myself in the early part of August. Besides, it occurred in several pools of water on the low grounds of the suburbs of Denver, August 5 and 8. Later, the pools had dried up, and their inhabitants were no longer to be found there.

4. *C. decolor*.

Corixa decolor Uhler, in Packard's Insects Inhabiting Salt Water, Silliman's Journ., 1871, 106.

Found by Dr. Packard, on July 27, in a brook flowing into Great Salt Lake, Utah, and in the lake.

HOMOPTERA.

Family STRIDULANTIA.

CICADA Fab.

1. *C. parvula*.

Cicada parvula Say, Journ. Acad. Phila., iv, 333, No. 5.

Two varieties of this species were collected, June 25, at Lawrence, Kans.

2. *C. synodica*.

Cicada synodica Say, Journ. Acad. Phila., iv, 334, No. 6.

One specimen occurred to me, on August 11, near Cañon City, Colo. It was dead and lodged in the axil of one of the Elkhorn Cacti, which there abound on the foot-hills.

3. *C. putnami*, new sp.

Blue-black, polished, pubescent, narrow, with long hemelytra. Head transverse, bluntly triangular, blue-black, clothed with erect, brownish pubescence, rugose and uneven; moderately flat above, with the orbits a little upturned, and eyes spherical, large, prominent, and projecting over the anterior angles of the pronotum; disk of the vertex convexly elevated, with the middle line deeply grooved, including the bed of the anterior ocellus, and with an arcuated, impressed line each side in the broad depression, anteriorly bounded by a straight, transverse, impressed line; supra-antennal plates orange, deeply excavated to receive the antennæ; antennæ stout, black, the basal joint orange, projecting a little beyond the margin of the plate; hypostoma compressed, margined each side with bright orange, distinctly ribbed, the face longitudinally split, and the gaping edges raised, thick, orange; the front superiorly bluntly semicircular, rugulose, grooved on the middle line and with a large fossa in the center; outer cheeks angular above, carinate, and edged with orange; labrum orange, the rostrum black, but banded with orange at base, the tip reaching well back upon the posterior coxæ. Pronotum short, blue-black, pubescent, dull, rugose, and irregularly tuberculated,

the sides steeply rounded, the anterior margin narrowly, the posterior margin broadly, and the flat, middle line, not reaching to the base, orange; lateral margins a little oblique, deeply decurved on the middle, causing the anterior angle to be upturned, the latter almost rectangular, but blunted; posterior margin a little concave, the outer angles lobate, broad, flattened, obliquely recurved behind the transverse, impressed line which separates the lobes, the outer margin oblique, almost truncate; each side anteriorly with two oblique, impressed lines. Propleuræ orange, rugose, with the margins thickened and a little raised; the other pleural pieces, sternum, and coxæ dull black, hairy, margined with orange; the tympanic fulcræ and the legs also orange, invested with fulvous pubescence; femora broadly black on the upper, fore, and hinder sides; the anterior pair also black on the under side, having two long, slender, cylindrical teeth, of which the one near the middle is very oblique; apices of the tarsi and nails blackish. Mesonotum polished, blue-black, obsoletely rugulose and punctate, the scutellum raised into a V, carried back upon the metanotum, and blunt and tumid at tip; the metanotum orange, short, with a black spot on the middle. Hemelytra and wings hyaline, faintly tinged with brown toward the apex; base, tegulæ, and costal nervure orange, the latter long and broadly arcuated; the marginal nervure beyond the anastomosis and all the other nervules blackish-piceous; the costal areole very long and broad, the discoidal also long and broad, much wider at the posterior end; the areole joining the tip of the costal one on its inner side short and triangular; the apical areoles narrow, but not very long. Abdomen black, hairy, the male genital sheath very long, tubular, a little tapering.

Length to end of genital sheath 21 millimeters; to tip of closed hemelytra 26 millimeters. Width of base of pronotum 7 millimeters.

Collected in the vicinity of Clear Creek, Colorado, by Mr. J. Duncan Putnam, to whom I take great pleasure in dedicating this pretty little species. It pertains to the same group as *C. areolata* Uhl., agreeing with it pretty nearly in the shape of the genital organs. But it differs in the prominence of the eyes, in the narrower pronotum and hemelytra, and in the more acutely angular ends of the areoles. Other specimens have been taken at Ogden, Utah, which are identical with the type in color and structure. For the specimen obtained by Mr. Putnam, I am indebted to the kindness of Baron Osten Sacken.

Family MEMBRACIDÆ.

CERESA Fairm.

C. bubalus.

Membracis bubalus Fab., Ent. Syst., iv, 14.

I met with this species at every station in Colorado that afforded moisture sufficient for the growth of willows. The species is quite as abundant and variable as we find it to be in Maryland, Delaware, and

New Jersey. In the mountain-gulches, at the higher levels which admit the development of the willow, I found it in less numbers, of smaller size, and with less prominent thoracic horns. As in Maryland, I took, from a single clump of willow-bushes, a series of forms ranging from the extreme, with short, blunt, thoracic angles, and filled-out or convex disk, to that with long recurved angles and concave disk. In Denver City, it was also found abundantly upon many kinds of weeds growing on the depressed spots near water, as well as upon the willows; and it was only a little less common near Cañon City, where the soil is very different from that near Denver. In Clear Creek Cañon, it was not rare.

ENCHENOPA Amyot et Serv.

E. curvata.

Membracis curvata Fab., Syst. Rhyng., 13, No. 34.

Membracis latipes Say, Long's Expedition, ii, 302, No. 5.

Enchenopa antonina Walker, Brit. Mus. Homopt., ii, 488, No. 32.

Enchenopa venosa Walk., *E. densa* Walk., *E. frigida* Walk., *E. bimaculata* Walk., ib., ii, pp. 488-491.

Not uncommon in many parts of Colorado on the plains and foot-hills. I met with it in Denver, near Golden, near Colorado Springs, on small plants in low grounds, and also in the valley of the Arkausas near Cañon City in August. Dr. Packard obtained a specimen in the vicinity of Boulder on June 29.

PUBLILIA Stål.

P. modesta.

Publilia modesta Uhler, in Bull. U. S. Geol. Surv., ii, 78, No. 2.

Not abundant in any of the localities visited by me. I detected a few specimens in Clear Creek Cañon, August 6; at Colorado Springs and Manitou, August 17, and west of Denver, August 18; also at Pueblo, August 10.

CYRTOSIA Fitch.

C. fenestrata.

Cyrtosia fenestrata Fitch, Fourth Ann. Report, 49, No. 2.

A few specimens occurred to me while beating small oak-trees at Manitou, August 16.

Family CERCOPIDÆ.

APHROPHORA Germ.

A. quadrangularis.

Cercopis quadrangularis Say, Journ. Acad. Phila., iv, 335.

One specimen from the vicinity of Cañon City, and a few others from the region of irrigation west of Denver, August 6 to 17. Probably the scarcity of this insect may have been occasioned by the lateness of the season during which I was in the field. It is usually common in the places to which it attaches itself in its onward distribution.

PHILÆNUS Stål.

P. lineatus.

Cicada lineata Linn., Systema Naturæ [ed. 12], 709, No. 31.

Philænus lineatus Stål, Hemipt. Fabriciana, ii, 16, No. 2.

On the foot-hills near Golden, August 5. Doubtless it is widely distributed through the mountainous region of Colorado; but my period of collecting was probably too late in the season for the swarms in which it sometimes appears.

CLASTOPTERA Germ.

C. delicata.

Clastoptera delicata Uhler, in Bull. U. S. Geol. Surv., ii, 82.

I found only one specimen near Colorado Springs, while sweeping rank growths of plants in damp ground, on August 16.

Family FULGORIDÆ.

SCOLOPS Germ.

S. sulcipes.

Fulgora sulcipes Say, Jour. Acad. Phila., iv, 335.

Flata pungens Germ., Thon. Entom. Archiv., ii, p. 47, No. 11.

Captured on August 18, on low ground, in the suburbs of Denver.

CIXIUS Latr.

C. vicarius.

Cixius vicarius Walker, British Museum List Homopt., ii, 343, No. 22.

Originally described from Florida, but now known also from Massachusetts, Maryland, Texas. A few specimens occurred to me while sweeping the weeds in Western Denver on August 5. They were smaller than the specimens from Texas, and had the spots of the hemelytra much reduced in size.

STIROMA Fieb.

S. inconspicua, new sp.

Robust; vertex a little tumid, excavated each side and before the apex, sordid testaceous, marked with black. Front long and moderately narrow, almost parallel-sided, a little infuscated, the lateral keels prominent, piceous below the first third, the two central keels approximate, coalescing above, piceous; epistoma with the middle and lateral carinas and a slender stripe each side of the middle piceous; rostrum somewhat piceous. Eyes very moderately convex, longer than high, dark brown, margined with orange, the excavated inferior lobe yellowish-white. Pronotum dull testaceous, the disk posteriorly fuscous, minutely scabrous, with the central keel abbreviated anteriorly, and the lateral keels high, oblique, entire, a little infuscated; decurved sides orange, waved, acutely tapering, with the margins recurved. Mesonotum a little depressed, smooth, dull testaceous, tricarinate, the carinæ tinged with piceous. Legs pale yellowish, the fore and middle femora obsolete lined with fuscous; the tibiæ a little infuscated and with fuscous

spines; the apex of the last tarsal joint and the nails black-piceous. Mesopleuræ with the round indentation fuscous; the coxæ also a little fuscous. Hemelytra short, not reaching beyond the middle of the abdomen, broad, bluntly rounded behind, a little dusky, but paler exteriorly, on the base, disk, and posteriorly having some obscure, blackish, irregular cloudings, the nervures very distinct, those of the disk interrupted with piceous, and forking at tip; the apical margin a little thickened. Tergum dull ochereous, with the posterior margins of the segments black; venter spotted and marked with black.

Length $2\frac{1}{2}$ millimeters. Width of pronotum 1 millimeter.

It occurred in moderate abundance upon small bushes in Clear Creek Cañon August 6.

BRUCHOMORPHA Newm.

B. pallidipes.

Bruchomorpha pallidipes Stål, *Novæ vel Minus Cognit. Homopt.*, Berlin. Ent. Zeit., vi, 309, No. 3.

One specimen, swept from plants on the plains near Colorado Springs, August 13.

This species has a less prolonged and acute head than *B. dorsata* Fitch, to which it is closely related. The length of the yellow vitta on the head, pronotum, and commissure of the hemelytra varies very much; and the legs are often rufo-piceous, with only the coxæ yellow.

Subfamily TETTIGONINÆ.

Ocelli placed on the vertex superiorly.

PROCONIA St. Farg. et Serv.

P. costalis.

Tettigonia costalis Fab. Ent. Syst., suppl., 516, Nos. 22-23.—Signoret, *Annales Soc. Ent. France*, 3d ser., ii, 359, pl. 12, fig. 8.

Widely distributed throughout the region of Colorado less remote from the foot-hills. It was extraordinarily numerous near Colorado Springs, upon low plants, August 13-17. On the low hills west of Denver, also near Golden and in Clear Creek Cañon, it was found less abundantly. In Manitou Park, a few specimens were taken from low plants. The nymph is odd-looking, pale brown, with three yellow stripes along its whole length. Dr. Packard collected a larval specimen at Boulder, June 29.

DIEDROCEPHALA Spin.

1. *D. mollipes.*

Tettigonia mollipes Say, *Journ. Acad. Phila.*, vi, 312, No. 4.

Very abundant on grass and weeds in low spots near Denver and in the vicinity of Golden, August 5 and later in the month.

2. *D. noveboracensis.*

Aulacizes noveboracensis Fitch, *Catal. Ins. N. Y. State Cabinet*, 56, No. 2.

This is more particularly a foot-hill and mountain species. It occurred

to me in Clear Creek Cañon and at Golden, August 5-7. One specimen was taken west of Denver on August 9.

HELOCHARA Fitch.

H. communis.

Helochara communis Fitch, Ins. N. Y. State Cabinet, 56.

Very common in grassy marshy spots in the bed of the creek which passes through Denver, also in similar situations on the farms west of Denver. Some specimens were of larger size than usual. On the eastern side of the continent, it is common in damp meadows from Maine to Georgia. It is found also in Texas, and in my collection is a specimen from New Leon, Mexico. In Maryland, it sometimes swarms in the grass adjacent to brooks and streams, and occurs in two varieties, the less common one of which is mostly of a clear bright green.

TETTIGONIA Geoff.

T. hieroglyphica.

Tettigonia hieroglyphica Say, Journ. Acad. Phila., vi, 313, No. 6.

Common in many parts of Colorado. I swept it from plants in Beaver Brook Gulch, near Golden, in Denver, abundantly near Colorado Springs, at Manitou, and in Manitou Park, and less common near the mouth of the great cañon of the Arkansas.

GYPONA Germ.

1. *G. octolineata.*

Tettigonia octolineata Say, Journ. Acad. Phila., iv, 340, No. 1.

Gypsona striata Burm., Gen. Ins. Fam., v, No. 9.

Taken by beating bushes in Clear Creek Cañon, August 7; also at Denver; at Manitou, August 13; and in the mouth of the cañon of the Arkansas.

2. *G. cinerea*, new sp.

Aspect of *Philenus*, short, dark cinereous, more or less tinged with yellow. Head long-semilunate, angular at tip, and with the tip recurved, black; vertex flat, coarsely punctate with black, a little pubescent, impressed behind the apex generally with a short, impressed, longitudinal line, and each side with a longer one, or with simply indentations in their places; face irregularly dotted with piceous, and with a few punctures on the sides, the front convex transversely, more prominent above, triangularly impressed at base, sometimes with traces of transverse brown lines; cheeks broad, the outer ones oblique, a little expanded, and broadly rounded, very slenderly tapering on the apical half. Antennæ largely piceous, or banded with piceous. Pronotum transversely rugulose, pointed with fuscous, a little punctate anteriorly and near the sides, a transverse series of short, indented lines behind the forward margin, and with a bald patch in the place of callosities; lateral margins oblique, slanting beneath the middle of the eyes, the

edge narrowly recurved; propleuræ dotted with fuscous, the meso- and meta-pleuræ pale, a little tinged with piceous on the disks. Legs pale brownish, or dull testaceous, dotted with fuscous; the coxæ clouded with fuscous, and the femora and tibiæ more or less piceous on the upper face, and the latter sometimes also on the under face; tarsal joints either black beneath or at the apex or with the last joint; nails and pulvilli piceous. Scutellum short, acute, minutely rugulose and punctate at base and in patches, minutely dotted with fuscous at remote, unequal intervals. Hemelytra very broad, and with the costal margin more arcuated in the female than in the male, and with the cells shorter and more irregular; the nervules thick, prominent, margined each side, throughout, with fuscous, impressed punctures; the costal edge thickened, a little recurved, the submargin punctate with fuscous; apical cells longer and less oblique-sided in the female than in the male. Tergum more or less black, and the venter black basally, or with the disks only of the segments before the apex black, or with all the segments simply punctate with fuscous. The surface is generally invested with minute, prostrate, yellowish pubescence.

Length to tip of hemelytra 7-9 millimeters. Width of pronotum $2\frac{1}{2}$ -3 millimeters.

One specimen from near Manitou, August 13. Other specimens have been taken in Kansas, Utah, Illinois, and Connecticut.

PARAPHOLIS, new gen.

Aspect of *Eupelix* Burm., but with the head forming a more symmetrically rounded scale, and with the ocelli placed on the back of the vertex, a little in advance of the anterior line of the eyes. Head extremely depressed and thin, composing a disk which is a very little wider than long, with the sides obliquely rounded and meeting at tip almost in an angle; front very long-elliptical, very convex and prominent, with the adjoining fore part of the face correspondingly depressed; the outer cheeks narrow and long, sinuated exteriorly, and curving inwardly with an acutely angular tip; the inner cheeks small and very narrow, almost confined to the sides of the *epistoma*. Antennæ very short, stout at base, the two basal joints subequal, roundish, the third much narrower, conical, thence tapering and setaceous. Pronotum transverse, the latero-posterior sides long and sinuated; the middle of the posterior margin also angularly sinuated. Posterior lobe of the scutellum very long, narrow, and acuminate at tip. Hemelytra long, steep behind the base, wider posteriorly, the inner margin straight, and at tip slightly valvate, the costal margin broadly arcuated; nervules coarse and wide apart, the apical cells blunt, short and broad, five in number, the outer one triangular at base, the inner one oblique, subtrapezoidal; tip obliquely rounded.

P. peltata, new sp.

Pale green, elongate, flattened disk-like in front, and wedge-shaped

behind, closely sunken-punctate all over, excepting the sternum, tergum, and legs. Head very broad and long, flat, acutely long-lunate, the tip faintly turned up and subangulate, with an obsolete, slender, raised line running back to the base of the pronotum; edge sharp; punctures brown, and sometimes a brown streak along the middle; each side of middle with a short impressed line; front and cheeks a little tinged with brown, and with the punctures of the same color, the superior part of cheeks with finer uncolored punctures. Antennæ yellow at base, green at tip. Eyes oblong, dull brown, carinated behind. Pronotum flattened and uneven anteriorly, a little convex posteriorly, very coarsely and deeply, closely punctate, the punctures chiefly brown, each side of middle anteriorly a little impressed, and exterior to this a larger and deeper impression; lateral margins oblique and almost continuous with the arcuated, anterior margin; the latero-posterior margins sinuated and with a thickened edge, the outer angle almost rectangular; posterior margin concavely sinuated, and with the ends of the sinus broadly rounded. Scutellum irregularly and more finely punctate, the apex impunctate. Legs green, including the tarsi, finely dotted with brown; the pulvilli large and stout, as in *Gypona*. Hemelytra very coarsely, deeply, closely punctate, the punctures usually brown, placed in longitudinal series; nervures straight, a little wavy at tip. Tergum smooth; venter remotely and finely pointed with brown, and punctate.

Length to tip of hemelytra 6-9 millimeters. Width of pronotum 2-3 millimeters.

One specimen from Clear Creek Cañon, August 7. Inhabits also Texas, Mexico, Cuba, Hayti, Georgia, Massachusetts, and Maryland. In the latter State, I have swept it from Ferns in June, September, and October.

Subfamily JASSINÆ.

Ocelli placed on the front edge of the vertex near the eyes, or on the sides of the face below the front line of the vertex.

GLOSSOCRATUS Fieber.

1. *G. viridis*, new sp.

Bright apple-green, yellowish when faded, opaque, long and narrow; the edge of the head and outer margins of the pronotum and hemelytra whitish. Head shorter than usual, flat, shorter than wide, angularly long-lunate, the edge a little recurved; surface not apparently punctate, the middle line smooth, conspicuous chiefly at base; front broad and moderately convex, sometimes a little impressed immediately below the upper margin, and with a dark line concurrent with the margin; tip of rostrum piceous; eyes a little dusky; the ocelli placed very near them on the margin, pale yellowish. Pronotum transverse, almost flat, a little rounded down on the sides, somewhat indented and uneven anteriorly; the lateral margins recurved, oblique, a little curved, and almost continuous with the slightly arcuated anterior margin; posterior

broadly and very feebly concave; the postero-lateral margin short, a little oblique, the outer angle almost rectangular. Beneath and legs pale greenish; the tarsi and nails luteous or pale piceous. Hemelytra opaque, impunctate, narrow, the inner margin straight, very fully valvate at tip, where it is also thinner, almost transparent, and sometimes tinged with fulvous; the costal margin straight at base, but broadly arcuated posteriorly; the nervures straight and often of a slightly deeper green; the apical areoles short and small, sometimes nearly quadrangular, and the costal area occasionally with several oblique cross-nervures. End of the abdomen acutely tapering, sometimes rufous.

Length to tip of hemelytra 6-7 millimeters. Width of pronotum $1\frac{3}{4}$ - $2\frac{1}{4}$ millimeters.

Apparently a rare insect. One specimen was found near Golden, and a few others were taken on the highlands west of Denver. It has also been captured in Eastern Massachusetts, Connecticut, New York, Canada, and Illinois. It resembles *Gypona*, and is the *G. reverta* of my former list.

2. *G. lineatus*, new sp.

Pale green, broader than the preceding, with the head very flat, long, and longer than wide, with four slender, longitudinal, orange stripes, which extend also upon the pronotum and scutellum, and the nervures of the hemelytra also striped with orange. Head having the outline of a bishop's miter, but a little acute at tip, the margins reflexed; the surface obliquely indented each side, roundly indented each side near the base, and with a slender, longitudinal line along the middle; submargin of the face broadly flattened, the front convex, moderately broad, hardly rugulose; rostrum a little tinged with piceous. Pronotum very short, obsoletely rugulose; the sides a little obliquely widening anteriorly, margined with white, slightly decurved; anterior margin straight along the middle, but curving toward the sides; posterior margin a very little concave; the postero-lateral margins obliquely truncated, but almost continuous with the posterior margin. Scutellum short and wide, smooth. Legs green, the spines of the tibiae stout, yellow; incisures of the tarsi, and the nails reddish. Hemelytra shorter than the abdomen, straight, the costal margin almost parallel with the sutural one; nervures straight, destitute of straight cross-nervures; the apical areoles very small and confined to the tip of the membrane; the outer areole usually absent. Venter smooth, pale yellow, the ovipositor and valves more or less rufous; end of the body acutely tapering.

Length to tip of hemelytra 7-8 millimeters. Width of pronotum $2\frac{1}{4}$ - $2\frac{1}{2}$ millimeters.

Occurred to me in a few specimens upon the salt-marshes of the coast of New Jersey in August.

This and the two following species are introduced here to complete the series as thus far known in North America.

These beautiful insects are of great interest in the fauna of North America, recalling a group hitherto known only from Southern Russia and the East Indies. Although of a clear green color when fresh, they are apt to turn pale yellow after the lapse of a few weeks.

3. *G. vulneratus*, new sp.

Pale green; form of the preceding, depressed, the head long, very flat, not narrowed at base, but obliquely rounded anteriorly, and with the tip narrow, almost acute, and a little turned up; the vertex with an oblique, short, vermilion stripe each side, and with three longer ones on the pronotum; nervures of the hemelytra orange. Margins of the head reflexed; the submargin of the face very much flattened, the front moderately inflated, obsolete rugulose in chevrons; the under side of the head, the pectus, and the venter pale yellowish. Eyes brown. Antennæ and rostrum pale yellow. Pronotum transverse, short, of the same shape as in the preceding. Scutellum smooth, with three slender, longitudinal, orange stripes. Hemelytra shorter than the body, a little tapering posteriorly; the costal margin moderately arcuated; wings white. Abdomen smooth, a little infuscated at tip.

In two specimens, the head has an orange chevron exterior to the red lines and an orange line in the middle; and the pronotum has four orange lines.

Length to tip of hemelytra 7-8 millimeters. Width of pronotum $1\frac{1}{2}$ - $2\frac{1}{2}$ millimeters.

From Central Texas; collected by G. W. Belfrage.

4. *G. fenestratus*, new sp.

General form of the preceding; head very long and flat, but with the sides more narrowing toward the tip; color yellowish-green, the head with four slender, orange lines, and the pronotum with six, and the scutellum with four. Head more obliquely rounded than in the others, more acute at tip, the tip upturned; surface of the face a little uneven, the sides anteriorly less flattened than usual, the front inflated, a little flattened in the middle, and occupying most of the width of the face, pale yellowish-green, a little infuscated in front; antennæ and rostrum yellow. Pronotum as in *G. lineatus*, the sides oblique, narrowing toward the head, the margins recurved. Scutellum short and broad, smooth. Legs yellow, the posterior tibiæ blackish, with orange spines; tarsi blackish, with the joints margined with testaceous. Pectus orange. Hemelytra pale green and with orange nervures on the basal half, the posterior half whitish-hyaline, bounded behind and before by a broad blackish arc, the two bands connected on the costal margin by a black streak, and in the costal middle a transverse blackish streak runs inwardly; the costal margin a little arcuated; the sutural margin straight, tinged with fuscous; apical areoles large. Wings white. Metapleura and venter black, the posterior edges of the segments of the latter yel-

low; the anal segment of the male with tufts of fulvous bristles above and below.

Length to tip of hemelytra 6 millimeters. Width of pronotum 2 millimeters.

Thus far I have found it only once, on the salt-marshes of the New Jersey coast, in August.

BYTHOSCOPIUS Germ.

1. *B. pallidus*.

Idiocerus pallidus Fitch, Ins. N. Y. State Cabinet, 59, No. 5.

This species proved to be quite common in Clear Creek Cañon, also near the South Platte River and its tributaries near Denver, and at Manitou and Colorado Springs, chiefly upon willows, August 6 to 18.

2. *B. verticis*.

Jassus verticis Say, Journ. Acad. Phila., vi, 303, No. 6.

Found upon willows, at Denver, August 9 to 18.

3. *B. ramentosus*, new sp.

Form of *B. pallidus*, broader and more robust than *B. verticis*; pale testaceous, more or less clouded with rust-brown and fulvous. Head broad and short, fulvous above, yellow inferiorly; vertex with a round black spot each side and a smaller black dot each side interior to the ocelli; face sometimes irregularly marked with small brown spots and lines, those above being arranged transversely, and those below in a horseshoe arc; epistoma chestnut-brown, with the base and middle line testaceous; rostrum pale testaceous. Pronotum transverse, short, pale testaceous, with a chestnut-brown uneven cloud on the disk, leaving an abbreviated line of the ground-color along the middle; each side near the outer margins with a few brown patches; the posterior margin feebly sinuated, and the lateral margins very oblique and a little curved. Scutellum pale testaceous, a triangular black spot near each basal angle, and a blackish dot each side of the middle of the disk; the base and sides more or less fulvous. Beneath pale yellow, with two or more black spots on the center of the pleural pieces. Coxæ with a few traces of brown; femora and tibiæ with a few brown streaks; tarsi banded with brown, the nails and pulvilli piceous. Hemelytra pale testaceous, or even milky-white, the areoles and tips of the nervures pale brownish; costal and sutural margins and basal part of nervure pale; wings hyaline, faintly tinged with brown, the nervures fuscous.

Length to tip of hemelytra 5-5½ millimeters. Width of pronotum 1¾-2 millimeters.

On willows in the city of Denver; also in Clear Creek Cañon and at Manitou.

The upper surface of the head and the pronotum are frequently variegated with brown, fulvous, and yellow in areas of different sizes; and the face lacks the spots, or a portion of them, from the front and cheeks.

PACHYOPSIS, new gen.

Broad and robust; head from above very short, bluntly rounded, including the eyes a little wider than the pronotum, the vertex and front confounded in a common convexity in both diameters; ocelli on a line with the middle of the eyes, large, and placed remotely from each other; front short and broad, prominently and abruptly raised above the level of the cheeks and epistoma; epistoma flat, almost as wide as long, short and broad, the end truncated, and the sides a very little oblique, or very feebly sinuated; antennæ short, the basal joint short, very thick, rounded, the four following joints very short, narrow, tapering, the apical one with a short, oblique bristle; outer cheeks very broad, curving bluntly to concur with the tip of the epistoma; inner cheeks wider, a little longer than the epistoma, with the inner margin oblique and the outer margin curving inferiorly and making an acute tip. Pronotum transverse, of medium length; the posterior margin feebly concave, the postero-lateral margins oblique, with the angles a little rounded. Hemelytra moderately long, not valvate, narrowing toward the tip, the tip narrow and obliquely rounded; inner margin straight, and the costal margin broadly arcuated; nervures straight, the outer one acutely forked near the base, and its two branches each forking on the last third of the corium; apical cells short, the middle one shortest, quadrangular; the next outer one almost twice as long as the former; the next inner one widening posteriorly, and of the same length as the outer; the outer marginal apical cell much longer than the other, and showing a tendency to reticulation; the inner marginal apical cell a little longer than the one next outward, acute at tip. Anterior tibiæ with close, long bristles; posterior ones with long, stout spines.

1. *P. latus*, new sp.

Clear yellowish-green; contour somewhat like *Selenocephalus*. Head formed above of a narrow arc, its curve agreeing with the anterior curve of the pronotum; face bluntly convex; the surface minutely sericeous pubescent, very minutely rugulose; ocelli amber-yellow, large; antennæ pale yellow at base, a little dusky at tip; eyes brown, triangular, with the angles rounded. Pronotum transversely wrinkled, finely pubescent; the sides short, and with the edge slenderly recurved. Scutellum broad and short, a little scabrous, and feebly punctate on the base of disk; minutely pubescent. Beneath paler; legs yellowish-green, the under side of tarsi and the pulvilli and nails slightly piceous. Hemelytra translucent, pale greenish, slightly blackish pubescent, coarsely punctate in longitudinal series; nervures stout, those of the apical part of the costal area a little reticulated; costal nervule stout, recurved; the tip narrow, and obliquely rounded; wings hyaline, with the nervures scarcely discolored.

Length to tip of hemelytra 7 millimeters. Width of pronotum $2\frac{1}{4}$ millimeters.

It occurred at Manitou and near Cañon City, upon small bushes near water, August 11-16.

2. *P. robustus*, new sp.

Shorter and more robust than the preceding species, with a shorter and blunter vertex. Color pea-green, yellowish when faded. Face broad and short, the surface microscopically punctate and very minutely wrinkled across the whole width; cheeks broad, a little angular exteriorly, emarginated next the anterior coxæ; antennæ short, yellowish; eyes fuliginous; rostrum dusky at tip. Pronotum transverse, feebly convex, transversely wrinkled; the posterior margin a little concave; the lateral margins oblique, a little arcuated, with the edge recurved; the lateral angles triangular, a little rounded at tip; postero-lateral margin oblique, hardly sinuated. Legs pale green, with the sockets of the tibial spines, the apical margins of the tarsal joints, the nails, and pulvilli piceous. Scutellum transversely wrinkled, and with a transverse, arcuated, impressed line on the middle. Hemelytra beset with short, oblique, black bristles in the punctures all over the surface, the tip a little narrow, slightly infuscated within the margin; the nervures brighter green, the inner, bounding one, apically, oblique, angularly emarginated at base; the apical areoles short, the central one quadrangular; wings whitish. Tergum more or less orange on the disk; venter yellowish-green, set with remote, small punctures, and remotely pubescent, the tip with bundles of longer hairs.

Length to tip of venter 4 millimeters; to tip of hemelytra $4\frac{1}{2}$ millimeters. Width of pronotum 2 millimeters.

Inhabits New Mexico and Texas. Two fine specimens from Waco were sent to me by G. W. Belfrage.

The tegmina are thick and more opaque than in the delicate green *Gyponas*, and in this species rather more so than in the preceding one. The male is as yet unknown to me.

PEDIOPSIS Burm.

P. viridis.

Pediopsis viridis Fitch, Insects New York State Cabinet, 59.

One specimen from the willow, in Clear Creek Cañon, and another from the vicinity of Cañon City.

JASSUS Germar.

1. *J. irroratus*.

Jassus irroratus Say, Journ. Acad. Phila., vi, 308, No. 7.

Jassus testudinarius Burm., Genera Insect. Jassus, No. 4.

Common in most parts of the United States upon a great variety of plants and bushes. I secured specimens in the suburbs of Denver and in the valley of the Arkansas.

2. *J. excultus*, new sp.

Pale testaceous, marked and marbled with pale brown and fuscous,

very stout and short; aspect of *J. irroratus* Say, but much thicker and shorter. Head narrower than the pronotum, relatively to its width longer, and more acutely triangular than in *J. irroratus*, smooth and polished, the occipital margin with white, irregular patches, and each side of middle with a short, arcuated, or hooked black line; vertex each side posteriorly with a large patch of vermiculate or marbled fuscous lines, sometimes coalescing, the surface behind these a little depressed; each side of apex with a paler spot of brown lines; face irrorated and marbled with dark brown, sometimes omitting the middle line of the front and the disks of the cheeks; occasionally fuscous with remote testaceous dots; epistoma a little wider at tip, the base and sometimes each side marked with brown; rostrum piceous at tip. Pronotum broadly sublunate, much narrower anteriorly, transversely wrinkled, minutely punctate in a few places; generally with two brown, arcuated spots on the middle behind the head, the remaining surface inscribed with fuscous, sometimes also with ochreous in curved lines and marblings or dots, either of which may be obliterated or confused; lateral margins curvedly oblique, pale, recurved; the posterior margin a little concave; the lateral and postero-lateral angles rounded, the latter very bluntly so; the deflexed sides with a large black patch above. Epipleuræ and coxæ generally with more or less large black patches on the disks and superiorly. Legs pale testaceous or yellowish-white; the femora stout, the anterior and intermediate ones twice banded or clouded and dotted with brown; tibiæ, excepting the posterior pair, with four black abbreviated bands, the posterior pair with a large black spot at the base of each spine; tips of all the tibiæ, of the tarsal joints above, and the nails and pulvilli black. Scutellum short and broad, smooth, unevenly and irregularly marked and spotted with fuscous. Hemelytra pale testaceous or whitish, ramosely lined with fuscous, with fuscous nervures on the clavus, the other nervure pale brown, but darker posteriorly; the inner margin of clavus broadly wavyly pale, and marked with about three fuscous spots, of which the posterior one is placed on the apex; costal margin broadly curved, the nervure white, just inside of it is a series of small brown spots, reaching around the tip and becoming larger at that point; transverse nervules generally marked with branching brown spots; apical areoles short, with their lateral nervules curved; the areoles are sometimes so crowded with brown branching lines that the surface appears dark brown, and in such specimens pale dots are conspicuous in the spaces between. Wings milk-white, the nervures fuscous. Tergum black, the segments sometimes margined behind narrowly and on the sides broadly with testaceous, or sometimes bright yellow; venter generally black on the disk, the sides and apical segments dotted with fuscous; genital segment of the female beset with remote, pale, stout bristles.

Length to tip of venter 5-8 millimeters; to tip of hemelytra 6-8 millimeters. Width of pronotum $2\frac{1}{4}$ - $2\frac{3}{4}$ millimeters.

This is a most variable insect, of which I have received specimens from Florida, Georgia, Texas, Illinois, Massachusetts, Pennsylvania, New Jersey, New York, Minnesota, and Kansas. The largest specimens are found in Florida; those of Texas are not so large. I collected one specimen near Denver, August 18; it was of the small size, and pale in colors. Another specimen from Pueblo is smaller than either from the other localities, and has less of the fuscous marking upon the upper surface. In Maryland, it may occasionally be found sitting upon the oak-bushes in late summer and early autumn.

3. *J. jucundus*, new sp.

In form similar to *J. irroratus*, and like it with the head a little wider than the pronotum, white or yellowish-white, a little reticulated, and twice or thrice broadly clouded with brown across the hemelytra. Vertex lunate, hardly angular at the apex, but faintly ridged at that point, traversed by four faint brown clouds, or with a brown transverse line crossing nearly its whole width, a longitudinal line on the middle connecting with this behind a fainter one each side, also running back; the two outer spaces thus formed being occupied each by a brown oblong dot; the margin brown, and behind it four brown dots, of which the two central are near together, and the outer ones remote and transverse; eyes large, fuscous, margined with testaceous; front brown, marked with pale, transverse lines, or fuscous below and pale above; the outer cheeks a little angular exteriorly, broad, infuscated above, or clouded exteriorly and below; inner cheeks either brownish above or fuscous, excepting only the margins; tylus obliquely narrowing at base, the disk with a large piceous spot; antennæ long, slender, more or less fuscous beyond the base; sometimes the basal joint is fuscous above. Pronotum moderately long, bluntly lunate, concave behind; white or yellowish, transversely rugulose, marked nearly all over with brown, more or less confluent freckles, which omit the sides and sometimes the middle line; anterior margin each side convex and slanting down behind the eyes; lateral margins very short, curving down and forming a part of the curve of the anterior margin; latero-posterior margin long, oblique, with the inner angle not obtuse and a little rounded; the deflexed sides fuscous; pleural pieces yellow and orange, and each marked with a more or less large black spot. Scutellum yellowish, chestnut-brown each side, with four spots or lines of dark brown each side in contact with the lateral margin, a fuscous fusiform line on the middle; another transverse, and two round dots near the base; sometimes with a white streak in each basal angle, a larger spot each side and the tip whitish. Coxæ blackish at base, or they and the femora, excepting the knees, blue-black; anterior and intermediate femora with a black patch and oblique line on the inner face and with a streak of dots, a line, and a long spot on the outer face; tibiæ pale testaceous, marked with black dots at the base of the spines; the tip of tarsi piceous. Hem-

elytra milky-white, with a yellowish cloud at base, another behind the middle, and a third at tip; or with only a trace at base and a cloud from before the middle to the tip, or all these wanting; the nervures brown, darker at tip, the one between the clavus and corium testaceous or ochreous; transverse nervules of the costal area, a few ramose nervules on the disk and behind it, a macular open band before the middle, a similar one behind the middle, and some traces and an irregular circle at tip, together with broad margins of the nervures, dark brown; wings whitish, with brown nervures, and highly iridescent; the three apical areoles blunt and broad. Venter black at base, testaceous beyond, and rosy at tip, the valves being set with long, remote, stout, white bristles; tergum testaceous, black on the disk.

Length to tip of venter $4\frac{3}{4}$ – $5\frac{1}{2}$ millimeters; to tip of hemelytra $5\frac{1}{2}$ – $6\frac{1}{2}$ millimeters. Width of pronotum $1\frac{3}{4}$ –2 millimeters.

One specimen from Manitou, August 13; other specimens from Maryland, August 10, and from Texas.

The translucent hemelytra, with the clear brown marking in such strong contrast, give this species a very lively appearance, and signalize it as one of the most marked of its group.

4. *J. plutonius*, new sp.

Deep black, robust, the head a little more tumid and angular at tip than in the preceding species. Head, including the eyes, wider than the pronotum, black; the vertex triangularly lunate and a little tumid anteriorly; each side near the eyes with three dots, a dot at tip, a short line on the middle, anteriorly; four curved lines each side, the posterior margin, and the margin of the eyes orange; front prominent, obliquely declining, a little flat inferiorly, the transverse lines interrupted in the middle, orange, and with an orange geminate spot adjoining the ocellus, one a little lower down, a small one on the inner cheek, a large one on, and the margin of the outer cheek, the central line of the front, a spot at its tip, and a large spot each side of the base of tylus, orange; antennæ piceous, the base of the first joint yellow. Pronotum long-sublunate, moderately convex, convexly decurving each side, black, marbled, and flecked transversely, and slenderly margined with orange; the spots on the middle next the anterior margin and two or more each side of these larger; the lateral margin broadly orange, very short, and continuous with the anterior margin; the anterior margin convexly decurving beneath the eyes; the latero-posterior margin moderately long, a little oblique, arcuated, with the angles much rounded; the posterior margin almost straight; the decurved sides very short, black, contracted, and sinuated above. Mesopleura very large, the metapleura shorter, triangular, both black and margined with yellow. Coxæ black, partly margined with yellow; femora black, banded beyond the middle and at tip with testaceous; tibiæ pale testaceous, more or less clouded with piceous; tip of tarsi piceous. Scutellum black,

narrowly margined with orange. Postdorsalium and its side-pieces orange. Hemelytra blackish, the nervures and disks of the areoles whitish; membrane whitish, faintly tinged with dusky; the two outer areoles of the apex short, the next one inwardly long, widening gradually toward the tip, the inner one acutely triangular at tip. Wings hyaline, smoky at tip, highly iridescent, the nervures brown. Tergum and venter black, the apex and valves of the latter sprinkled with yellow, and beset with yellow stiff bristles; the penultimate segment of the female yellow each side, the posterior margin a little convex in the middle. Length to tip of venter 4 millimeters; tip of hemelytra 5 millimeters. Width of pronotum $1\frac{1}{4}$ millimeters.

One female from Clear Creek Cañon, August 6; others from Texas and Dakota.

5. *J. belli*, new sp.

Form of *J. letus* Uhl.; elongated, greenish-yellow; the head a little tumid, and, including the eyes, wider than the pronotum; vertex and face greenish-yellow, the former with a black transverse line on the middle, including a dot in the center and one at each end; front of vertex with two large, round, black dots placed transversely; front very moderately convex, slightly prominent superiorly, the bounding sutures and base of tylus black, the transverse lines brown; antennæ yellowish; eyes large, pale brown. Pronotum short, sublunate, pale bluish-green, highly polished, the anterior margin convex, bordered with dark brown, the sides arching beneath the eyes; the lateral margin very short and a little deflexed; the postero-lateral margin forming hardly more than a continuation of the curve of the posterior margin; deflexed sides short, of almost equal width throughout. Sternum and pleuræ black, the latter margined with yellow. Legs pale testaceous, the spines ochreous, and the tips of the tarsal joints and the nails and end of tibiæ pale piceous. Scutellum yellowish, the base with a transverse black line, and the middle with a brown T. Hemelytra greenish-yellow, the nervures straight, yellow; suture of the outer boundary of the clavus pale brown; the three areoles of the clavus with a brown streak at the sutural end, and a longer brown streak runs from near the base of the corium to beyond its middle; apical margin a little brownish, the areoles long and wide, the central one narrowest. Wings whitish, a little smoky at tip, and with brown nervures. Tergum black, excepting the outer margin and the posterior margins of the last two segments, which are yellow; venter yellow, black at base and in the marginal sutures of the genital segment and ovipositor; apex of the penultimate ventral segment deeply and widely incised and tinged with brown, with the side-lobes oblique and a little arcuated. ♀.

Length to tip of venter $3\frac{1}{2}$ millimeters; to tip of hemelytra 5 millimeters. Width of pronotum $1\frac{1}{4}$ millimeters.

One female specimen from Manitou.

Named in kindly remembrance of Dr. William Bell, and of his courtesies to me at Manitou, Colo.

6. *J. divisus*, new sp.

Chiefly black, ground-color of head and pronotum yellow, hemelytra hyaline, with two or three dusky bands across them. Head a little tumid, including the eyes, wider than the pronotum; vertex moderately long, bluntly rounded in front, yellow, with a transverse, quadrangular black spot anteriorly, which is divided in the middle, and sends a short, slender branch along the inner margin of the eye; each side posteriorly is a round, black dot; sometimes the black spot is broken into four smaller ones; face yellow, with a black stripe running down the middle to the tip of the tylus, expanded in the center; each side with a series of lines, and across the tip of the front a broad band; inner cheeks broadly margined all round, a spot beneath the eye and the depressed sutures black; antennæ piceous, occasionally banded at base with yellow. Eyes pale brown, set on a yellow base. Pronotum transverse, moderately flat, transversely rugulose, pale yellow, with two oblique blackish streaks on the middle, which converge anteriorly and touch two transverse, small, black spots; the stripes are occasionally straight, and widened posteriorly; the two spots are usually indented; the posterior margin almost truncated; the anterior margin broadly arcuated, a little curved downward on the sides anteriorly; latero-posterior margins absent, but the lateral margin straight, leaving the posterior angle rectangular, a little rounded; deflexed sides very narrow, sinuated, black inferiorly; pleural pieces black, partly margined behind with yellow. Coxæ yellow, generally clouded with blackish; femora lineated exteriorly with blackish; the tibiæ yellow, anterior and intermediate ones lineated with blackish, and the posterior ones with black dots at the bases of the piceous spines; tarsal joints tipped with black, and with the nails and pulvilli of the same color. Scutellum yellow, broadly black at base, and on the middle is a quadrangular, black line, which is bilobed on its posterior boundary. Hemelytra dusky hyaline, a little brownish at base and on the suture, apical margin of the corium, and apex of the clavus; before the middle is an angular double spot, running backward slenderly, and behind the middle a broad, incomplete band of two or three spots; nervures pale yellow, brown at tip; inner nervure of the clavus usually yellow, with a brown interruption at base and another at tip. Wings hyaline, the nervures a little brown near the tip. Tergum black, margined with yellow each side, and on the two segments preceding the tip, and the tip itself yellow; venter yellow, black at base, and sometimes on the middle of the posterior segments; the apical segment more or less ocherous.

Length to the tip of abdomen $2\frac{3}{4}$ -3 millimeters; to tip of hemelytra $3\frac{3}{4}$ - $4\frac{1}{2}$ millimeters. Width of pronotum 1 - $1\frac{1}{4}$ millimeters.

Abundant upon low herbage in damp fields at Denver, and near Sloan's Lake, west of Denver, August 17. One specimen has the hemelytra dusky yellow and without markings.

7. *J. latus*.

Jassus latus Uhler, Bull. U. S. Geol. Surv., vol. ii, No. 5, p. 94.

One specimen from the mountains near Beaver Brook, August 6.

PLATYMETOPIUS Burm.

P. acutus.

Jassus acutus Say, Journ. Acad. Phila., vi, 306, No. 2.

One specimen from near Manitou, August 13, swept from herbage near the Fountain Creek. It is very common in the Atlantic region, being found from Boston, Mass., as far as to the Saint John's River, Florida. A single specimen is in a bottle of my specimens from Utah, near Salt Lake.

DELTOCEPHALUS Burm.

D. argenteolus, new sp.

Form very similar to that of *Athysanus stylatus* Boh.; hemelytra very short, truncated, not reaching beyond the second abdominal segment; color bluish-green, silvered. Head short-conical, green, the vertex indented just behind the tip, the basal surface a little depressed; face paler, the front showing traces of faint, transverse lines; antennæ dusky, paler at base. Pronotum bluish-green, highly polished, short, much arcuated anteriorly, minutely transversely wrinkled; the lateral margins oblique, a little thickened; the deflexed sides depressed, bluish-white, crossed by two slender, black lines. Legs yellowish-green; coxæ a little clouded with black; femora faintly streaked with black on one or both faces, the outer face of the middle pair also twice banded with blackish; tibiæ usually a little streaked with blackish, but the posterior pair has a strong blackish line on the inner face. Sternum and pleural pieces black, the latter more or less margined with yellow, superiorly with a broad, pale vitta. Scutellum minutely rugulose, uniform bluish-green. Hemelytra short, almost truncated, bluish-green, tinged with silvery, coarsely punctate in oblique series, the nervures indistinct and the apical cells obliterated. Tergum elegant bluish-green, highly silvered, black at base; the penultimate segment margined on the sides posteriorly and on the posterior margin, the base of the last segment, and a transverse line of dots on each segment (on the last segment with only two dots) black; venter green, black on the base and along the disk as far as the ovipositor, a blackish dot on the center of each segment of the connexivum; sides of anal valves whitish-green, a little clouded or streaked with fuscous; the ovipositor and its sheath produced very much beyond the end of the abdomen, ochereous-tinged

with rufous, a little black at tip; the ventral segment at base of ovipositor emarginated in the middle, the side-pieces valvular, arcuated.

Length to tip of ovipositor 4-4½ millimeters; to tip of abdomen 3-3½ millimeters. Width of pronotum 1 full millimeter.

One female has the hemelytra fully developed, reaching to the end of the abdomen, with the nervures moderately straight and the cells long; the posterior edges of the segments on the tergum black. No males were seen or captured. Quite common upon willows at Colorado Springs and near Manitou.

The above description was taken from the fresh specimens. Shortly after death, the clear colors are lost, and then the insect appears soiled-yellow, with the black markings distinct, and the ovipositor reddish-ocherous.

Several other species of *Jassinæ* were collected at Colorado Springs, Denver, and Manitou, but they are too much changed to admit of accurate definition. Descriptions of them can readily be given hereafter when fresh specimens are procured. Work in this field of research is liable to be mixed with error unless the specimens are obtained in full series of both sexes, the colors noted when the insects are alive, and then carefully preserved, all of which demands much time, as well as skill and attention.

TYPHLOCYBA Germ.

T. aureo-viridis, new sp.

Long and slender, vivid yellowish-green, the hemelytra translucent, exquisite golden-green, faintly blackish on the apical margin. Head broad, hardly tumid, sublunate, wider than the pronotum, rich yellowish-green on the vertex and front; the latter with a pale stripe down the middle, and a short one on the inner margin next the eye; cheeks deeper green; eyes narrow, as seen from above; antennæ long, pale green at base, fuscous beyond. Pronotum smooth, yellowish-green, moderately long, arcuated in front, and a little convex; each side and middle just behind the head with a pale round spot; lateral marginus hardly reflexed, slightly prominent, a little obliquely arcuated. Beneath and legs green, the nails and pulvilli black. Scutellum with a broad, paler green line along the middle. Hemelytra narrow, yellowish-green, golden; the apex with four cells, of which the middle one is long, narrow, and almost straight, the two outer ones triangular, and the one next outside of the middle obtriangular. Wings hyaline, highly iridescent, and with a bright golden tinge. Ovipositor projecting beyond the long valvular genital segment.

Length to tip of ovipositor 3-4 millimeters; to tip of hemelytra 5-5½ millimeters. Width of pronotum 1½ millimeters.

This brightest of our green Typhlocybas was found in large numbers at Denver and in Clear Creek Cañon, upon the leaves of willows August 7 to 18.

PSYLLIDÆ.

Several species were swept from plants and bushes in the vicinity of Colorado Springs; but they have been too much altered in appearance to admit of description.

APHIDÆ.

Aphis, and other genera closely allied, were common upon many kinds of plants and bushes wherever I went in Colorado. The specimens, however, are too much shriveled and changed to admit of correct description.

[*To be continued.*]



1. *Nysius angustatus*.



2. *Ischorcoris errans*.



3. *Cymus clavicularis*.



4. *Zosmenus cinereus*.



5. *Trapezonotus agrestis*.



6. *Ischnorhynchus didymus*.



7. *Orthops scutellatus*.



8. *Phygadicus behrensi*.



9. *Plagiognathus obscurus*.



10. *Camptobrochis nebulosus*.



11. *Capsus capillaris*.



12. *Stiphrosoma stygica*.



13. *Rhopalotomus brachycerus*.



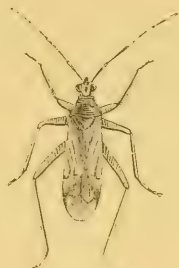
14. *Aneurus inconstans*.



15. *Lopidea media*.



16. *Agalliastis associatus*.



17. *Idolocoris agilis*.



18. *Lygus annexus*, var.



19. *Dacota hesperia*.



20. *Rhopalotomus ater*.



21. *Pocciloseytus unifasciatus*.



22. *Malacocoris irroratus*.



23. *Fit chia aptera*.



24. *Calocoris rapidus*.

ART. XV.—DESCRIPTIONS OF THE ARANEÆ COLLECTED IN
COLORADO IN 1875 BY A. S. PACKARD, JR., M. D.

BY T. THORELL, PH. D.,
Junior Professor of Zoölogy in the University of Upsala, Sweden.

CLASS ARACHNOIDEA.

Order ARANEÆ.

Section* ORBITELARIÆ.

Fam. EPEIROIDÆ.

Subfam. EPEIRINÆ.

Gen. EPEIRA (Walck.), 1805.

1. *E. trivittata* Keyserl.

SYN.—1864.—*Epeira trivittata* Keyserl., Besch. neuer . . . Orbitelæ, in Sitzungsber. d. Isis zu Dresden, 1863, p. 95 (33), tab. v, figs. 6-9.

One adult male and several young examples of both sexes were captured by Dr. Packard at Boulder, Colo., June 29.

This species is probably nearly related to *E. domiciliorum* Hentz, but it is much smaller, the full-grown female being only about 7-8 millim. in length, and the male about 6 millim. It appears to be common in the United States, and has perhaps been described both by Walckenaer and Hentz, though I am unable to identify it with any of the species of these authors.

Gen. TETRAGNATHA Latr., 1804.

2. *T. elongata* Walck.

SYN.—1841.—*Tetragnatha elongata* Walck., H. N. d. Ins. Apt., ii, p. 211.

1850.—*Tetragnatha gallator* Hentz, Deser. and Fig. of the Arau. of the United States, in Bost. Journ. Nat. Hist., vi, p. 26, pl. iv, figs. 1, 2

1865.—*Tetragnatha gallator* Keyserl., Beitr. z. Kenntn. d. Orbitelæ, in Verhandl. d. zool.-bot. Gesellsch. in Wien, xv, p. 850 (52), tab. xxi (iv), figs. 24-27.

As this spider is very variable, and the above synonyms not quite sure, I shall here give the characteristics of the species and of its principal varieties known to me.

* Reasonable objections having been made (by Gerstaecker) against calling the principal groups of the order *Araneæ* "suborders", I have here adopted the more indifferent term "sections".

T. elongata Walek.—Space between the two lateral eyes smaller than that between the posterior central and lateral eyes, smaller, or at least not larger, than the space between the anterior and posterior central eyes. Length of mandibles of male about nine-tenths of the length of cephalothorax, armed above, toward the extremity, with only a strong tapering spine, emarginated at the truncated apex; the anterior margin of the claw-furrow is provided with at least 8 teeth; first tooth small; second larger, directed somewhat backward; third very long and strong; the distance between first and second larger than (in general, about double as large as) that between second and third, and rather larger than the space between third and fourth, which is at least double as large as that between fourth and fifth; the posterior margin has also about 8 teeth; first small; second rather long and strong; the following smaller; the distance between first and second smaller than that between second and third, which is about double that between third and fourth. Mandibles of *female* about two-thirds as long as the cephalothorax; the claw-furrow is armed on the anterior margin with about 8 teeth; first somewhat stronger than the following, (generally) removed from second by a very long toothless space, and placed opposite to the fourth teeth of the posterior margin, the first tooth of which is in general much farther removed from the second than this from the next following; the claw of mandible is provided with a small protuberance near the base on the outer side. The tibial part of the *male* palpus longer than the patella, its long apophysis being provided with a protuberance toward the middle of the inner side. Legs testaceous, their joints more or less evidently brownish or blackish at the apices, the metatarsus and tarsus of the first pair of legs together shorter than patella, tibia, metatarsus, and tarsus of the fourth pair of legs; belly blackish, with two more or less distinct parallel yellow longitudinal bands.—♂ ♀ *ad.* Length 4–10 millim.

Forma principalis.—Interval between the two lateral eyes much smaller than that between the anterior and posterior centrals; tibial joint of the male palpi at least half as long again as the patellar joint; cephalothorax brownish-yellow, sometimes sooty at the margins, and then provided with a sooty V anteriorly; sternum brownish-yellow, sometimes blackish at the margins; abdomen brownish or yellowish, with a ramified longitudinal black line along the back and often an undulated paler band on each side.

♀.—Length of body $8\frac{1}{2}$ millim.; length of cephalothorax 3, breadth of same 2 millim.; length of mandibles 2, of palpi 4 millim. Legs: I 21, II $15\frac{1}{2}$, III $8\frac{1}{4}$, IV $12\frac{1}{2}$ millim.; metat. + tars. I 8, pat. + tib. + metat. + tars. IV $8\frac{2}{3}$ millim.

♂.—Length of body $6\frac{1}{2}$, of cephaloth. nearly $2\frac{1}{2}$ millim.; breadth of cephaloth. $1\frac{3}{4}$ millim.; length of mandibles $2\frac{1}{4}$, of palpi 4 millim. Legs: I $21\frac{1}{4}$, II 16, III $7\frac{3}{4}$, IV $13\frac{1}{2}$ millim.; metat. + tars. I 8, pat. + tib. + metat. + tars. IV $8\frac{3}{4}$ millim.

Var. β , *undulata*.—Eyes and palpi of male as in the forma princip. Cephalothorax dark brownish-yellow, with black margins and the pars cephalica blackish on the sides; sternum black, with a longitudinal yellowish middle line; abdomen brownish-gray, with a longitudinal, tapering, grayish-white middle band or line sinuated in the margins and geminated by a black line, as also with two large undulated grayish-white bands, one on each side.

δ .—Length of body $9\frac{1}{2}$, of cephaloth. $3\frac{1}{2}$; breadth of same $1\frac{3}{4}$ millim.; length of mandibles $2\frac{2}{3}$, of palpi $4\frac{3}{4}$ millim. Legs: I $26\frac{3}{4}$, II $19\frac{1}{2}$, III 10, IV $16\frac{3}{4}$; metat. + tars. I 10, pat. + tib. + metat. + tars. IV $10\frac{3}{4}$ millim.

\varnothing *jun*.—Length of body $7\frac{1}{4}$, of cephaloth. $2\frac{2}{3}$, breadth of cephal. 2, length of mandibles nearly $1\frac{2}{3}$, of palpi $3\frac{1}{2}$ millim. Legs: I $19\frac{1}{2}$, II 13, III 7, IV $12\frac{1}{2}$; metat. + tars. I $7\frac{2}{3}$, pat. + tib. + metat. + tars. IV $11\frac{1}{4}$ millim.

Var. γ , *debilis*.—Smaller than the former. Interval between the two lateral eyes scarcely less than that between the anterior and posterior central eyes. Tibial joint of the male palpi but little longer than the patellar joint. Sternum often blackish, at least at the sides; abdomen yellowish above, in general with a ramified black middle line, blackish on the sides below; color for the rest about as in the forma princip.

δ .—Length of body $5\frac{1}{2}$, of cephaloth. 2, breadth of same nearly $1\frac{1}{2}$ millim.; length of palpi $2\frac{1}{3}$ millim. Legs: I $17\frac{1}{4}$, II 12, III $5\frac{1}{2}$, IV $11\frac{1}{3}$; metat. + tars. I $6\frac{1}{4}$, pat. + tib. + metat. + tars. IV $7\frac{1}{3}$ millim.

\varnothing *jun* (?).—Length of body $6\frac{3}{4}$, of cephaloth. 2, breadth of same $1\frac{1}{3}$ millim. Legs: I 15, II $9\frac{1}{2}$, III $4\frac{3}{4}$, IV $9\frac{1}{2}$ millim.; metat. + tars. I $5\frac{2}{3}$, pat. + tib. + metat. + tars. IV nearly $6\frac{1}{4}$ millim.

The var. γ , of which I have seen very many adult males and (young?) females, appears to me gradually to pass into the principal form, and is therefore probably not a peculiar species, as I at first believed. In the only full-grown male of var. β that I have seen, the distance between the first and second teeth of the anterior margin of the claw-furrow is but little greater than that between the second and third teeth.

The citation from Walckenaer is of course very uncertain, his description, like that given by Hentz, being quite insufficient; but as the species here characterized by me no doubt is the *T. grallator* of Hentz, and this author considers his *T. grallator* to be identical with *T. elongata* Walek., I think I may safely adopt this latter name, which has the priority. *T. grallator* Keyserl. I consider a tolerably sure synonym, although the specimens described by that author has more teeth on the margins of the mandibles' claw-furrow and longer legs than I have observed in this species; but the number of those teeth, as well as the length of the legs, appear to be pretty variable; even the relative distances between the eyes, as also those between the teeth of the mandibles' claw-furrow, are not always the same.

Of *T. elongata*, which appears to be common in most parts of the United

States, the collection contains a full-grown ♂ and a young ♀ of the principal form from Boulder, Colo., captured June 29; a full-grown ♂ and a young ♀ of the var. *β*, *undulata*, the ♂ from Idaho (captured July 6), the ♀ from Manitou, Colo. (July 12), as also several examples of the var. *γ*, *debilis*, collected at Boulder, Colo. (among them one ♂ *ad.*) (June 24), Golden, Colo. (July 3), and the Great Salt Lake, Utah (July 23). In the adult male, both of var. *β* and var. *γ*, the abdomen is wanting. I have also examined many specimens of the principal form and of var. *γ* from Wisconsin. The measures above given of these two varieties are taken from examples from that State.

I must confess that I am not at all certain that *T. elongata* is specifically different from the true *T. extensa* (Linn.) or *T. norwicksi* L. Koch. The number of the teeth of the claw-furrow and the arrangement of these teeth appear to be slightly different in these two forms, but these characteristics are somewhat variable in both of them. The European *T. extensa* has the sternum black, with a triangular yellow spot or line in the middle; but this is also the case in the variety *undulata* of the American species; also in *T. extensa* ♂ the apophysis of the tibial joint of the palpus is furnished with a short blunt process toward the middle of the inner side. At all events, *T. elongata* differs less from *T. extensa* than do for instance *T. islandri* (Scop.) Thor. and *T. obtusa* C. L. Koch.

Section RETITELARIÆ.

Fam. THERIDIOIDÆ.

Gen. LINYPHIA Latr., 1804.

3. *L. orophila* n.

Cephalothorax, mandibles, maxillæ, palpi, and legs pale testaceous; cephalothorax with black margins; eyes black, large, close together, and prominent, the four central ones forming a trapezium broader behind than in front and as long as broad behind, little shorter than the height of the clypeus; first pair of legs the longest; thighs and tibiæ with traces of black rings; abdomen olive-colored, with sinuated oblique bands or lines on each side above, followed on the back by a short row of transverse angular lines, sides also with a row of spots below, these markings being all of a pale yellowish hue, as is also at least the posterior part of the belly and the region around the mamillæ; vulva pale reddish-brown, with a longitudinal narrow middle ridge below, and forming, seen from the side, an oblong protuberance slightly two-toothed at the extreme apex.—♀ *ad.* Length about $2\frac{2}{3}$ millim.

Female.—*Cephalothorax* shorter than patella and tibia of the fourth pair together, oblong, rounded in the sides, with the pars cephalica rather large and high; the breadth of the clypeus is a little greater than half the breadth of the pars thoracica, the height of the clypeus is but little greater than the length of the area of the central eyes. *Eyes* large, prominent, and close together, not much differing in size; the

posterior central eyes are, however, larger, and the anterior central eyes appear to be a little smaller than the rest. Seen from above, the hind row of eyes is straight; the front row, seen from before, is also nearly straight, very slightly curved backward. The four central eyes, of which the anterior are placed on a prominent tubercle, form a trapezium much broader behind than in front and as long as broad behind; the intervals between the eyes of the hind row are nearly equal, and scarcely as large as half the diameter of one of those eyes, the interval between the anterior lateral and the anterior central eyes is at least half as great again as that between these latter eyes and fully as great as the diameter of a lateral eye; the lateral eyes are contiguous. *Sternum* very large, triangular, with slightly rounded sides, and the apex directed backward, broadly truncate in front, but little longer than broad, slightly convex. *Mandibles* a little thicker than the thighs of the first pair, nearly cylindrical, somewhat narrowed on the inner side toward the apex, about $2\frac{1}{2}$ times as long as broad; claw rather long and slender. *Maxille* about half again as long as broad, nearly ovate, broadly and obliquely truncate on the inner side of the apex. *Labium* transversal, slightly rounded at the apex. *Palpi* slender, the tibial joint nearly thrice as long as broad, the tarsal joint gradually tapering toward the apex, longer than the two preceding joints together. *Legs* slender; first pair longer than the second and fourth, which are nearly of the same length. (In the only example examined, all the spines of the legs are broken off; on the tibiæ, but not on the femora and metatarsi, there are distinct traces of spines lost.) *Abdomen* longer than broad, tapering behind, nearly ovate; seen from the side, the *vulva* forms a short and thick protuberance directed backward, strongly convex below, and slightly bifid or two-toothed at the extreme apex: this protuberance is about as thick as the posterior thighs and about half as long again as thick; seen from below, the vulva is about as long as broad at the base, tapering toward the blunt apex very uneven, with a narrow ridge along the middle; the slightly incrassated apex of this ridge appears to reach a little longer backward than the rest of the vulva.

Color.—*Cephalothorax* pale testaceous, with a fine black margin; eyes placed on black spots. *Sternum* of a sooty testaceous hue, with the margins blackish; *labium* blackish. *Mandibles* and *maxille* pale testaceous, the claw of the former pale reddish. *Palpi* and *legs* pale testaceous, somewhat darker toward the extremity; the tibiæ show more or less distinct traces of a sooty ring near the base, and the thighs traces of such a ring toward the apex. The *abdomen* is above and on the sides greenish-black or olive-colored, with pale yellowish markings; it has in front, on each side above, a broad short band, somewhat dilated at the posterior end, which bands together nearly form a coarse Λ above the petiolum; near the middle line of the back this marking is followed by two pairs of short longitudinal lines, of which at least the hindmost are curved outward; the posterior end of these lines is pro-

duced obliquely downward and backward, thus forming one short band and one somewhat curved or sinuated line on each side; then follows on the back, three or four transversal angularly bent lines, gradually diminishing in length. The sides of the abdomen, toward the belly, show also a longitudinal row of three pale spots, or streaks, of which the foremost is the largest. The region round the mamillæ is pale yellowish, as is also the belly, which shows a large, irregular, sooty patch behind the vulva. The *vulva* is of a pale reddish-brown hue, the *mamillæ* pale yellowish, darker at the extreme apex.

Length of body $2\frac{2}{3}$, of cephalothorax somewhat more than 1 millim. Legs: I $5\frac{1}{2}$, legs II and IV 5 millim., patella + tibia iv $1\frac{1}{2}$ millim.

A single specimen, a female, was captured under a stone on Gray's Peak (about 14,000 feet above the level of the sea), a little below the summit, July 7, 1875.

Gen. ERIGONE Sav. et Aud., 1825-27.

4. *E. cacuminum* n.

Brown, with the palpi and legs brownish-yellow, darker at the extremity; abdomen olivaceous or brownish-gray; cephalothorax as long as patella + tibia of the 4th pair, the pars cephalica large, slightly sloping from the middle toward the eyes; height of clypeus a little greater than length of the area of the central eyes, this area being nearly double as broad behind as in front, and a little shorter than broad behind; eyes small, the fore lateral ones little if at all larger than the eyes of the hind row; claw-furrow of the mandibles armed with a row of 5 teeth; vulva forming a transverse, elevated, uneven area, which is black at the ends and reddish-brown in the middle.—♀ *ad.* Length about $3\frac{1}{2}$ millim.

Female.—*Cephalothorax* as long as patella and tibia of the 4th pair of legs, rather abruptly but slightly narrowed between the palpi and the coxæ of the 1st pair; the pars thoracica large, rather slightly rounded in the sides, the pars cephalica shortish, broad with the anterior angles broadly rounded; the breadth of the clypeus equals about $\frac{2}{3}$ of the greatest breadth of the pars thoracica. The cephalic furrows are but slightly marked. On each side of the pars thoracica are three shallow and short depressions.

The ordinary middle fovea is rather large, shallow, and forms the apex of the posterior declivity, which is well defined, forming a triangle a little larger than broad. Seen in profile, the back of the cephalothorax is straight and gradually ascending about to the middle of the pars cephalica, where it is convex, and then slightly sloping toward the eyes; the pars cephalica has above some forward-directed hairs. The height of the clypeus is a little greater than the length of the area of the central eyes and nearly equals the length of the line occupied by three eyes of the front row. *Sternum* large, a little longer than broad, slightly rounded on the sides, broadly truncate in front, slightly convex, shining, strewed

with fine hairs. The *eyes* are small and of nearly equal size, with exception of the anterior central ones, which are evidently smaller than the other eyes; the anterior lateral eyes are little, if at all, larger than the posterior central and lateral eyes. The hind row of eyes is, seen from above, nearly straight; seen from in front, this row is strongly curved downward; the front row is curved a little upward. The central eyes form a trapezium nearly double as broad behind as in front, and a little shorter than broad behind. The interval between the posterior central eyes, which is fully as great as the diameter of one of these eyes, is a little smaller than that between the posterior lateral and central eyes and as great as the interval between the anterior and posterior centrals; the small anterior central eyes are nearly contiguous; the lateral eyes of the same side are contiguous; the interval between the anterior lateral and central eyes equals the diameter of the former. The *mandibles* are ovato-cylindrical, strong, and thick, their length equaling thrice the height of the clypeus; seen from the side, they are nearly ovate and strongly convex toward the middle; they are smooth, hairy at the apex, with the claw-furrow armed with a single row of five rather strong teeth. The *maxillæ* are about half as long again as broad, rounded on the outer side toward the apex and at the apex, inclined toward the *labium*, which is a little broader than long, rounded at the apex. *Palpi* rather slender; the tibial joint, which is about two and a half times as long as the patellar, is slightly and gradually incrassated toward the extremity; the tarsal joint is very slightly narrowed toward the apex, not longer than the two preceding joints together. The *legs* are of moderate length, rather slender, spread with longish not thickly set hairs - the thighs are gradually, not abruptly narrowed at the base; the fourth pair of legs is the longest, with the tibia at least three times as long as the patella. The *abdomen* is inversely ovate, rather elongate, obtuse in front and behind, spread with fine, short hair, or down; the *vulva* is very simple, consisting of a rather large, uneven, transverse elevation at the margin of the rima genitalis.

Color.—*Cephalothorax*, *mandibles*, and *maxillæ* brownish; *sternum* dusky testaceous, with the margins darker; *labium* blackish; *abdomen* of an olivaceous or brownish-gray hue; *palpi* and *legs* brownish-yellow, darker at the extremity; the *vulva* forms a transversal area, which is black at the ends and reddish-brown in the middle, this middle portion being a little broader than the black spots formed by the extremities of the area.

Length of body $3\frac{1}{2}$, of cephalothorax nearly $1\frac{1}{2}$ millim.; breadth of cephalothorax 1 millim.; length of legs I a little more than 4, of legs II 4, of III nearly $3\frac{1}{2}$, of IV $4\frac{3}{4}$ millim.

A few female specimens of this species were found under stones on Gray's Peak, a little below the summit, July 7.

5. *E. strabo* n.

Cephalothorax yellowish-brown, slightly ascending and somewhat

convex from the posterior margin to very near the hind central eyes; height of clypeus about one-third of the length of the mandibles and as great as the length of the area of the central eyes, which is nearly as long as broad behind, much broader behind than in front; lateral eyes larger than centrals, contiguous; fore laterals about double as large as fore centrals, which are nearly contiguous; interval between the hind central eyes larger than their diameter and than the interval between them and the hind laterals; mandibles but slightly convex above; palpi and legs yellowish; abdomen short, brownish or olivaceous-gray.—♀ *ad.* Length about 2 millim.

Female.—*Cephalothorax* longer than broad, about as long as patella and tibia of the fourth pair together; the pars thoracica moderately rounded in the sides, narrowed and slightly sinuated at the pars cephalica, which is rather strongly narrowing forward, with rounded sides, and with the forehead rounded and nearly half as broad as the pars thoracica; seen in profile, the cephalothorax is rather low, slightly and gradually rising and somewhat convex from the posterior margin to very near the hind central eyes, then, with the area of the central eyes, sloping forward, the clypeus sloping still more strongly forward or downward; the cephalic impressions are well marked, the whole surface smooth and shining. The *sternum* is large, nearly as broad as long, broadly truncate in front, nearly heart-shaped, slightly convex, very smooth and shining. The hind row of *eyes*, seen from above, is straight, the front row, seen from before, is slightly curved upward; the lateral eyes are contiguous, oblong, and larger than the central eyes, the fore laterals about double as large as the fore centrals, which are the smallest of the eight; the central eyes occupy an area a little shorter than broad behind, much broader behind than in front; the hind central eyes are separated from each other by an interval evidently greater than their diameter from the hind laterals by an interval equaling half their diameter, and from the fore centrals by an interval at least as large as their diameter; the fore centrals are very close together, nearly contiguous, and separated from the fore laterals by a space equaling half their diameter; their distance from the margin of the clypeus is as great as the length of the area of the central eyes. *Mandibles* somewhat thicker than the fore thighs, somewhat more than double as long as broad, their length being nearly three times as great as the height of the clypeus; they are but slightly convex above, somewhat narrowing toward the apex on the inner side; their claw-furrow is armed with teeth of moderate length and the claw is rather long and slender. The *maxille* are longish, nearly ovate, slightly inclined toward the broad *labium*, which is rounded at tip. The *palpi* are of moderate strength, the patellar joint scarcely half again as long as broad, the tibial joint not double as long as the patellar, the tarsal joint but very slightly narrowing toward the obtuse apex; the *legs* are rather slender, the tibiæ of the fourth pair about four times as long as the patellæ. *Abdomen* not much

longer than broad, elliptical, shining, almost hairless, like the cephalothorax; the *vulva* appears to consist of a rather large low tubercle, divided into three parts by a transverse angularly forward bent furrow and a middle longitudinal furrow proceeding backward from the angle of the former (?).

Color.—*Cephalothorax* yellowish-brown, the extreme lateral margins blackish. When the animal is placed in water or in spirit of wine, it shows three fine longitudinal blackish lines along the *pars cephalica*. *Sternum* of a dark, sooty, testaceous hue. *Mandibles* yellowish-brown; *maxillæ* and *labium* testaceous. *Palpi* yellowish, with black bristles; legs yellowish, with slight brownish or reddish tint. *Abdomen* dark brownish or olivaceous gray, darker on the under part; the *vulva* brownish.

Length of body ♂, of cephalothorax nearly 1 millim.; length of legs I nearly 3, of tibia + patella IV nearly 1 millim.

A single somewhat mutilated example was captured at Arapaho Peak (11–12,000 feet above the level of the sea), July 7. By the arrangement and relative sizes of its eyes, this species shows some transition to *Pholcomma* Thor., in which genus, however, the lateral and especially the hind central eyes are, compared with the small fore central eyes, much larger than in *E. strabo*, and the hind central eyes contiguous with the hind laterals.

Gen. STEATODA (Sund.), 1833.

6. *S. distincta* n.

Cephalothorax reddish; legs reddish, with black rings; the thighs of the fourth pair and all the tibiæ and tarsi black at the apex, the anterior thighs black, reddish at the base; abdomen black or piceous, with white markings; a broken band surrounding the anterior margin, a row of 3–4 spots along the back, an oblique line on each side, and a short transverse line in front of the mamillæ below; first and fourth pair of legs of the same length; vulva nearly ω -formed.—♀ *ad.* Length about 6 millim.

Female.—*Cephalothorax* shorter than patella and tibia together of the fourth pair, somewhat longer than broad, much narrowed anteriorly, but slightly sinuated at the *pars cephalica*; the *pars thoracica* strongly and amply rounded in the sides, the *pars cephalica* small, narrowing forward, with the forehead rounded and not half as broad as the *pars thoracica*; the surface is smooth and shining, the cephalic impressions strong; besides them, there are three short shallow radiating depressions on each side; the ordinary middle fovea is large and deep, situated somewhat behind the centrum, just behind the coxæ of the second pair; seen from the side, the cephalothorax is nearly horizontal in front of the middle fovea, neither very high nor elevated anteriorly; the clypeus is broader than high, its height being about as great as the length of a line formed by three eyes of the front row; it has a strong transverse depression under the front row of eyes, and is convex and somewhat

sloping seen in profile. The *sternum* is rather large, of a short ovate form, truncate in front, but slightly convex, very densely and finely impresso-punctate, hairy. The *eyes* are somewhat large, the anterior central ones a little smaller than the others; the hind row is straight, the front row slightly curved downward; the four central eyes form a nearly perfect square, the area occupied by them being scarcely perceptibly shorter than broad and scarcely broader behind than in front; the lateral eyes are contiguous, the interval between the posterior central eyes is nearly as large as their diameter and slightly larger than the interval between the hind central and lateral eyes, which interval is evidently smaller than the diameter of one of these eyes; the anterior central eyes, which are placed on a strong blunt protuberance, are separated from each other by an interval as large as the diameter of these eyes and little larger than that which separates them from the anterior lateral eyes. The *mandibles* are perpendicular, nearly cylindrical, very slightly convex longitudinally, smooth and shining, and hairy, especially at the apex and on the inner side; their length is more than double their breadth, and nearly double as great as the height of the clypeus; the length of the claw is scarcely greater than the basal breadth of the mandibles. *Maxilla* oblong, rounded at tip, and also slightly rounded on the outer side, straight on the inner, and inclined toward the *labium*, which is rounded on the sides, narrowing toward the rounded extremity, and about as long as wide at the base. The tibial joint of the *palpi* is scarcely double as long as broad, but very slightly and gradually incrassated toward the apex; the tarsal joint is a little narrower, and tapers gradually toward the blunt apex; it is about as long as the two preceding joints taken together. The *legs*, like the palpi, are shortish, and covered with coarse hairs; the first and fourth pair of legs are of equal length; the metatarsus of the fourth pair is scarcely longer than the tibia. The *abdomen* is oblong, somewhat inversely ovate, and rather broadly rounded at the extremities, not very high, shining, and somewhat hairy; the belly shows a very distinct spiracle between the mammillæ and the rima genitalis. The *vulva* consists of two large rounded shallow foveæ open on the inner side; the depression formed by these two foveæ, which is open in front, and is limited posteriorly by a sinuated ridge, has nearly the form of a Greek ω .

Color.—*Cephalothorax* rusty-red, the eye-area and *mandibles* in general darker, brownish or blackish. *Sternum*, *maxilla*, and *labium* reddish-brown. *Palpi* blackish or piceous, with more or less distinct reddish rings. *Legs* of a bright rusty-red color, the thighs of the fourth pair, as also the tibiæ and tarsi (and sometimes even the metatarsi), black at the apex, the anterior thighs black, red at the base. *Abdomen* black or piceous, with white spots; its anterior margin is surrounded by a white, narrow band, broken in the middle, and not reaching the middle of the sides; along the middle of the back is a series of three or four spots, gradually diminishing in size backward, the first of these spots

being situated somewhat before, and the second somewhat behind, the middle of the back; in the middle of each side is an oblique white line, and the belly has in front of the mamillæ a short white line, or transverse spot curved a little backward.

Length of body 6 millim.; length of cephalothorax $2\frac{1}{2}$, breadth $1\frac{5}{8}$ millim.; length of abdomen $4\frac{1}{2}$ millim. Length of legs: I $8\frac{1}{2}$, II 7, III $5\frac{1}{2}$, IV $8\frac{1}{2}$ millim.; patella + tibia IV $2\frac{1}{2}$ millim.

A few specimens of this fine species were collected at Manitou, Colo., June 12.

Gen. LITHYPHANTES Thor., 1869.

7. *L. corollatus* (Linn.).

SYN.—1758.—*Aranea corollata* Linn., Syst. Nat., ed. 10, i, p. 621.

1778.—*Aranea albomaculata* De Geer, Mém., vii, p. 257, pl. 15, figs. 2-4.

1870.—*Lithyphantes corollatus* Thor., Rem. on Syn., 1, p. 92.

A few specimens of this species were captured at Idaho Springs, Colo., July 5, a female in Boulder, Colo., June 29, and a male in Denver, Colo., July 10. A larger variety (female), almost totally black, only marked along the belly with a whitish middle line, crossed by a short line of the same color at its hind extremity, was found at Manitou, Colo., July 12.

Fam. SCYTODOIDÆ.

Subfam. PHOLCINÆ.

Gen. PHOLCUS Walek., 1805.

8. *Ph. pullulus* Hentz.

SYN.—1850.—*Theridion?* *pullulum* Hentz, Deser. and Fig. of the Aran. of the U. S., vi, ii, p. 288, pl. x, fig. 5.

Pale testaceous; cephalothorax with a black central band along the pars thoracica, which band is forked in front; abdomen not much longer than broad, whitish-gray, with black spots, the spots on the back forming two longitudinal rows; tarsal part of the male's palpi with a long, narrow process below, the bulbous drawn out into a strong, compressed beak.—♂ *ad.* Long. circa $2\frac{1}{2}$ millim.

Mas.—*Cephalothorax* at least as broad as long, inversely orbiculate-cordiform, with a middle furrow, which is forked anteriorly, here forming the very deep cephalic expressions; pars cephalica high, the clypeus very high and sloping. *Sternum* large and broad, almost semicircular, truncated in front. *Eyes*: three larger ones on each side and two small ones in the middle; the hind row of eyes is nearly straight; the front row strongly curved downward, its eyes being all contiguous, or very nearly so; the three eyes on each side also nearly touch each other, forming a triangle open inward; the interval between the posterior central eyes is fully as large as the diameter of one of these eyes, which are evidently larger than the posterior lateral ones, and perhaps a little larger also than the anterior laterals; these latter are double as large as the anterior central eyes. *Mandibles* coalesced

along the inner side, free only at the apex, which has a fine-pointed spine at the inner angle; they are small and short, seen from in front slightly tapering toward the broadly truncated apex, seen in profile conical. They are not half as long again as broad at the base, and their length does not equal half the height of the clypeus; near the base, in front, they are armed with a very long and strong spine directed forward and somewhat downward, and curved downward at the apex. The claw is slender, but slightly curved, as long as the mandible is broad at the apex. *Mamillæ* narrow, longish, dilated at the base, inclined toward the *labium*, which is triangular, rather broader than long, slightly rounded at the sides. *Palpi* very thick, but slender at the base. The femoral joint is strongly thickened at the apex, clavate, the patellar joint, which has a few long straight black hairs at the very apex above, is very short, appearing, seen from the side, to form a wedge between the femoral and tibial joints; this latter is, seen from above, somewhat longer than broad and subcylindrical, seen from the side much shorter below; the tarsal joint again is very short, as short as the patellar, and is on the under side drawn out into a downward directed, very long, straight, narrow, blunt process, or spine, closely applied along the bulb and its beak; the bulbus, which forms the extremity of the palpus, is very simple, thick, nearly ovate, with the extremity drawn out into a strong, rather long, compressed beak, somewhat tapering toward the oblique and blunt apex, which appears to be provided with a few minute teeth, or spines. *Legs* very slender, long, the first pair (which are mutilated in the only specimen examined) no doubt the longest, second and fourth pairs nearly equal; the patellæ very short. The unguicular article of the tarsi is not very distinct except in the third pair of legs, the tarsi of which, except at the base, are divided into 10-12 short joints; also in the other tarsi there appear to be traces of segmentation. The superior claws are long, equably curved, densely beset with long comb-teeth; the inferior claw is small, with one tooth. *Abdomen*, seen from above, a little longer than broad, seen from the side about as high as long, globosopyriform, with the mamillæ placed near the middle of the belly.

Color.—*Cephalothorax* pale testaceous, with a somewhat unequal black band along the middle of the pars thoracica, which band is forked in front, here inclosing the hind extremity of the pars cephalica. The *eyes* are surrounded by a narrow black ring. The *sternum* (with the *coxæ*) is of a whitish testaceous color. The *parts of the mouth* are pale testaceous, the *legs* of the same color, black-haired. The *abdomen* is grayish-white, with two rows of rather large rounded black spots along the back; the space between these rows has a whitish band, or line, along the middle, which in front includes a darker, somewhat lanceolate band; also the sides of the abdomen are black-spotted.

Length of body $2\frac{1}{2}$, of cephalothorax $1\frac{1}{4}$ millim. Legs: (I?), II $13\frac{1}{2}$, III 11, IV $13\frac{3}{4}$ millim. (Thighs I $4\frac{1}{2}$, II and IV $3\frac{1}{2}$ millim.)

A single male example of this curious spider, which no doubt is identi-

cal with *Ther. pullulum* Hentz, was captured at Manitou, Williams' Cañon, July 13. The legs of the first pair, with exception of one of the thighs, are wanting in this example. Notwithstanding the apparent division of the tarsi into a great number of joints, I have not thought it necessary to separate this species from the genus *Pholcus*.

Section TUBITELARIÆ.

Fam. AGALENOIDÆ.

Subfam. AGALENINÆ.

Gen. AGALENOPSIS Giebel, 1863.

9. *A. navia* (Bosc et Walck.).

SYN.—1841.—*Agelena navia* Bosc et Walck., in Walck. et Gerv. H. N. d. Ins. Apt., ii, p. 24.

1843.—*Agelena pennsylvanica* C. L. Koch, Die Arachn., x, p. 111, tab. ccccliv, fig. 828.

1846.—*Agelena potteri* Blackw., Notice of Spid. capt. by Prof. Potter in Canada, etc., in Ann. and Mag. of Nat. Hist., xvii, p. 43.

1848.—*Agelena navia* Hentz, Deser. and Fig. of the Aran. of the U. S., v, iv, p. 465, pl. xxx, figs. 1, 1a.

1869.—*Agelenopsis* albipilis* Giebel, Ueber einige Spinnen aus Illinois, in Zeitschr. f. d. gesamt. Naturwiss., xxxiii (1869), p. 250.

A single young specimen of this species was found at Manitou, Colo., July 12.

Fam. DRASSOIDÆ.

Gen. GNAPHOSA (Latr.), 1804.

10. *G. conspersa* n.

Cephalothorax longer than patella + tibia of the fourth pair, dull brown, with a narrow black margin, and covered with grayish or reddish-brown hair; fore series of eyes curved moderately downward; fore lateral eyes double as large as the fore centrals; central eyes forming a rectangle much longer than broad; legs dull yellowish-brown; tibiæ of the first pair armed with one, those of the second pair with two, spines below, near the apex; abdomen brown above, densely spread with small black spots, sometimes forming irregular oblique rows on the sides; vulva consisting of an egg-shaped fovea occupied in front by a backward-curved eminence, its bottom behind this eminence being tongue-shaped, brown.—♀ ad. Length about 11 millim.

Female.—Cephalothorax longer than patella + tibia of the fourth pair amply but not strongly rounded in the sides of the pars thoracica, with the pars cephalica narrowing forward, the breadth of the clypeus being little more than half that of the pars thoracica; it is surrounded by a fine elevated border (not by a broad "hem"); the central furrow is

**Agelenopsis* is evidently an error of the press, instead of *Agelenopsis* or *Agalenopsis*.

shortish, situated between the coxæ of the second and third pairs, the cephalic impressions and two other furrows on each side are fine and shallow. The cephalothorax is densely clothed with short, appressed hair, and strewed with long, upturned, bristly hairs. *Sternum* nearly elliptical, truncate in front, hairy. The hind row of *eyes* is rather strongly curved backward, the front row curved downward; a line tangent to the upper margins of the fore lateral eyes will cut the fore centrals a little below their middle. The fore lateral eyes are oblong, little larger than the posterior eyes, and double as large as the fore centrals; the area occupied by the central eyes is very nearly rectangular, scarcely perceptibly broader behind, much longer than broad; the interval between the flat and somewhat oblique hind centrals is little smaller than that between the fore centrals, this latter interval being as great as their diameter, and greater than the interval between them and the fore laterals; the interval between these eyes and the margin of the clypeus is about half again as great as the diameter of one of these eyes and smaller than that which separates them from the hind laterals, this latter space being double as great as the diameter of the eyes, and a little greater than the interval between the hind central and hind lateral eyes. The *mandibles* are rather small, a little narrower than the thighs of the first pair, as long as the patellæ of the first pair, double as long as broad, strongly convex at the very base, otherwise but slightly convex longitudinally, clothed with bristly hairs; the posterior margin of the claw-furrow forms a denticulate lamella; the claw is short, strong. The *maxillæ* are strongly rounded on the outer side, with a rather deep transversal depression in the middle; they are curved round the *labium*, which is about half as long again as broad, somewhat tapering toward the broadly rounded apex, slightly rounded in the sides. The *palpi* and *legs* are short, the tibial joint of the former only half as long again as broad. The fourth pair of legs is not much (little more than the length of their tarsus) longer than the first pair. The thighs have 1. 1. spines above the first pair besides 1., the second 1. 1. in front, the third and fourth have 1. 1. in front, 1. 1. behind; the four anterior metatarsi have only 1. 1. spines, situated toward the base below; the tibiæ of the first pair have only 1., and the tibiæ of the second pair only 1. 1. spines near the apex below. The patellæ and tibiæ are destitute of spines above (*i. e.*, along the middle line of the upper part), with exception of the tibiæ of the third pair, which have 1. spine above. The tarsi and metatarsi of the four anterior legs are provided with a scopula. The *abdomen* is inversely ovate, densely covered with shorter appressed hairs and spread with longer upturned ones. The *vulva* has the form of a shallow, oblong, egg-shaped fovea, the length of which is not greater than the diameter of the tibiæ; in front, this fovea is occupied by a nearly half-moon-shaped eminence or ridge, emarginate behind, and convex transversely; the much longer, lower, hinder part of the bottom is flat, tongue-shaped.

Color.—*Cephalothorax* of a dull brown hue, clothed with grayish-brown, shorter, and black long hairs; the extreme margin is black; the furrows blackish. *Sternum* yellowish-brown; *mandibles* and *labium* dark-brown or piceous; *maxillæ* somewhat paler; all these parts black-haired. *Palpi* and *legs* are rather lighter than cephalothorax and abdomen, of a dull yellowish-brown color, paler on the under part, provided with black hairs and spines; the apex of the palpi is piceous. *Abdomen* dull brown, clothed with grayish or reddish-brown and black hair, densely strewed with small black spots and points, especially on the back and on the sides; on the back, toward the sides, these spots form several oblique rows, which, however, are neither regular nor very conspicuous; along the middle of the fore part is a slightly paler band or line, reaching to the middle of the back. The anterior, more elevated part of the *vulva* is rusty-brown; the posterior, tongue-shaped portion dark brown, at least sometimes marked with two paler longitudinal lines.

Length of body 11, of cephalothorax $4\frac{3}{4}$ millim.; breadth of cephaloth. $3\frac{1}{2}$, of forehead (clypeus) nearly 2 millim. Length of legs: I $10\frac{3}{4}$, II 10, III $9\frac{1}{4}$, IV $12\frac{1}{2}$ millim.; patella + tibia IV $3\frac{5}{6}$ millim. Length of mandibles $1\frac{3}{4}$ millim.

Of this species, one female was captured at Kelso Cabin, Colo., July 6, and another on Gray's Peak, 11–12,000 feet above the level of the sea, July 7. A third, smaller female example, in which the hind portion of the vulva is destitute of the two pale lines seen in the other specimens, was found in Idaho, July 5. The species is also met with in the Eastern States. I possess a female example, captured on Mount Lebanon, Mass., and presented to me by my kind friend Mr. G. Eisen, Docens of zoölogy in the University of Upsala, to whom I am also indebted for a great many other North American, especially Californian, spiders.

11. *G. scudderi* n.

Cephalothorax longer than patella + tibia of the fourth pair, dark with a narrow black margin, and covered with grayish or somewhat brown, reddish-brown hair; fore row of eyes curved moderately downward; fore lateral eyes double as large as fore centrals; central eyes forming a rectangle, much longer than broad; legs brownish-black, paler at the base; tibiae of first pair armed with 2., of second pair with at least 2. 1. 1. spines below; abdomen dark brown, covered with grayish or reddish-brown hair; vulva consisting of a rhomboidal fovea, the anterior margin of which is produced backward as an obtuse process, and which has a large oblong fovea on each side between the margin and the lamina, which forms the floor of the vulva.—♀ *ad.* Length about $11\frac{3}{4}$ millim.

Female.—In general form, this spider is very similar to the preceding species, *G. conspersa*. The pars cephalica of the *cephalothorax* is only a little more equably and strongly rounded in the sides; in other particulars, *cephalothorax*, *sternum*, *maxillæ*, *labium*, and *palpi* are as we have described these parts in *G. conspersa*. The *eyes* have the same relative

sizes and position as in that species; the distance between the anterior lateral eyes and the margin of the clypeus appears, however, to be a little greater, somewhat more than half again as great as the diameter of the eye, and the interval between the anterior and posterior lateral eyes is also somewhat greater than in *G. conspersa*, nearly half again as great as the interval between the lateral and central eyes of the hind row. The *mandibles* are less strongly convex at the base; in other respects they are as in the former species, equaling in length the patellæ of the first pair. The *legs* are of nearly the same relative lengths as in *G. conspersa*, but somewhat more slender; the thighs and the four anterior metatarsi are armed with the same number of spines as in that species; but the tibiæ of the first pair have 2. spines near the apex below, and the tibia of the second pair 2. 1. 1. (or 2. 2. 1.) spines below, and the tibiæ both of the first and second pairs 1. spine above. The *abdomen* appears to be more elongate than in *G. conspersa*, being nearly double as long as broad. The *vulva* is quite different from that of *G. conspersa*; it consists of a fovea, which is a little longer than the diameter of the tibiæ, somewhat longer than broad, somewhat dilated from the ends toward the middle, nearly rhomboidal, but truncated in front and with a depression in the middle, behind, of the limiting margin; the anterior margin is produced backward as a thick, transversely striated, blunt process, reaching the center of the vulva; along the middle, the bottom of the fovea forms an uneven, elevated lamina about double as broad as the said process, nearly double as long as broad, and having a longitudinal depression anteriorly, on which the process is reposing; on each side, between this lamina and the margin of the vulva, is a large oblong fovea.

Color.—*Cephalothorax* dark and dull brownish, with darker impresiones cephalicæ and furrows, and with a fine black margin; it is covered with appressed grayish or somewhat reddish-brown hairs, and spread with longer upturned black ones. *Sternum*, *mandibles*, *maxillæ*, and *labium* blackish-brown. *Palpi* and *legs* blackish-brown, paler, brownish-yellow toward the base. *Abdomen* brownish, covered with appressed grayish or somewhat reddish-brown hair, and spread with longer, more upturned, black hair. The *vulva* is brownish, the middle lamina paler, blackish at the apex.

Length of body $11\frac{3}{4}$, of cephalothorax $4\frac{1}{2}$ millim.; breadth of cephalothorax a little more than 3, of clypeus $1\frac{4}{5}$ millim. Length of legs: I $10\frac{1}{2}$, II $9\frac{3}{4}$, III nearly 9, IV $12\frac{1}{2}$ millim.; of patella + tibia IV $3\frac{3}{4}$ millim.; length of mandibles nearly $1\frac{1}{2}$ millim.

One female example was found at "Garden of the Gods", Colo., July 13. The species appears to be closely allied to *G. brumalis* Thor.,* from

* Notice of Some Spiders from Labrador, in Proceed. of the Boston Soc. of Nat. Hist., xvii, p. 497. —The words "cephalothorace breviorum quam", etc., in the diagnosis of this species, is a slip of the pen for "cephalothorace longiorum quam", etc. In the diagnosis of *Clubiona frigidula* Thor., *ibid.*, p. 496, "20 aculeis" is an error of the press instead of "2 aculeis".

Labrador, but the armature of the tibiæ of the second pair is different in this latter species, which has only 2. 1. spines on the under side of these tibiæ.

Gen. PROSTHESIMA L. Koch, 1872.

12. *P. melancholica* n.

Black, with the palpi and legs dusky yellowish at the base and the tarsi and anterior metatarsi rusty-brown; eyes of the hind row of equal size, much smaller than the fore laterals, which are more than double as large as the fore centrals; the interval between these latter eyes larger than that between the hind centrals; legs of the fourth pair much longer than those of the first; the 4 anterior tibiæ destitute of spines; vulva forming a large pale area, which shows two fine brown costæ curved inward and united in the form of a ~ behind, and inclosing an area broader than long, scarcely narrowing forward.—♀ *ad.* Length about $7\frac{1}{2}$ millim.

Female.—*Cephalothorax* a little longer than tibia + patella of the fourth pair, rather strongly rounded in the sides behind, then equally narrowing forward, with the breadth of the clypeus nearly equaling half the breadth of the pars thoracica; it is surrounded by a fine elevated margin, rather strongly convex transversely, very finely coriaceous, strewed with hairs, and has a distinct short middle furrow; the cephalic impressions and three radiating furrows on each side are very faint. The front row of *eyes* is rather strongly curved downward, the hind row is straight, the interval between the hind lateral and central eyes is somewhat greater than that between the two hind centrals, which is a little smaller than that between the fore centrals; this latter interval is fully as great as the diameter of the central eyes and greater than the interval between these and the fore laterals. The central eyes occupy an area longer than broad behind and slightly broader behind than in front; the hind central eyes are little if at all larger than the hind laterals; the interval between the fore and hind central eyes is double as great as the diameter of the former, and a little greater than the interval between the fore and hind laterals; the fore lateral eyes are oblong, much larger than the other eyes, more than double as large as the fore centrals, which are the smallest of the eight. The *mandibles* are rather strongly convex toward the base, about as long as the patellæ of the first pair, more than double as long as broad at the base, not thicker than the tibiæ of the first pair, striated transversely, with hairs and bristles of the ordinary form. The *maxillæ* are rounded (not sinuated) and curved inward in front of the insertion of the palpi, truncated at the apex inward; they have a strong transverse depression somewhat in front of the middle. The *palpi* and *legs* are of the form common in this genus, the tibiæ of the first pair incrassated; the fourth pair of legs are much (nearly with the length of their metatarsus) longer than the first, which are but little longer than the second; these are nearly with the length

of their tarsus longer than the legs of the third pair. The four anterior tibiæ are without spines; the anterior metatarsi have 1. 1. spines below; the tibiæ of the third pair have 2. 1. spines in front, 1. 1. behind, and 2. 2. below. The *abdomen* is elongate, ovato-elliptical. The *vulva* consists of a large flat area truncate in front, and with a fine longitudinal middle costa; on each side, behind and near the margins, this area vulvæ shows a furrow and a fine costa close to each other, these costæ being curved inward and united with each other behind; the area inclosed by them is thus limited behind by a \sim -formed ridge, and is scarcely broader than long, and but very slightly narrowing forward. Close to each side of this area the margins of the whole area vulvæ are gradually incrassated backward and curved inward, forming two large, low tubercles behind the said smaller area.

Color.—*Cephalothorax* black, with black hairs. *Sternum*, *mandibles*, and *labium* dark brown. *Maxillæ* dusky testaceous, darker in the middle, pale at the apex. *Palpi* blackish, with the femoral joint and the base of the patellar joint dusky testaceous. *Legs* for the greatest part black, yellowish at the base; the *coxæ* are of a sooty, testaceous hue, black at the apex above; the *thighs* are black, those of the first pair broadly testaceous at the base on the inner side, and also, though less distinctly, on the outer; the following *thighs* are also more or less broadly and evidently paler at the base; the *patellæ* are black at the apex, blackish testaceous at the base; the black *tibiæ* have two longitudinal blackish testaceous lines above (less distinct on the posterior *tibiæ*); the *tarsi* and the anterior *metatarsi* are rusty-brown, the posterior *metatarsi* piceous. The *abdomen* is black with brownish-black hairs, the belly grayish black; the *pulmonary shields* brownish-yellow, bordered with black; the *area vulvæ* is pale yellowish, with the posterior costæ and tubercles piceous.

Length of body $7\frac{1}{2}$, of cephalothorax 3 millim.; breadth of cephalothorax $2\frac{1}{5}$ millim. Length of legs: I $7\frac{1}{2}$, II $6\frac{3}{4}$, III 6, IV $9\frac{1}{6}$ millim.; patella + tibia IV $2\frac{1}{2}$ millim.

A single female was captured at Manitou, Colo., July 12. This spider is no doubt closely allied to the European *P. petiveri* (Scop.) or *P. subterranea* (C. L. Koch), but is, I think, a separate species.

Section LATERIGRADÆ.

Fam. THOMISOIDÆ.

Subfam. THOMISINÆ.

Gen. XYSTICUS (C. L. Koch), 1835.

13. *X. cunctator* n.

Cephalothorax somewhat broader than long, as long as patella + tibia of the first pair, brown, with a large whitish middle band, inclosing a grayish-brown, rather obtuse, wedge-shaped patch in front and a small triangular black line behind; legs grayish-white, with a longitu-

dinal whitish line above, the anterior ones brownish above, with brownish and black points, their metatarsi immaculate, the posterior legs paler, with black spots forming distinct transversal bands above; tibiæ of the first pair with 2. 2. 2. 2., second with 2. 2. 2. 1. spines beneath; metatarsi of first and second pairs with 5 pairs of spines; back of the abdomen brown, with a very large grayish-white middle band, coarsely dentated on the margins, behind; vulva consisting of a large black rounded fovea having a narrow septum along the middle.—♀ *ad.* Length about $6\frac{1}{2}$ millim.

Female.—*Cephalothorax* as long as patella + tibia of the 1st pair, slightly longer than broad, nearly truncate in front; seen from the side, its back between the posterior declivity and the hind central eyes is rather strongly convex, less strongly convex and more slightly sloping in front than behind; it is strewed with coarse bristles, and has a long, strong, curved bristle on each side of the pars cephalica under the hind central eyes; the clypeus shows six bristles in the margin, and one in the middle, somewhat above the margin. The area formed by the four central eyes is evidently broader than long, rectangular, at least not broader behind than in front. The *sternum* and *parts of the mouth* are of the same form as in *X. cristatus* and other typical species of the genus, strewed with hairs, the *mandibles* and *palpi* also with coarse bristles. The *legs* of the first pair are thrice as long as cephalothorax, evidently (with the length of their tarsus) longer than those of the second pair; the legs are all strewed with bristles, hairs, and spines, the difference between spines and bristles not being always easy to determine; the thighs have one spine above, the first pair, moreover, two or three spines in front; the spines on the under part of the anterior tibiæ and metatarsi are rather strong; the tibiæ of the first pair have 2. 2. 2. 2. spines, those of the second pair 2. 2. 2. 1. spines beneath; the four anterior metatarsi show, seen from beneath, five pairs of spines, the third pair belonging to the sides of the joint, *i. e.*, these metatarsi have 2. 2. 2. spines beneath, 1. in front, and 1. behind. The *abdomen* is evidently longer than broad, but slightly rounded; nearly truncated in front, gradually somewhat broader backward to behind the middle, then triangularly tapering with rounded sides, longitudinally wrinkled in the sides, transversely wrinkled on the upper part, behind. The *vulva* consists of a very distinct, deep, almost circular fovea; it is but little longer than broad, strongly rounded in front and in the sides, slightly tapering behind, bluntish at the apex, and bordered by a narrow, rather high margin, which is not depressed or open behind; along the bottom of this fovea is seen a low, narrow, slightly elevated septum, which is not dilated at the apex; in the bottom of the fovea, there appears also to be a very short, low, longitudinal costa close to the middle of the septum, on each side.

Color.—The *cephalothorax* has along the middle a very broad band, the breadth of this band being but a little smaller than that of the

clypeus; the band has in front a large, pale, grayish-brown patch, with the sides at first nearly parallel, then in the middle this patch is slightly dilated and rounded, at last triangularly narrowed, almost wedge-shaped, not much pointed; a little behind its apex, and commencing from the central furrow, is a little black triangle, or short line, tapering backward. The sides of the cephalothorax, on each side of the middle band, are brown, the extreme lateral margin white; each of these brown side-bands ends behind with two rather large black spots, separated by a white spot or short broad line. The *sternum* and *parts of the mouth* are grayish-white, somewhat mottled with brownish. The *legs* are grayish-white, densely mottled with brown and black points; the four anterior ones are brownish above, with a whitish longitudinal line reaching to the end of the tibiae; the thighs of the first pair have a few more conspicuous small black spots in front, above; the 4 hinder legs are grayish, with a white line above, and spread with smaller and larger black spots, which form a broken ring or transverse band toward the apex of the thighs above; two such rings on the patellae and tibiae (and at least traces of two rings on the metatarsi), one at the apex, the other at the base; the anterior metatarsi and tarsi are brownish-gray, without rings. The back of the *abdomen* is along the middle whitish-gray, strewed with small black points, and brown in the sides; the whitish-gray middle band is double as broad (about 2 millim.) as the brown side-bands, slightly dilated behind the middle, and then tapering, its posterior portion being coarsely dentated in the margins; the sides of the abdomen and the belly are whitish-gray, somewhat brownish in the side-wrinkles; the belly shows two rows of brownish points; on the outer side of the pulmonary shields are two black spots, the posterior nearly ring-shaped, open inward. The *vulva* is black, the *mamillae* grayish-white; the hairs and bristles of the body are black, the spines on the upper part of the legs also black, on the under part pale brownish, at least on the anterior legs.

Length of body $6\frac{1}{2}$, of cephalothorax $3\frac{1}{5}$ millim.; breadth of cephalothorax 3, of clypeus $1\frac{3}{4}$ millim.; length of abdomen $4\frac{1}{2}$, greatest breadth of same $3\frac{2}{3}$ millim. Length of legs: I $9\frac{1}{2}$, II $8\frac{5}{8}$, III 5, IV 7, of pat. + tib. I $3\frac{1}{2}$, of pat. + tib. IV $2\frac{1}{2}$ millim.

A single female specimen of this species was captured at Boulder, Colo., June 29. It is very nearly related to *X. cristatus* (Clerck) and its European allies, but may, I think, be without difficulty distinguished by the marks in the above description. *Thom. ferox* Hentz (l. c., v, p. 445, pl. xxiii, fig. 3) appears also to be a closely related species.

Gen. OXYPTILA Sim., 1864.

14. *O. conspurcata* n.

Cephalothorax as long as patella + tibia of the first pair, equably and finely coriaceous, provided with clavated bristles on the clypeus, dark brown, with a longitudinal rusty-brown middle band and an irregular

rusty-brown band on each side; legs dark brown, pale at the base, the hinder pairs rather paler, with a black ring on the tibia and metatarsus; thighs of the first pair with one spine in front, the other thighs without spines, anterior tibiæ with two, anterior metatarsi with three pairs of strong spines beneath; abdomen brownish above, mottled with black spots and strewed with small spatulate bristles; vulva consisting of a little pale Y-shaped fovea bordered on each side behind by a brown tubercle.—♀ *ad.* Length about 4 millim.

Female.—*Cephalothorax* as broad as long, rather longer than patella + tibia of the first or second pair, slightly rounded in front, finely and equably coriaceous, thinly spread with small appressed bristles, the clypeus being furnished with some strong club-shaped bristles. Seen in profile, the cephalothorax is high, very steep behind, the back being perfectly straight to the hind central eyes, the forehead then sloping. The front row of *eyes* is moderately curved upward, the hind row strongly curved backward; the area occupied by the central eyes, which are the smallest of the eight and of nearly equal sizes, is longer than broad, scarcely perceptibly broader behind than in front; the interval between the front and hind central eyes is greater than the height of the clypeus, and much shorter than the interval between the hind central and hind lateral eyes, which distance is nearly half again as great as that between the two hind centrals; the interval between the fore central eyes is greater than that between them and the fore laterals, which are much larger than the other eyes; the interval between the two lateral eyes is somewhat smaller than that between the fore and hind centrals. The *sternum* is nearly ovate, smooth and hairy, as are also the *maxillæ* and *labium*; the *mandibles* are coriaceous and provided with some bristles; their length is at least double as great as the height of the clypeus. The *palpi* are clothed with bristles, of which some are blunt and even clavate. The *thighs* of the first pair have a blunt spine or coarse bristle in front; the other thighs appear to be unarmed; the tibiæ have above a coarse and blunt upturned bristle; on the under part, the four anterior tibiæ are armed with 2. 2. long and strong spines; the four anterior metatarsi have 2. 2. 2. such spines on the under part, the last apical pair, however, situated rather on the sides of the joint. The *abdomen* is somewhat broader than long, truncate in front, gradually dilated backward to behind the middle, then narrowing with rounded sides, and rounded behind; it is thinly spread with spatulate bristles; in front of the *maxillæ*, the belly is sprinkled with hairs of the ordinary form. The *vulva* consists of a small Y-shaped depression (the fore margin of the vulva having the form of a triangular lobe) bordered behind by two tubercles, one on each side.

Color.—*Cephalothorax* blackish-brown, with a longitudinal middle band, which is as broad in front as the clypeus, narrowing backward, and of a pale rusty-brown color, with darker spots on the *pars cephalica* and a blackish line along the middle of the *pars thoracica*; the sides have

also each a paler, irregular, longitudinal band, composed of rusty-brown spots; the extreme lateral margins are of a rusty testaceous hue. *Sternum*, *maxillæ*, and *labium* pale rusty-brown, the maxillæ whitish at the apex; the *mandibles* dark, with rusty-brown spots. *Palpi* and *legs* blackish-brown, pale at the base; the *coxæ* are of a pale grayish testaceous color, as is also the base of the thighs, especially of the hinder legs, which are rather paler than the two anterior pairs, and in which both tibiæ and metatarsi have a blackish ring near the base. *Abdomen* grayish-brown above, mottled with black, these black markings forming a large patch occupying the greatest part of the back behind; toward the sides, the abdomen is also strewed with small whitish points; the sides and belly are dusky or sooty gray, the *vulva* pale, with exception of the two larger lateral tubercles, behind, which are brown. The *mamillæ* are pale grayish. The hairs and bristles of the body and the extremities are blackish, with exception of the appressed bristles of the cephalothorax, these being rusty-yellow; the long spines on the under part of the fore tibia and metatarsi are pale brownish.

Length of body nearly 4 millim.; length and breadth of cephalothorax $1\frac{3}{4}$ millim.; length of abdomen $2\frac{1}{4}$, breadth of same $2\frac{1}{2}$ millim. Length of legs: I $4\frac{1}{3}$, II nearly $4\frac{2}{3}$, III 3, IV $3\frac{1}{2}$ millim.; patella + tibia I $1\frac{1}{2}$ millim.

Of this species, which is closely allied to the European *O. praticola* (C. L. Koch) and others, a single female specimen was captured at Manitou Springs, Colo., July 13.

Gen. DLÆA Thor., 1870.

15. *D. lepida* n.

Cephalothorax brownish testaceous, with two brownish longitudinal bands toward the sides; area occupied by the central eyes somewhat broader than long, scarcely broader behind than in front; legs testaceous, at least the second pair, with broad brownish-red rings at the apex of tibia, metatarsi, and tarsi; upper part of abdomen pale grayish-brown, whitish toward the sides, with two converging, dentated, reddish-black bands on its posterior half; tibial joint of the male's palpi broader than long, oblique, its outer side at the apex drawn out into a forward-directed, pointed process, as long as the joint itself.—♂ *ad*. Length about $2\frac{2}{3}$ millim.

Male.—*Cephalothorax* fully as broad as long, strongly and equably rounded in the sides of the large pars thoracica, sinuated just under the hind lateral eyes; the pars cephalica broad, its free part very short, rounded in front; the height of the perpendicular clypeus somewhat smaller than the length of the area occupied by the central eyes. The front row of eyes rather slightly curved upward, the hind row more strongly curved backward; the distance between the two lateral eyes, which are placed on a common low and broad ridge, or long tubercle, is much greater than that between the fore and hind central eyes.

The central eyes occupy an area slightly broader than long, and scarcely perceptibly broader behind than in front; the lateral eyes of the anterior row are at least half again as large as the fore centrals, the eyes of this row being at equal distances from each other; the eyes of the hind row are of equal size, the lateral ones being somewhat more distant from the centrals than these from one another. The *sternum* is about as broad as long, nearly heart-shaped, truncate in front. The *mandibles* are small and perpendicular, their length is not half again as great as the height of the clypeus. The *palpi* are very short; their patellar joint is as long as broad and of equal breadth when seen from above, gradually incrassated toward the apex when seen from the side; the tibial joint is shorter than the patellar, seen from above transverse and somewhat oblique, the outer side being longer than the inner; the apex of the outer side is drawn out into a rather strong forward-directed process, which is about as long as the joint itself, straight, and tapering toward the pointed apex. The tarsal joint, or lamina bulbi, is longer than the two preceding joints together, much broader than they, convex longitudinally, nearly ovate; the bulb is surrounded by a very long and fine black spine, the extremity of which forms a circular coil on the outer side of the bulb, toward its apex. The *legs* are long and slender, armed with fine spines. The *abdomen* is much longer than broad, ovate; as well the cephalothorax as the abdomen is, in the only quite bare-rubbed example that I have seen, very thinly scattered with small elevated tubercles, which probably have borne each a bristle or hair; the legs of the first and fourth pairs are wanting in this example and nearly all the spines rubbed off.

Color.—*Cephalothorax* brownish testaceous, thinly strewed with small dark points, and provided with two brown longitudinal bands toward the sides, each ending with a black spot behind; the extreme margin is black, the pale space between the margin and the lateral bands rather narrower than the bands, the pale middle space broader, gradually narrowing backward, with the large lateral eye-tubercles whitish. *Sternum* and *parts of the mouth* testaceous, the *mandibles*, however, grayish testaceous, whitish at the apex, and there marked with a small, brownish-red, transverse line; the *palpi* are pale testaceous, with the tarsal joint grayish-white; the extreme apex of the process of the tibial joint is black, as is also the long spine of the bulb. The *legs* are dusky yellow or testaceous, the thighs thickly sprinkled with small brownish-red spots and points; in the anterior legs, at least those of the second pair, the thighs have a narrow, the tibiae a broader, brownish-red ring at the apex, the metatarsi and tarsi have their apical half reddish-brown, the extreme apex, however, of the tarsi being pale. The posterior legs, at least those of the third pair, are without rings. The back of the *abdomen* is, on its anterior half, pale grayish-brown, thinly strewed with some small blackish points; it is surrounded by a paler whitish band, and on its posterior half are two rather broad longitudinal reddish-brown bands reaching from the middle of the back to the anus, converging backward, and coarsely den-

tated in their outer margin; the space between these bands is whitish. On each side of the abdomen, at its fore extremity, just beneath the whitish band which surrounds the back, is a short, longitudinal reddish-brown line; the sides have, moreover, behind and more downward, a row of small, irregular, reddish-brown spots. The under part of the abdomen is whitish-gray, with two brownish-red points at the rima genitalis. The *mamillæ* are whitish-gray, the inferior pair with a brownish-red spot at the base.

Length of body $2\frac{3}{8}$, length and breadth of cephalothorax $1\frac{1}{8}$ millim.; length of abdomen $1\frac{3}{4}$, breadth of same somewhat more than 1 millim. Length of legs II 7, of legs III 3 millim.; pat. + tibia II a little more than $2\frac{1}{8}$, pat. + tibia IV 1 millim.

The collection includes a single very damaged male specimen of this fine little spider, captured at American Fork Cañon, Utah, July 22. The female differs probably much both in form and color from the male.

Gen. MISUMENA (Latr.), 1804.

16. *M. vatia* (Clerck).

SYN.—1757.—*Araneus vatius* Clerck, Svenska Spindl., p. 128, pl. 6, tab. 5.

1758.—*Aranea calycina* Linn., Syst. Nat., ed. 10, i, p. 620.

1778.—*Aranea citrea* De Geer, Mém., vii, p. 298, pl. 18, figs. 17–22

1848.—*Thomisus fartus* Hentz, Descr. and Fig. of the Aran. of the U. S., c, v, p. 445, pl. xxiii, fig. 4.

1872.—*Misumena vatia* Thor., Rem. on Syn., 3, p. 258.

Of this widely spread species, the collection contains three female examples, captured at Lawrence, Kans., Boulder, Colo., and Golden, Colo., ("Foot-hills entrance in Clear Creek Cañon"), June 25 to July 13. *Thom. aleatorius* Hentz (l. c., p. 444, pl. xxiii, fig. 2) is *perhaps* the male of this species, and *Th. celer* id. (l. c., p. 446, pl. xxiii, fig. 5) a variety of the female.

Subfam. PHILODROMINI.

Gen. PHILODROMUS (Walck.), 1820–26.

17. *Ph. aureolus* Clerck.

SYN.—1757.—*Araneus aureolus* Clerck, Svenska Spindl., p. 133, pl. 6, tab. 9.

1872.—*Philodromus aureolus* Thor., Rem. on Syn., 3, p. 264.

A male of this in Europe common species was captured at the Great Salt Lake, Utah, July 27, and a female at Manitou, Colo., July 16; both examples are full-grown.

18. *Ph. virescens* n.

Pale whitish or yellowish-green, the cephalothorax brownish or violet on the sides; joints of legs slightly violet at the apex; abdomen with a pale violet band along each side, and two short parallel violet lines above the anus; second pair of legs the longest, third and fourth pairs of very nearly the same length; eyes of the front row of the same size, hind lateral eyes slightly larger than hind centrals; area of the central eyes

much broader behind, shorter than broad behind; interval between the central eyes greater than that between them and the laterals of the same row; abdomen nearly half again as long as broad; vulva consisting of a pale brownish depression, bordered on the sides by two nearly parallel strong blackish costæ.—♀ *ad.* Length about 6 millim.

Female.—*Cephalothorax* as long as the tibia of the second pair, shorter than patella + tibia of the fourth pair, a little broader than long, strongly rounded in the sides, also rounded in front, with the clypeus nearly half as broad as the pars thoracica; seen in profile, the cephalothorax is of moderate height, with the posterior declivity rather steep and short, the back then straight to the hind central eyes, the forehead between the central eyes sloping; also the clypeus is sloping, and its height a little greater than the length of the area occupied by the central eyes. *Sternum* broad, truncate in front. *Eyes* small, of nearly equal size, both the rows curved moderately upward, the front row being a little more strongly curved than the hind row. The lateral eyes of the front row are scarcely, those of the hind row a little, larger than the central eyes of the same row; the area occupied by the central eyes is about half again as broad behind as in front, its length being smaller than its breadth behind and a little greater than its breadth in front. The interval between the hind lateral and central eyes is smaller than that between these latter, the interval between the fore lateral and central eyes, which is not much greater than the diameter of an eye, is nearly double as small as that between the fore centrals, and also smaller than the interval between the fore lateral and the hind central eyes. The length of the *mandibles* is scarcely more than half again as great as the height of the clypeus, and their thickness at the base is about that of the fore tibiæ. The *palpi* are short and armed with several spines. The *legs* are of the usual form; the second pair, which is the longest, is five times as long as cephalothorax, the third pair is very nearly as long as the fourth; all the thighs, tibiæ, and metatarsi are armed with several long spines, and even the patellæ have one or two spines; the spines on the under part of the tibiæ are 2. 2. 2. The *abdomen* is nearly half again as long as broad, broadest between the middle and the apex, inversely pentagono-ovate. The *vulva* consists of a rather small but very conspicuous depression a little longer than broad, and limited on the sides by two parallel strong costæ, curved a little inward at the apices. The whole body is rather densely covered with fine appressed hair.

Color.—*Cephalothorax* pale greenish along the middle, brownish-violet on the sides; these side-bands nearly as broad as the pale greenish middle band, which shows a less distinct, coarse, whitish V on the pars cephalica, behind. *Sternum* and *parts of the mouth* pale greenish or yellowish. *Palpi* and *legs* pale greenish, the thighs, patellæ, tibiæ, and metatarsi slightly violet at the extreme apex. The *abdomen* is of a pale whitish or yellowish-green color, paler beneath; it has two short, longitudinal, nearly parallel, unequal, violet lines immediately above the

anus, and a less distinct, pale, unequal, violet band along each side. The *vulva* is placed in a pale brown spot, and is itself pale brown, with the lateral costæ blackish. The *mamillæ* are pale greenish-yellow; the upper pair violet above. The fine hair with which the body and extremities are covered is whitish; the thighs are sprinkled with black hairs; the spines are black.

Length of body 6, of cephalothorax 2 millim.; breadth of cephalothorax $2\frac{1}{6}$ millim.; length of abdomen 4, breadth of same $3\frac{1}{2}$ millim. Length of legs: I $8\frac{1}{2}$, II 10, III nearly $7\frac{1}{2}$, IV $7\frac{1}{2}$ millim.; pat. + tibia I 3, II $3\frac{1}{2}$, IV $2\frac{1}{2}$ millim.

The only example in the collection, a female, was captured at Golden, Colo., July 3.

19. *Ph. inquisitor* n.

Cephalothorax dark brown, with a longitudinal short and rather narrow, pale middle band behind; the eye-rows very slightly curved, the lateral eyes of each row little, if at all, larger than the centrals of the row; area of the central eyes slightly broader than long, broader behind than in front; interval between the lateral and the central eyes of the same row much smaller than that between the centrals; legs dark brown, with pale irregular rings; back of abdomen pale grayish-white in front, with a lanceolate black band along the middle of this grayish-white area, which is continued backward as a tapering grayish-white band, on the sides of which the back is dark brown, mottled with black and white; vulva consisting of a small, semicircular, pale brown depression, with two short, longitudinal, parallel, black costæ behind.—♀ ad. Length about 6 millim.

Female.—*Cephalothorax* little longer than broad, as long as tibia of the fourth pair, very strongly rounded in the sides, strongly sinuated and narrowed just in front of the coxæ of the first pair, rather thickly covered with coarse appressed hair; the pars cephalica narrowing forward, slightly rounded in front, the breadth of the clypeus not equaling half that of the pars thoracica; seen in profile, the back is nearly straight from the rather short posterior declivity to the eyes, slightly sloping between the eyes, the clypeus more abruptly sloping, with a transversal depression just under the eyes; its height is evidently greater than the length of the area occupied by the central eyes. The cephalic furrows and the hind central furrow are very distinct. Both the front and the hind row of *eyes* but very slightly curved backward (upward); the eyes of the front row appear to be a little larger than those of the hind row, and to be of equal size, the central ones at least not larger than the laterals; the hind laterals are perhaps slightly larger than the hind centrals. The area occupied by the central eyes is very nearly as long as broad behind, broader behind than in front; the interval between the fore lateral and central eyes is nearly double as small as that between these latter, which are separated by an interval about half

again as great as the diameter of an eye; the space between the hind centrals is nearly half again as great as that between them and the hind laterals. The distance between the fore lateral and hind central eyes is double as great as that between the former and the fore centrals, and the distance between the fore and hind central eyes is much larger than that between the fore and hind laterals. The *mandibles* are perpendicular, covered with long hairs and several long, fine bristles; their length is not half again as great as the height of the clypeus. The *palpi* and *legs* are coarse, appressed hair, and armed with numerous long and rather fine spines; on the under part of the fore tibiæ, the spines are 2. 2. 2. The third and fourth pairs of legs are very nearly of the same length. The *abdomen* is much longer than broad, egg-shaped, covered above with coarse, appressed hair, especially on its paler parts; the *vulva* consists of a small, almost semicircular depression, rounded in front and truncated behind, where it shows two longitudinal, low, short, and coarse, parallel costæ.

Color.—The whole body above and the extremities are covered more or less thickly with coarse, appressed, whitish hair. The *cephalothorax* is dark brown, with a pale, brownish-gray, longitudinal, middle band behind, which only reaches to the pars cephalica, and is geminated by a blackish line behind; this band is only half as broad as the brown space on each side of it. *Sternum*, *maxilla*, and *labium*, as also the coxæ beneath, pale grayish-brown; *mandibles* blackish-brown. *Palpi* and *legs* blackish-brown, with pale grayish-brown irregular rings, and paler toward the apex; the thighs have a rather broad pale ring at the base and another narrow ring near the middle, as also a pale patch at the apex; the patellæ have one such ring toward the base, the tibiæ one in the middle, and they are also more or less distinctly pale at the very apex; the metatarsi and tarsi are pale brownish, the former with three narrow black rings. The spines are mostly black, partly pale. The back of the *abdomen* is, on its anterior half, of a pale, slightly brownish-gray color, this gray area being behind, on each side, limited by an oblique row of whitish spots continued down the sides of the abdomen; along the middle, this area shows a lanceolate band, reaching from the base to the middle of the back, and having on either side an *oblique*, short and narrow branch; the pale gray color on either side of the lanceolate band is continued backward in the form of a rather narrow middle band, gradually tapering toward the anus, and divided into spots by about four short, transversal, black lines; on the sides of this band the back is dark grayish-brown, and outward marked with a couple of large black spots, as also with a few smaller whitish ones. The appressed hair with which the back is covered is of a grayish-white color. The sides of the abdomen are blackish, sprinkled with small paler spots, and provided with a longitudinal, broad, irregular, whitish-gray band behind, upward; the belly is gray, with three longitudinal dusky bands converging backward. The *vulva* is pale brown, its costæ black.

Length of body somewhat more than 6, of cephalothorax nearly $2\frac{1}{2}$ millim.; breadth of cephalothorax $2\frac{1}{4}$ millim.; length of abdomen $4\frac{1}{5}$, breadth of same 3 millim. Length of legs: I 10, II $11\frac{1}{4}$, III 9, IV little more than 9 millim.; patella + tibia II somewhat more than 4, patella tibia + IV $3\frac{1}{4}$ millim.

A single adult female was captured at Kelso Cabin, Colo., July 6.

Section CITIGRADÆ.

Fam. LYCOSOIDÆ.

Gen. LYCOSA Latr., 1804.*

20. *L. sternalis* n.

Cephalothorax brownish-black, with three narrow bands, the middle one only reaching to the pars cephalica, the lateral bands supramarginal, continuous, and uneven in the margins; sternum yellowish, with a large, middle, ovate, black patch, geminated by a yellowish line; legs dusky yellow, paler at the base, with blackish rings, the second and third pairs of equal length; back of the abdomen brownish-black, with a shortish, lanceolate, middle band in front, and a row of small whitish spots on each side behind; vulva consisting of a nearly inversely-ovate corneous area, having two large circular foveæ rather close together at its hind extremity and two fine furrows along the middle.—♀. Length $5\frac{1}{2}$ –7 millim.

Female.—*Cephalothorax* much shorter than patella + tibia of the fourth pair, as long as these joints together of the first pair, rather narrow, not very high in front; seen in profile, the back is straight, without any depression between the posterior declivity and the hindmost eyes, slightly convex and anteriorly somewhat sloping between the four posterior eyes; the sides of the pars cephalica are, seen from in front, nearly perpendicular, slightly rounded downward. The front row of eyes is much shorter than the middle row, evidently curved downward; the eyes of this row are of equal size, the interval between

* I fully agree with those who think that when an author has named a certain species as the *type* of a genus proposed by him, the generic name in question ought to be kept for that species; thus, for instance, the generic name *E. piblemum* Hentz for *Araneus scenicus* Clerck or *Epibl. faustum* Hentz. But Latreille has not, at least not in any work to which I have had access, given any definite species as the type of his genus *Lycosa*; to name one or more species as *examples* of a genus is not the same as to declare them to be *typical* species of it. Sundevall, who first broke up *Lycosa* Latr. into several smaller genera, was therefore free to keep the old name for those species which *he* considered most typical of the genus, and which indeed by almost all authors are believed to be so. I continue then to take *Lycosa* in the same sense as *Sundevall* has done (with *L. lugubris* Walck. as type), till it has been shown that (and where) Latreille has expressly stated that he considered "*L. tarantula*" as "*type*" of the genus. As to the generic name *Tarentula*, vid. Thor., On Eur. Spid., p. 11; id., On the Classif. of Scorpions, in Ann. and Mag. of Nat. Hist., 4th ser., xvii, p. 4, the foot-note.

the two central ones is fully as great as their diameter, and at least half again as great as that between them and the lateral eyes. The area occupied by the four posterior eyes is but slightly longer than broad in front, its breadth behind surpasses the breadth in front with about the diameter of one of the two large eyes of the middle row, which eyes are separated by an interval somewhat greater than their diameter; the interval between them and the eyes of the hindmost rows is about double as great as the diameter of one of these latter eyes. *Mandibles* as long as the tarsi of the first pair. *Palpi* and *legs* of the ordinary form, the fourth pair of legs at least four times as long as the cephalothorax, the second pair scarcely longer than the third. The spines of the legs are in part very long, the tibiæ of the four anterior legs have 2. 2. 2. spines beneath, the apical pair being much shorter than the others, and besides 1. 1. short spines in front and behind. The *abdomen* is elliptical or rather inversely ovate; the *vulva* has the form of a rather large corneous area gradually narrowing forward, almost inversely ovate, rounded in front, and there limited by an elevated margin, more truncate behind; near its broad, blunt, posterior extremity it shows two large profound circular foveæ; the part of the area which separates these foveæ is narrow, x-shaped, and from this septum proceed forward, nearly to the apex of the area, two fine furrows limiting three fine narrow costæ gradually converging forward.

Color.—*Cephalothorax* brownish-black, with three longitudinal, narrow, dusky testaceous bands covered with grayish-white hair; the middle band reaches only to the pars cephalica, and is slightly tapering backward and geminated anteriorly by a fine black line; the side-bands, which are continued along the cheeks and meet under the front row of eyes, are continuous, uneven in the margins, as broad as the middle band and as the dark space between them and the extreme margin of the cephalothorax, but scarcely half as broad as the two spaces between the bands. *Sternum* dusky yellow, surrounded by a row of small black spots at the very margin, and with a large, black, ovate, middle patch, geminated along the greatest (anterior) part of its length by a yellowish line. *Mandibles* dusky yellow with blackish spots; *maxillæ* and *labium* yellowish, this latter dark at the base. *Palpi* and *legs* dusky yellow, paler at the base, with blackish rings and spots. The *coxæ* are yellow beneath; the thighs have three (or four) more or less distinct irregular rings formed of blackish spots, the tibiæ and metatarsi have three more regular blackish rings. The spines and bristles are black. *Abdomen* blackish-brown above, with a lanceolate pale brownish band (which appears to have been covered with grayish-white hair) along its anterior part; behind this band, which does not reach the middle of the back, are two rows of small pale brownish spots close together and converging toward the anus, the posterior spots being united transversely two and two into short angular lines, or spots; more outward, the hinder part of the abdomen shows two rows of

small whitish-gray spots, or points, formed of grayish-white hair. The belly is grayish-yellow, with small blackish spots, forming three more or less distinct longitudinal bands converging backward; it is, like the sternum, covered with whitish-gray hair. The *vulva* is pale brown, at least sometimes blackish toward the lateral margins.

Length of body $6\frac{1}{2}$, of cephalothorax $3\frac{1}{2}$ millim.; breadth of cephalothorax a little more than $2\frac{1}{2}$ millim. Length of legs; I $10\frac{1}{2}$, II and III 10, IV $14\frac{1}{2}$ millim.; patella + tibia IV $4\frac{1}{2}$ millim.

A female specimen of this very distinct little *Lycosa* was captured at Boulder, Colo., June 29; another at Manitou, Colo., July 12.

21. *L. concinna* n.

Cephalothorax black, with three longitudinal, narrow, pale bands, the middle band dilated on the pars cephalica, the laterel ones continuous; supermarginal, or geminated by a black line; sternum black; legs pale brown, with blackish spots or rings, at least on the posterior pairs, the coxæ yellowish beneath; abdomen blackish above (in the bottom), with a longitudinal, lanceolate, pale brownish, black-edged band in front, continued by two series of spots of the same color gradually converging and uniting together toward the anus; vulva consisting of an oblong, deep corneous brown fovea, strongly narrowed in front and broadly truncated behind, its posterior, much longer and broader, portion being divided into two large foveæ by a high plane septum with parallel sides and thrice as long as broad.—♀ *ad.* Length about 7 millim.

Female.—Cephalothorax somewhat shorter than patella + tibia of the fourth pair, longer than these joints of the first pair together, not very high, rather narrow, with the sides of the pars cephalica almost perpendicular, and, when seen from in front, slightly rounded; seen in profile, the back of the cephalothorax is, between the posterior declivity and the hindmost eyes, not perfectly straight, but slightly concavated; between the posterior eyes, it is sloping, but very slightly convex. First row of eyes nearly straight, scarcely perceptibly curved downward; the central eyes of this row appear to be a little smaller than the laterals, and are removed from each other by an interval fully as large as their diameter, and evidently larger than the interval which separates them from the lateral eyes. The area occupied by the four posterior eyes is slightly longer than broad in front; its hinder breadth exceeds the fore breadth with at least the diameter of one of the largest eyes. The interval between the two eyes of the second row is slightly greater than their diameter; the space between them and the hindmost eyes is double the diameter of these latter. The *mandibles* are $2\frac{1}{2}$ – $2\frac{1}{3}$ times as long as broad, slightly convex longitudinally toward the base. The *legs* are rather short, fourth pair 4 times as long as cephalothorax, second and third pairs of the same lengths. The four anterior tibiæ have 2. 2. 2. spines beneath and 1. 1. spines in front, these spines not being very long. The *abdomen* is inversely ovate. The corneous *vulva* consists of

a large deep fovea, narrow in front, then gradually and strongly dilated, at last somewhat narrowing backward, and limited by a sharp margin, which is strongly elevated in front, lower behind; the anterior, narrow part of this fovea is rounded at the apex, with nearly parallel sides, not much longer than broad; the posterior or principal part is at least as broad as long, about three times as broad and long as the anterior part, somewhat rounded in the sides, broadly truncated behind; all along the middle, it has a high, broad, prismatical septum, with almost parallel sides, about three times as long as broad, nearly as broad as the two deep oblong foveæ into which it divides the vulva; this septum is shortly pointed in front, and there produced as a fine costa along the bottom of the anterior part of the vulva; at the truncated posterior apex, behind, it shows two small and slight depressions, above it is plane, with two scarcely perceptible longitudinal furrows.

Color.—*Cephalothorax* blackish, with three longitudinal pale bands, covered with brownish or whitish-gray hair; the middle band is on the pars thoracica at least as broad as the tibiæ of the first pair, slightly tapering backward, and geminated by a fine black line in front; at the pars cephalica it is suddenly dilated and continued forward between the posterior eyes, filling up the area between them, and here nearly double as broad as on the pars thoracica. The lateral bands are supramarginal, continuous, but uneven in the margins, narrow, and separated from the edge of the cephalothorax, which is also covered with grayish-white hair, by a blackish-brown line, so that the bands may also be said to be marginal and geminated. The *sternum* is black, and covered with grayish-white hair. The *mandibles* are dark brown; *maxilla* and *labium* yellowish, the former brown along the middle toward the base, the latter brown at the base. *Palpi* and *legs* of a pale brown hue, the *coxæ* yellowish beneath; the posterior legs are rather distinctly but not densely black-ringed; the anterior legs have distinct blackish spots or rings only on the upper part of the thighs. The *abdomen* is above blackish, with a very strongly marked, lanceolate, pale brown, black-edged band on its anterior half, and two converging series of rather large spots of the same color behind, reaching from the sides of the band to the anus and gradually melting together as they approach the anus; moreover, the back appears to be mottled with black and grayish-white spots, and to have a row of small grayish-white points on either side behind. The belly is grayish-brown, and covered with grayish hair. The *vulva* is dark brown, the *mamillæ* black.

Length of body 7, of cephalothorax $3\frac{1}{2}$ millim.; breadth of cephalothorax at least $2\frac{1}{2}$ millim. Length of legs: I $9\frac{1}{2}$, II and III $9\frac{1}{2}$, IV 13 millim.; patella + tibia IV $3\frac{3}{4}$ millim.

The only example contained in the collection is a rather bare-rubbed female captured at Kelso Cabin, Colo., July 6. The species much resembles the European *L. monticola* (Olerck) and several others of the same group, but the vulva is entirely different, and also the central pale band of the cephalothorax is of another form than in that species.

22. *L. uncatu* n.

Cephalothorax blackish, with a pale, rather broad, longitudinal, middle band covered with grayish-white hair; sternum black or brown; legs brownish-yellow, with blackish rings, second and third pairs of equal length, fourth pair more than four times as long as cephalothorax; abdomen blackish, with a broad, longitudinal, pale band, or area, covered with grayish-white hair, and with two rows of small spots of the same color; tibial joint of the male palpi black on the sides, pale brownish above, covered with black hair; tarsal joint black, pale at the apex; bulbus very high at the base, and there armed with two spines, one very long, curved upward and directed forward and outward, the other directed downward and outward; vulva forming an oblong pale area, narrow in front, and there provided with two longitudinal furrows, strongly dilated and rounded on each side, behind, and here bordered by a brown margin.—♂ ♀ *ad.* Length of ♀ 7-8, of ♂ about 6 millim.

Female.—*Cephalothorax* shorter than patella + tibia of the fourth pair, nearly as long as patella + tibia of the first pair, of moderate breadth, rather strongly rounded in the sides, and with the sides of the pars cephalica nearly perpendicular; seen in profile, the back is nearly straight, but very slightly concavated between the posterior declivity and the hindmost eyes, slightly sloping and convex between the posterior eyes. The front row of *eyes* is much shorter than the middle one, very slightly curved downward; the eyes of this row are very nearly of the same size, the interval between the central ones being as great as their diameter, and greater than the interval between them and the laterals. The area occupied by the four posterior eyes is little longer than broad in front, with more than the diameter of one of the largest eyes broader behind than in front; the space between the two largest eyes is evidently greater than their diameter, the space between them and the hindmost eyes double as great as the diameter of these latter. *Mandibles* as long as the tarsi of the first pair, their claw-furrow armed with three pointed, rather small teeth on the posterior, and with two teeth on the anterior margin, the innermost of these latter teeth being very small. The fourth pair of *legs* is about $4\frac{1}{4}$ times as long as the cephalothorax; the second pair are scarcely longer than the third. The tibiae of the first pair have 4 pairs of spines beneath, the apical pair being short, the third pair placed a little higher up than the others, and they have, moreover, one spine on each side between the middle and the base; on the tibiae of the second pair, the third pair of spines is placed still more upward, so that these tibiae have 2. 2. 2. spines beneath and 1. 1. spines on each side. *Abdomen* is of the ordinary form; the *vulva* is not very conspicuous. It consists of an oblong (not depressed) pale area, which is narrow in front, strongly dilated on both sides, behind; the anterior narrow portion, which is much longer than broad, and rounded at the apex, with nearly parallel sides, shows two longitudinal fine furrows; the posterior portion is about double as broad as the anterior, some-

what transverse, rounded in the sides, also slightly rounded behind, and limited by a brown margin on the sides and behind, but without any distinct sculpture.

Color.—*Cephalothorax* black, with a pale brownish, longitudinal, middle band, reaching at least to the hindmost eyes, behind which it is somewhat constricted, and nearly as broad in front as the area of the posterior eyes, gradually tapering backward, geminated by a fine black line, and covered with grayish-white hair. The sides of the cephalothorax are clothed with brownish hair, more grayish toward the margins. *Sternum* black or brown, covered with short grayish-white hair. *Mandibles* brownish-black, with indistinct yellowish spots; *maxillæ* yellowish, blackish along the middle; *labium* yellowish, blackish at the base. *Palpi* and *legs* of a dull brownish-yellow color with blackish rings; the *coxæ* are yellowish beneath, especially at the base; the thighs, which sometimes are blackish beneath, have three or four broken rings, formed of irregular black spots; the anterior thighs have, moreover, a yellowish longitudinal line on the outer side; the tibiæ have two or three, the metatarsi three blackish rings. The back of the *abdomen* is blackish toward the sides, rusty-brown along the middle, with a black spot on each side in the margin of this broad rusty-brown band, or area, between the middle of the back and the anus; this area is covered with grayish-white hair, forming a broad longitudinal band all along the back, and a row of small spots of the same color along the lateral margins of the band. The belly is grayish-brown, covered with grayish hair; the *mamillæ* are deep black, paler at the apex.

Length of body 7, of cephalothorax $1\frac{1}{2}$ millim.; breadth of same $2\frac{3}{4}$ millim. Legs: I 11, II $10\frac{1}{2}$, III $10\frac{1}{2}$, IV 15 millim.; patella + tibia IV $4\frac{2}{3}$ millim.

Male.—The male closely resembles the female in form, with exception of the sexual organs. The *cephalothorax* is as long as tibia + patella of the second pair. The patellar joint of the *palpi* is, seen from above, cylindrical, rounded in front, not fully double as long as broad. The tibial joint is a little broader, and, at least when seen from the side, slightly longer than the patellar joint, gradually, but very slightly, thickened toward the apex; the tarsal joint is fully as long as the two preceding joints together, about double as broad as the tibial joint, nearly ovate, but strongly narrowing toward the apex, very convex; the genital bulb is nearly circular, elevated into a very high, almost conical, tubercle at the base; from the anterior, excavated side of the blunt apex of this tubercle, more inward, proceed two strong spines; the inner, which is by far the longest and strongest, and tapering toward the obtuse apex, is directed forward and outward and curved upward and slightly backward, thus separated from the anterior lower part of the bulb by a great empty space; the other spine, which issues in front of the first named, is much shorter and slenderer, more pointed, directed downward and outward, with the extreme apex curved inward. In front of the elevated basal

part, the bulbus sends out, from its inner margin, a large tapering costa (spine?), very broad at its base, directed outward and backward, curved upward, and concealing its apex under the basis of the elevated posterior part of the bulb; outward, the anterior part of the bulbus is occupied by a lamina truncated at the apex.

The color of the *cephalothorax* and *abdomen* appears to be as in the female. The *mandibles* are blackish, with dusky brownish-yellow streaks. The *maxillæ* and *labium* are also mostly blackish. The femoral joint of the *palpi* is brownish-yellow, with black spots and streaks, especially toward the base; the patellar joint is yellowish-brown, the tibial black on the sides, pale brownish above, covered with black hair; the tarsal joint is black and black-haired, pale at the apex; the bulbus rusty-brown, with the smallest of the three spines black, and the lamina of the low anterior part pale, grayish. The *legs* are brownish-yellow; the thighs black beneath, except at the apex, and with distinct blackish rings above; the following joints are less distinctly ringed.

Length of body 6, of cephalothorax a little more than 3 millim.; breadth of cephalothorax nearly $2\frac{1}{2}$ millim. Legs: I nearly 10, II and III $9\frac{1}{2}$, IV 14 (?) millim.; patella + tibia IV $3\frac{1}{2}$ millim.

A male and a female example of this species were captured at Georgetown, Colo. (9,500 feet above the level of the sea,) July 8; two other females were found on the Blackhawk, Colorado, July 2, one on Mount Gray, July 7, and one in Idaho, July 5.

23. *L. tristis* n.

Cephalothorax black, with a broad, rusty-brown, middle band strongly constricted behind the eyes, and with a supramarginal row of rusty-brown spots on each side; legs blackish, with rusty-brown streaks and spots, and with two distinct rings of the same color, at least on the metatarsi; legs of second and third pairs of equal length; fourth pair of legs rather more than four times as long as cephalothorax; abdomen sooty black above, grayish beneath; vulva flask-shaped, its anterior part forming an **M**; the posterior, much broader part, rounded at the sides, consisting of two large deep foveæ separated by a septum gradually broader backward, and also continued along the anterior part, forming its middle portion.—♀ *ad.* Length about 7 millim.

Female—*Cephalothorax* shorter than patella + tibia of the fourth pair, little, if at all, longer than these joints of the first pair together, of moderate breadth, strongly rounded in the sides, with the sides of the pars cephalica nearly perpendicular, and, when seen from in front, slightly rounded; the back is between the posterior declivity and the hindmost eyes very slightly concave longitudinally, the area between the posterior eyes slightly convex and sloping. First row of *eyes* straight; these eyes appear to be of the same size; the interval between the central ones is scarcely as great as their diameter and much greater than the interval between them and the lateral eyes of the row. The area of the

four posterior eyes is a little longer than broad in front, much (the diameter of one of the largest eyes) broader behind than in front; the space between these two eyes is a little greater than their diameter, that between them and the hindmost eyes double the diameter of one of these latter eyes. The *mandibles* are about $2\frac{1}{2}$ times as long as broad, slightly convex longitudinally; the posterior margin of the claw-furrow is armed with three rather small teeth, the anterior with two. The *legs* are slender, of moderate length, the fourth pair rather more than 4 times as long as cephalothorax; the tibiæ of first pair have 2. 2. 2. spines beneath and 1. in front; those of the second pair 2. 2. 2. beneath and 1. 1. in front. The *abdomen* is of the ordinary form, rather inversely ovate. The *vulva* is a large and corneous area, which behind shows two deep, semi-elliptical or rounded foveæ, continued forward as two short, nearly parallel furrows; between these furrows and the foveæ is a long septum, very narrow between the furrows, gradually dilated backward quite to the end of the vulva, where it is truncated, and about as broad as the foveæ, and fills up the space between the lateral margins of the vulva behind; along the middle it shows a furrow, and it is also gradually dilated forward at the anterior apex, and there provided with a wedge-shaped furrow or depression; the anterior (not depressed or excavated) part of the vulva thus resembles a narrow M; the posterior part, which is the longer (at least sometimes), is somewhat transversal, nearly elliptical, and more than double as broad as the anterior part. The margins which limit the sides of the posterior part of the vulva (the foveæ) are incrassated behind, terminating in a low, broad tubercle on either side of the end of the septum.

Color.—*Cephalothorax* black, with a longitudinal, rather broad, middle band strongly constricted behind the eyes, narrowing backward from the middle, and there geminated by a fine black line; toward the margins, the cephalothorax shows a row of three or four larger, more or less distinct, supramarginal spots. The *sternum* is deep black, the *mandibles* blackish, with dusky testaceous spots. The *palpi* and *legs* are black, with rusty-brown rings or patches and streaks; the *coxæ* are somewhat paler beneath, at least at the very base; the thighs have two long rusty brown patches above, geminated by a black longitudinal line, and a more or less distinct patch between them, the anterior ones also a pale line along the outer side; the *patellæ* are brownish above, with a middle, black, longitudinal line; the tibiæ have two, more or less distinct, rusty-brown rings, geminated above by a black line; the *metatarsi* have two distinct, broad, rusty-brown rings; the *tarsi* are rusty-brown, blackish at the apex. The *abdomen* is brownish-black, the belly of a sooty-gray color. The *vulva* is brown. The superior *mamillæ* are rusty-brown, the inferior black.

Length of body 7, of cephalothorax $3\frac{1}{2}$ millim.; breadth of cephalothorax $2\frac{1}{2}$ millim. Legs: I $10\frac{1}{2}$, II and III 10 $\frac{1}{2}$, IV 15 millim.; patella + tibia IV somewhat more than 4 millim.

Of this species, the collection only includes two (completely bare-rubbed) female examples, one from Idaho, captured July 5, the other from Manitou, Williams' Cañon, Colo., captured July 17.

24. *L. indagatrix* n.

Cephalothorax black, with a rather broad yellowish-brown middle band on the pars thoracica and a supramarginal row of about three yellowish brown spots on each side; legs yellowish-brown, with black rings, the thighs black with yellowish-brown spots; third pair of legs evidently longer than second, fourth pair not four times as long as cephalothorax; abdomen blackish above and on the sides, brownish beneath; vulva dark brown, consisting of a deep, flask-like, sharp-edged depression, narrow in front, with the posterior, broader and longer part rounded in the sides; along its whole length, the vulva is divided into two large, long foveæ (open behind) by means of a narrow septum, which in front has the form of a fine costa, but then becomes broader, with almost parallel sides, and with a longitudinal furrow.—♀ *ad.* Length about 8 millim.

Female.—*Cephalothorax* rather broad, strongly rounded at the sides, shorter than patella + tibia of the fourth pair, longer than these joints of the first pair, its breadth equaling the length of patella + tibia of the third pair; seen in profile, the back, between the posterior declivity and the eyes, is evidently depressed toward the middle, slightly convex behind this depression, straight in front of it; the area of the posterior eyes is slightly sloping, the sides of the pars cephalica are nearly perpendicular. The first row of *eyes* is very slightly curved downward, its eyes of nearly equal size; the central ones are separated from each other by an interval as great as their diameter, and greater than the interval between them and the laterals. The area occupied by the four posterior eyes is much broader behind than in front, a little longer than broad in front; the interval between the largest eyes is a little greater than their diameter; that between them and the hindmost eyes scarcely double as great as the diameter of these latter eyes. The *mandibles* are about $2\frac{1}{4}$ times as long as broad at the base; the claw-furrow has three strong teeth in the posterior and two teeth in the anterior margin. The *legs* are rather short, the first pair but little longer than the third, which are slightly, but evidently longer than the second pair; the length of the fourth pair is not 4 times as great as that of the cephalothorax. The anterior tibiæ have 2. 2. 2. spines below, the first pair also 1., the second 1. 1. in front. The *abdomen* is inversely ovate; the area vulvæ is large and corneous, somewhat triangular; the *vulva* forms a deep, flask-like depression, bounded by sharp margins; these margins, however, being behind incrassated into two large, low tubercles; in front, the vulva is narrow, then equably and rather strongly dilated, and at last narrowed again, the anterior part being gradually and slightly dilated backward, also slightly dilated at the vey apex,

(in front), somewhat longer than broad; it gradually goes over into the posterior part, which is longer than the anterior, at least double as broad as this latter, about as broad as long, rounded in the sides, broadly truncate behind. The vulva is, along its entire length, divided, by a narrow septum, into two long, large foveæ, open behind; this septum is abruptly, but not very much dilated toward the middle; its anterior half has the form of a fine linear costa, the posterior half that of a broader costa, scarcely perceptibly increasing in breadth backward, about twice as long as broad, about as broad as the space which separates it from the incrassated, posterior, lateral margins of the vulva, and provided with a fine longitudinal furrow; in the bottom of the vulva, on each side of the septum, toward its hind extremity, is a small rounded tubercle.

Color.—The *cephalothorax* is black, with a longitudinal, paler yellowish-brown, middle band about as broad as the anterior thighs, reaching at least to the *pars cephalica*, somewhat tapering backward, and geminated by a black line; above the lateral margins is a row of about three yellowish-brown spots. The *sternum* is black; the *mandibles* blackish, with brownish-yellow spots. The *palpi* and *legs* are dark yellowish-brown, with black rings; the *coxæ* are brownish beneath; the thighs black, with very distinct yellowish-brown spots, which, above, have the form of two oblong patches, geminated by a black line, and a spot on each side between them; the *patellæ* are blackish on the sides, with a black line above; the *tibiæ* and *metatarsi* have three black rings; the *tarsi* are black at the apex. The *abdomen* is blackish above and on the sides, brownish beneath; the *vulva* dark brown. The under part of the body is rather thickly covered with grayish hair.

Length of body 8, of cephalothorax nearly 4 millim.; breadth of cephalothorax 3 millim. Legs: I $10\frac{1}{3}$, II 10, III $10\frac{1}{4}$, IV $14\frac{1}{2}$ millim.; patella + tibia IV $4\frac{1}{2}$ millim.

A single quite bare-rubbed female of this species was found at Denver, Colo., July 10.

25. *L. impavida* n.

Cephalothorax black, (probably) clothed with rusty-brown hair; legs black, with paler rings, the fourth pair about $4\frac{1}{2}$ times as long as cephalothorax, second and third pairs of equal lengths; abdomen black, with rusty-brown and whitish hair; vulva consisting of a transverse depressed area, narrowing backward, and containing two outward-curved costæ, strongly diverging forward, and including, together with the lateral margins of the vulva, two deep foveæ.—♀ *ad.* Length about 9 millim.

Female.—*Cephalothorax* much shorter than patella + tibia of the fourth pair, as long as patella + tibia of the first pair, rather broad, strongly rounded in the sides, its breadth equaling the length of the tibia of the fourth pair; the sides of the *pars cephalica* are slightly

sloping and somewhat rounded; the back, seen in profile, is very slightly concavated between the hind declivity and the area of the posterior eyes, which area is very slightly convex and sloping. The height of the face scarcely equals the length of the mandibles. First row of *eyes* nearly straight, but very slightly curved downward; these eyes are of equal size, the center ones separated by an interval as great as their diameter and greater than the space between them and the laterals; the area of the posterior eyes is much broader behind than in front, slightly longer than broad in front, the interval between the two largest eyes being a little greater than their diameter, the interval between them and the hindmost eyes scarcely double as great as the diameter of these latter eyes. *Mandibles* about $2\frac{1}{4}$ times as long as broad; the anterior margin of the claw-furrow has three, the posterior two teeth. *Legs* rather long, the fourth pair about $4\frac{1}{2}$ times as long as cephalothorax, with the metatarsus as long as patella and tibia together; the second and third pairs are of very nearly the same length; the four anterior tibiæ have 2. 2. 2. spines below and 1. 1. in front, the first pair besides 1., the second pair 1. 1. behind. *Abdomen* inversely ovate. The *vulva* consists of a rather large, corneous, depressed area, which is double as broad as long, slightly rounded in front, gradually and rather strongly narrowing backward, with slightly rounded sides; it is bordered on the sides, as also in front toward the sides, by an elevated margin, and is truncate behind; it shows two large coarse costæ curved outward and strongly diverging forward, and reaching from the hind margin of the vulva, where they nearly meet, to the vicinity of its anterior exterior angles; these costæ and the lateral margins of the vulva limit two rather deep, rounded foveæ, one on each side.

Color.—*Cephalothorax* black, with a large, very indistinct, paler patch in the middle; it appears to have been clothed with appressed, rusty-brown hair. *Sternum* black, covered with grayish hair. *Mandibles* blackish-brown, with a few paler patches, and sprinkled with grayish hair. *Legs* black, with paler yellowish-brown rings; three very irregular ones on the thighs, two or perhaps three on the patellæ (less distinct), tibiæ, and metatarsi; the tarsi are broadly yellowish-brown at the base. The pale rings and spots are covered with grayish or reddish-brown hair. The *abdomen* is black above, the back shows traces of having been clothed with rusty-brown hair, and to have been furnished with small spots formed of whitish hair; the belly is brownish, and appears to have been covered with grayish-white hair. The *vulva* is brown.

Length of body $9\frac{1}{4}$, of cephalothorax slightly more than 4 millim.; breadth of cephalothorax $3\frac{1}{3}$ millim. Legs: I, $12\frac{1}{2}$, II and III, $12\frac{1}{4}$, IV, $17\frac{1}{2}$ millim.; patella + tibia IV 5 millim.

The only specimen of this species that I have seen is a bare-rubbed female, captured at Manitou, Colo., July 6.

26. *L. iracunda* n.

Very hairy; cephalothorax black, with a pale, rather broad middle

band covered with grayish hair, and (♀) with a row of pale supramarginal spots on each side; legs black, with pale brownish rings; back of abdomen black along the sides, with a pale brown lanceolate band in front, mottled with grayish-white along the middle, and with two rows of grayish-white points toward the sides; tarsal joint of the black-haired palpi in ♂ not broader than the anterior thighs, somewhat longer than the two preceding joints together; genital bulb very high at the base, and there provided with a very short and coarse tooth and an outward-directed spine concealed in a fovea, as also toward the outer side with a strong downward-directed spine; vulva forming a large decanter-shaped brown fovea, its septum pale, narrow, very slightly increasing in breadth backward, and furnished with a fine longitudinal costa cloven at the posterior extremity.—♂ ♀ *ad.* Length about 9 millim.

Male.—*Cephalothorax* broad, strongly rounded in the sides, shorter than patella + tibia of the fourth pair, nearly as long as patella + tibia of the first pair, its breadth equaling the length of the tibia of the fourth pair; pars cephalica rather slightly convex transversely between the hindmost eyes, its sides somewhat sloping, slightly rounded; seen in profile, the back of the cephalothorax is but very slightly concave, nearly straight, between the posterior declivity and the hindmost eyes. Front row of *eyes* straight or scarcely perceptibly curved downward, these eyes being of equal size; the central ones more distant from each other than from the laterals, and separated by a space equaling their diameter. Area of the posterior eyes much broader behind than in front, scarcely longer than broad in front; the space between the two largest eyes a little greater than their diameter, the space between them and the hindmost eyes fully double as great as the diameter of these latter. *Mandibles* long and narrow, scarcely thicker than the anterior tibiæ, somewhat shorter than the tarsi of the first pair; the claw-furrow appears to be armed with three teeth on the posterior and with two teeth on the anterior margin. *Palpi* of moderate length; seen from above, the patellar and tibial joints are of nearly equal lengths, the patellar joint rather the longer of the two, with parallel sides, rounded at the apex, somewhat longer than broad; the tibial joint is gradually and slightly broader toward the apex, as long as broad, thickly hairy. The tarsal joint is somewhat longer than the two preceding joints together, as broad as the anterior thighs, double as long as broad; the genital bulb is very high at the base; seen from the inner side, it is almost perpendicular behind, then sloping forward; at the apex, on the outer side, it forms a thick and broad truncated downward-directed lamina (when seen in profile); from the inner margin, and closely applied to the inner side of the hindmost elevated part of the bulb, and forming its anterior half on this side, proceeds downward a very broad outward- and backward-curved costa rapidly narrowing toward the apex, which goes over into the transverse costa which limits the elevated part in front, outward; near the middle, toward the outer margin, the bulb is armed with a strong spine, or long pointed tooth,

directed downward and slightly curved forward; in the excavation or fovea at the summit of the elevated portion it shows a very short and coarse uneven tooth directed forward and outward, from the base of which proceeds, along the bottom of the fovea, and almost completely concealed in it, an outward-directed longer and more slender spine. *Legs* rather long and very hairy, the fourth pair four times as long as cephalothorax; the four anterior tibiæ have 2. 2. 2. spines beneath, 1. 1. in front, and 1. 1. behind. *Abdomen* very hairy, of the usual form.

Color.—*Cephalothorax* black in the bottom, with a pale brownish middle band reaching to the pars cephalica, geminated by a fine black line, tapering backward, and about as broad as the anterior thighs; it appears to have been closely covered with grayish, more appressed hair, especially along the middle, and is moreover rather densely spread with long, erect, black hairs. *Sternum* black, gray-haired. *Mandibles* black, with a few pale patches or streaks. *Maxille* and *labium* blackish, with paler edges. *Palpi* black, black-haired, their tibial and tarsal joints deep black, the patellar joint pale brown above, with a blackish line along the middle; the femoral joint black, with some paler spots; genital bulb mostly brownish, with the spines and tooth black. *Legs* black, with pale brownish spots and rings; the coxæ are pale at the very base beneath; the thighs have one or more pale spots, especially on the sides, and a pale geminated spot toward the apex above; the patellæ are pale, black at the base, and especially on the sides; the tibiæ have two (or three) pale rings; the metatarsi and tarsi are pale, the former provided with three black rings, the latter blackish at the apex. The legs are covered with very long, more erect, mostly black hairs, as also with short appressed black and pale hair. The *abdomen* is black above and on the sides, with a rusty-brown lanceolate band along the anterior half of the back; it is densely covered with black and grayish-white hair, and also rather densely spread with long erect black hairs; the abdomen thus becomes black along the sides of the back, mottled with grayish-white on the sides and behind the lanceolate band, and has a row of grayish-white spots toward the sides. The sides of the abdomen are black, the belly brownish-gray; the *mamillæ* black.

♂.—Length of body 9, of cephalothorax $4\frac{1}{2}$ millim.; breadth of cephalothorax nearly $3\frac{1}{2}$ millim. Length of legs: I 15, II nearly $14\frac{1}{2}$, III 14, IV 18 millim.; patella + tibia IV 5 millim.

Female.—A female which I think belongs to this species has somewhat shorter legs, and a more evident depression on the back between the pars thoracica and the pars cephalica, as also thicker mandibles, but is otherwise very similar to the above described male. The *cephalothorax* is slightly longer than patella + tibia of the first pair; its breadth equals the length of tibia of the fourth pair. The *vulva* consists of a large fovea, or depressed area, the sharp lateral edges of which are behind incrasated into two large low tubercles; it is somewhat longer than broad, narrow in front, broadly truncate behind, and has nearly the form of a

short-necked decanter; its anterior very narrow portion (the neck) is short, dilated, and somewhat cloven at the apex, the posterior portion is rounded at the sides, slightly tapering backward from the middle, at least as long as broad; the vulva is through its whole length intersected by a narrow septum, which in front, in the anterior third part of its length, has the form of a fine costa, then becomes somewhat broader, gradually but very slightly increasing in breadth backward; this septum, which is narrower than the depressed parts of the vulva on each side of it, and does not fill up the space between the lateral margins of the vulva behind, shows a fine longitudinal costa above, which is cloven at its posterior apex, here including a small triangular space. In the bottom of the vulva, on each side, toward the posterior apex of the septum, is seen a small shining tubercle or costa.

The color of the female does not differ materially from that of the male; the *cephalothorax* shows, however, besides the pale middle band, also a few pale spots and streaks on each side, forming a narrow broken supramarginal band. The *palpi* are yellowish-brown, with black spots and rings, especially on the femoral joint; the *legs* are more evidently annulated than in the male; the thighs have a transverse pale band above, between two geminated pale patches, one at the apex, the other at the base. The *vulva* is dark brown, the septum yellowish, the tubercles in the bottom black.

♀.—Length of body 9, of cephalothorax $4\frac{1}{2}$ millim.; breadth of cephalothorax $3\frac{1}{4}$ millim. Length of legs: I 13, II $12\frac{1}{2}$, III nearly 13; patella + tibia IV 5 millim.

The collection contains only two examples of this species, a male captured on Pike's Peak, 13,000 feet above the level of the sea, July 14, and a bare-rubbed female found at Kelso Cabin, Colo., July 6. *L. iracunda* is no doubt very closely allied to *L. grænlandica* Thos. (from Greenland and Labrador), and it is possible that it may turn out to be a variety only of that species; but as it shows some slight deviations from the description of *L. grænlandica*, of which I at present have no specimens to compare, I have thought it safest to describe this form as a separate species.

27. *L. sinistra* n.

Very hairy, almost totally black, with some paler streaks and spots on the extremities; fourth pair of legs nearly four times as long as cephalothorax; third pair of legs slightly longer than first and second pairs; tarsal joint of the black-haired male palpi as long as the two preceding joints together, as broad as the fore thighs, half as long again as broad; the genital bulb very high behind, transversely excavated in front, with a very coarse, forward-directed, prominent tooth issuing from the fovea of the elevated portion, and with an outward-directed spine proceeding from the base of this tooth, the apex of the spine being free, the bulb also armed with a downward-directed spine at the outer margin; vulva consisting of a large oblong fovea, about double as nar-

row in front as behind, with a very broad septum, which is rather gradually narrowing forward, flat, and provided with a broad shallow longitudinal middle furrow above.—♂ ♀ *ad.* Length about 9–11 millim.

Female—*Cephalothorax* broad and strongly rounded at the sides, somewhat shorter than tibia + patella of the fourth pair, somewhat longer than these joints of the first pair; its breadth equaling the length of the tibia of the fourth pair; seen in profile, the back, between the hind declivity and the eyes, is rather strongly concave, the area of the posterior eyes convex and sloping; the sides of the pars cephalica are somewhat sloping and slightly rounded. The first row of *eyes*, which eyes are of very nearly the same size, is straight; the space between the two central eyes of this row is somewhat larger than that between them and the laterals, and not fully as great as the diameter of an eye. The area occupied by the four posterior eyes is but little longer than broad in front, much broader behind; the interval between the two largest eyes is half again as great as their diameter, the interval between them and the hindmost eyes about double as great as the diameter of these latter. The *mandibles* are nearly as thick as the anterior thighs, about $2\frac{1}{2}$ times as long as broad at the base; the claw-furrow has three teeth behind and two in front. The *legs* are rather short, the fourth pair being scarcely four times as long as the cephalothorax; the third pair appears to be slightly longer than both the first and the second pairs, which are very nearly of the same lengths; the anterior tibiae have 2. 2. 2. spines beneath, 1. 1. in front, and 1. 1. behind; in the tibiae of the first pair, however, the anterior lateral spines are placed very low, and might be considered as belonging to the under part of the joint. *Abdomen* inversely egg-shaped; the *vulva* is a large oblong fovea about double as broad behind as in front, but very slightly increasing in breadth backward from the fore extremity nearly to the middle, then rather strongly dilated, with rounded sides, and at last slightly narrowing, broadly truncate behind; it is bordered at the sides by a sharp edge, which is incrassated at the posterior extremity; all along the vulva is extended an elevated broad septum, gradually somewhat broader backward, especially in its hinder longer part, flat above, with a longitudinal, broad, shallow, middle furrow; it fills up the space between the lateral margins of the vulva at its hind extremity, and is much broader than the deeper part of the vulva on each side, and about three times as long as broad at the hind extremity, where it is not fully double as broad as at its apex (in front).

Color.—The whole animal is black (covered with long black hairs), with exception of the mandibles, palpi, and legs showing traces of yellowish-brown streaks and patches. The coxæ are paler on the under side at the base; the thighs have above, at the apex and (less distinctly) at the base, a pale geminated patch, the anterior thighs moreover a pale line along the outer side; the posterior thighs are pale at the apex; the

patellæ are pale above, with a fine black line; the tibiæ have two broad pale lines above; the metatarsi are pale at the very base, with traces of a broad brownish ring; all these markings, however, very dull and rather indistinct. The belly is grayish-black, the vulva is dark brown, its septum rusty-brown, paler along the middle.

♀.—Length of body 11, of cephalothorax $4\frac{1}{2}$ millim.; breadth of cephalothorax nearly $3\frac{1}{2}$ millim. Length: of legs I nearly $12\frac{1}{4}$, II 12, III $12\frac{3}{8}$, IV $17\frac{1}{2}$ millim.; patella + tibia IV $4\frac{3}{4}$ millim.

Male.—The male differs little from the female. The *cephalothorax* is slightly longer than patella + tibia of the first pair; its breadth is as great as the length of the tibia of the fourth pair; the space between the central *eyes* of the first row is about as great as their diameter, and that between the two largest eyes not very much greater than the diameter of one of these latter eyes; the *mandibles* are narrow, scarcely thicker than the fore patellæ, the *legs* slightly longer than in the female. The *palpi* are rather thick and short; the patellar joint, seen from above, is at least as long as the tibial joint, which is slightly and gradually dilated toward the apex, slightly longer than broad, thickly covered with long hairs; the tarsal joint is as long as (not longer than) the two preceding joints together, scarcely more than half again as long as broad, and as broad as the anterior thighs. The genital bulb is very high behind, deeply and transversely excavated in front of this elevated portion, which, seen from the inner side, is truncate at the tip, sloping behind and in front; the tip of this portion is occupied by a large transverse fovea, from which proceeds a very coarse, uneven, forward- and slightly outward-directed tooth (very prominent when the bulb is seen in profile); from the base of this tooth, along the bottom of the fovea, proceeds a spine, the free downward-turned point of which is easily seen when the bulb is viewed obliquely from the outer side and from beneath; from the middle of the inner margin of the bulb, close to the posterior elevated portion, but divided from it by an opening at the base, proceeds a transversely outward- and backward-curved spine-like costa, rather broad at the base; at the outer margin, toward the middle, is a strong downward-directed tooth, slightly curved forward.

The *color* is the same as in the female, except that the palpi are totally black, black-haired, with only the patellar joint slightly paler above, and the bulb brownish with black spines and teeth; the pale markings of the legs are still less distinct than in the female.

♂.—Length of body $9\frac{1}{2}$, of cephalothorax $4\frac{1}{2}$ millim.; breadth of cephalothorax nearly $3\frac{1}{2}$ millim. Length of legs: I 13, II 13, III $13\frac{1}{2}$, IV $17\frac{3}{4}$ millim.; patella + tibia IV 5 millim.

Several examples of this species (most of them not fully developed) were captured on Gray's Peak (at about 12,000 and even at 14,000 feet above the level of the sea), July 7, as also at Arapaho Peak, Colorado, (11-12,000 feet), July 1.

Gen. TARENTULA Sund., 1833.

28. *T. modesta* n.

Cephalothorax longer than patella + tibia of the fourth pair, blackish brown, with a broad pale brownish-gray, longitudinal middle band, legs brown, the thighs slightly black-spotted on the sides; fourth pair thrice as long as cephalothorax; abdomen blackish, covered with blackish- or grayish-brown hair above, the belly black; vulva consisting of a semi-elliptical brown fovea, the lateral margins of which are behind dilated into two large transverse tubercles; it is provided with a fusiform septum dilated at its posterior extremity into two costæ, the whole septum thus forming a **⊥**, the transversal bars of which are long and slightly sinuated.—♀ *ad.* Length about 12 millim.

Female.—*Cephalothorax* somewhat longer than tibia + patella of the fourth pair, its breadth equaling tibia + half the patella (= metatarsus) of the fourth pair; moderately rounded at the sides, broad in front, the breadth of the clypeus nearly equaling three-fifths of the greatest breadth of the pars thoracica; seen in profile, the back is slightly convex between the posterior declivity and the hindmost eyes; the sides of the pars cephalica are, seen from in front, strongly sloping, rounded; the height of the face is not much more than half the length of the mandibles. First series of *eyes* little shorter than second row, slightly curved downward, with the central eyes somewhat larger than the laterals, and separated by an interval somewhat larger than that between them and the lateral eyes, and smaller than their diameter. Area occupied by the posterior eyes somewhat longer than broad in front, much broader behind than in front; space between the two largest eyes evidently smaller than their diameter, the space between them and the hindmost eyes about half again as great as the diameter of these latter eyes. *Mandibles* as thick as in the fore thighs, somewhat more than double as long as broad at the base, as long as the metatarsi of the second pair; the claw-furrow has three strong teeth on the posterior and two teeth on the anterior margin. *Palpi* slender, their tibial joint more than double as long as broad. *Legs* strong, fourth pair thrice as long as cephalothorax; their spines are short; tibia of the first pair is armed with 2. 2. 2. spines beneath and 1. in front (toward the apex); tibia of the second pair with 2. 2. 2. spines beneath and 1. 1. in front. *Abdomen* of the ordinary form; the *vulva* is a corneous semi-elliptical fovea of moderate size (its length equals the diameter of the hindmost tibia), rounded in front, truncate behind, somewhat longer than broad, and limited by a sharp edge, which, at the posterior ends of the vulva, on each side, is dilated into a large transverse shining tubercle; all along the bottom of the vulva is a rather narrow somewhat fusiform septum, which at its posterior end is suddenly dilated and produced transversally into a costa (behind the above-mentioned tubercles), thus forming a **⊥**, the transverse bars of which are slightly sinuated, or ~-shaped, and together nearly as long as the longitudinal bar.

Color.—*Cephalothorax* brown, with a broad, pale brown, middle band reaching to the hindmost eyes; it is covered with fine appressed hair, darker on the sides, paler along the middle, and forming a brownish-gray band with nearly parallel sides extending along the whole back of the cephalothorax, and being as broad as the area of the posterior eyes; also the lateral margins of the cephalothorax are paler, and their extreme edge is covered with pale brownish-gray hair. *Sternum* brownish-black, strewed with black erect hairs. *Mandibles* brownish-black, covered with brownish-gray hair on their basal half, black-haired toward the apex. *Maxilla* and *labium* piceous, paler at the apex. *Palpi* and *legs* brown, covered with fine, appressed, brownish-gray hair, strewed with longer black hairs, and armed with black or brownish spines; the under part of the coxæ is brownish-black and black-haired, paler at the very base; the thighs, at least the posterior ones, are rather indistinctly black-spotted on the sides. The *abdomen* is brownish-black, the back densely covered with blackish- or grayish-brown hair, and strewed with longer more erect black hairs; the belly is blackish and black-haired, the *vulva* dark brown.

Length of body 12, of cephalothorax $6\frac{1}{2}$ millim.; breadth of cephalothorax $4\frac{3}{4}$, of clypeus $2\frac{3}{4}$ millim. Length of mandibles nearly 3 millim.; of legs: I $15\frac{1}{2}$, II $14\frac{3}{4}$, III $14\frac{1}{2}$, IV $19\frac{1}{2}$ millim.; patella + tibia IV 6 millim.

A single adult female of this species, which is closely allied to the European *T. inquilina* (Clerck), was found on the Blackhawk, Colorado, July 12.

29. *T. scalaris* n.

Cephalothorax shorter than patella + tibia of the fourth pair, blackish, with three longitudinal pale bands all along the back and the sides, the middle band being as broad as the thighs, the narrower marginal bands geminated; legs yellowish, the posterior tibiæ and metatarsi black-ringed; fourth pair of legs about four times as long as cephalothorax; abdomen black above, with two rows of brownish-yellow spots along the middle, and here covered with pale brownish-gray hair; belly deep black behind the rima genitalis; vulva consisting of an oblong rather large fovea, increasing in breadth backward, with sinuated sides, and with a septum having the form of an anchor, or a **L**, the transverse bar of which is somewhat shorter and stronger than the longitudinal bar.—♀ *ad.* Length about $11\frac{1}{2}$ millim.

Female.—*Cephalothorax* of moderate breadth, not very strongly rounded in the sides, somewhat shorter than patella + tibia of the fourth pair, as long as patella + tibia of the first pair; its breadth is somewhat less than the length of tibia of the fourth pair, the breadth of the clypeus equaling $\frac{2}{3}$ of the greatest breadth of the pars thoracica; the back is straight behind the posterior declivity and the eyes; the sides of the pars cephalica are moderately sloping, slightly rounded, the height

of the face much greater than half the length of the mandibles. The front row of *eyes* is evidently shorter than the second row, curved downward; its central eyes are larger than the laterals, and separated by an interval that is smaller than the diameter of these eyes, and but little greater than that which separates them from the fore laterals. The area occupied by the four posterior eyes is scarcely longer than broad in front, not much (only with about the diameter of one of the hindmost eyes) broader behind than in front; the two eyes of the second row are very large, separated by an interval much smaller than their diameter; the interval between them and the hindmost eyes is little more than half again as great as the diameter of these latter eyes. *Mandibles* little, if at all, longer than the tarsi of the first pair, not quite as thick as the fore thighs, little more than double as long as broad. The *legs* are long and rather slender, the first pair rather more than four times as long as cephalothorax; the spines are tolerably short; the anterior tibiæ have 2. 2. 2. spines beneath, and moreover 1. (first pair) or 1. 1. (second pair) spines in front. The *vulva* is a rather large oblong fovea (as long as the diameter of the posterior thighs), rather narrow in front, with the apex rounded, broadly truncate behind, but slightly increasing in breadth backward in the first fourth part of its length, then somewhat more rapidly but not strongly broader to much behind the middle, with slightly rounded sides, at least in the hindmost fourth part, rapidly and strongly dilated, with the sides obliquely rounded; the sides of the vulva are thus twice sinuated. The sharp lateral edges of the vulva are incrassated at their posterior end, outward; all along the vulva is a rather narrow and low septum, somewhat incrassated toward the middle; at its hind, more elevated extremity, it is suddenly dilated on each side into a transverse costa, very slightly curved forward at the rounded extremity, which is received in the hindmost broadest part of the vulva; the septum thus forms an anchor, or a **⊥**, the transverse bar of which is somewhat shorter and stronger than the longitudinal bar.

Color.—*Cephalothorax* black, with three longitudinal pale brown bands covered with grayish-white hair, the middle grayish-white band thus formed being as broad as the fore thighs, and continued all along the back, with nearly parallel sides, the lateral bands marginal, narrower, as broad as the fore tibiæ, geminated by a brownish line; the sides of the cephalothorax between the bands are clothed with brown or blackish hair. *Sternum* black, covered with more appressed grayish and more erect black hairs. *Mandibles* black, with grayish hair, at least on their basal half, black-haired toward the apex. *Maxillæ* and *labium* dark brown, paler at the apex. *Palpi* and *legs* yellowish, covered with fine appressed whitish hair as also with longer black hairs; the spines mostly brownish; the posterior tibiæ and metatarsi have two blackish rings, the posterior thighs show traces of one or more blackish spots. *Abdomen* blackish above, paler on the sides; the belly is deep black

behind the rima genitális, and of a sooty-yellowish color in front of the rima; the back has two backward-converging rows of brownish-yellow spots along the middle, the two first spots more nearly together than the two next following, and more or less distinctly united with each other and (perhaps) with these latter, forming with them a trapezium broader behind; the second and third pairs form a trapezium slightly broader in front, the following four or five pairs are gradually more and more approximating. The back appears to be covered and mottled with pale brownish-gray hair, forming a broad, somewhat lanceolate band along the middle, and is more black-haired on the sides; the sides of the abdomen are clothed with grayish hair, the belly is black-haired. The *vulva* is yellowish, with the extremities of the transverse bar of the septum black. *Mamillæ* brownish-yellow.

Length of body $11\frac{1}{2}$, of cephalothorax $5\frac{1}{2}$ millim.; breadth of cephalothorax $3\frac{4}{5}$, of clypeus $2\frac{1}{2}$ millim.; length of mandibles $2\frac{1}{4}$, of legs: I 16, II $15\frac{1}{4}$, III 15, IV $20\frac{1}{2}$; patella + tibia IV 6, tibia IV $4\frac{1}{2}$.

The collection includes two examples of this species captured in Colorado, July 13; the one a full-grown female found in the "Garden of the Gods", the other a very young female captured at Manitou Springs.

Section SATTIGRADÆ.

Fam. ATTOIDÆ.

Gen. PHIDIPPUS (C. L. Koch), 1846.

30. *Ph. coloradensis* n.

Cephalothorax black, with whitish-gray hairs, especially on the sides of the pars cephalica and the clypeus; eye-rings grayish-white, the long hairs of the margin of the clypeus whitish; palpi brownish-yellow; legs black; abdomen black on the sides, orange-red above, with a longitudinal broad dark greenish middle band along the posterior two-thirds of its length, and with a spot of the same color in front of this band; vulva consisting of a rather large deep transverse fovea, behind which is seen another small fovea.—♀ *ad.* Length about 14 millim.

Female.—*Cephalothorax* very high, not much longer than broad, with the posterior declivity very steep, seen in profile somewhat concavated and nearly as long as the rest of the back, which is somewhat sloping, and convex between the eyes. The cephalothorax is broadest rather far behind the hindmost eyes, slightly narrowing forward and backward, with the sides rather equally rounded; the forehead is somewhat rounded, its breadth being somewhat more than two-thirds of the greatest breadth of the cephalothorax; the pars cephalica is almost flat above, transversally limited behind by a shallow depression. The interval between the margin of the clypeus and the fore central *eyes* is less than half their diameter. The length of the eye-quadrangle is slightly greater than one-third of the length of the cephalothorax; it is broader behind

(by about one-fourth of the breadth in front), and its greatest breadth surpasses the length by one-third of the former. Front row of eyes curved rather strongly upward; a straight line tangent to the upper margin of the central eyes would cut the lateral eyes a little above their center; the central eyes of this row, which are separated by a very distinct interval, are not very large, their diameter being about double that of the laterals, from which they are removed by an interval about half as great as the diameter of these latter eyes; they are not perfectly visible when the cephalothorax is viewed from above. The eyes of the second row are very small, their distance from the eyes of the third row nearly double as great as that which separates them from the fore lateral eyes; the three eyes on each side form a row rather strongly curved downward (outward); the hindmost eyes are placed much (at least as much as their diameter) higher than the fore lateral eyes. The interval between the two hindmost eyes, which are not very much smaller than the fore laterals, is a little greater than that which separates them from the lateral margin of the cephalothorax. *Mandibles* short and broad, tapering toward the apex, somewhat flattened, seen in profile rather convex but not geniculate toward the base, coarsely and transversely striato-rugose. *Palpi* and *legs* very hairy; the first pair of legs are much stronger than the others, the fourth pair nearly two and a half times as long as the cephalothorax; the patella and tibia of this pair are together much longer than these joints of the third pair; the metatarsus of the fourth pair is slightly longer than the tibia, and armed with several spines, not only at the apex. The tibiæ of the first pair, which are very thickly hairy on the under part, have there 1. 2. 2. (2. 2. 2.?) short and very strong spines, the two spines toward the outer side and the apex of the joint being tooth-like. The *coxæ* of the first pair are separated by an interval nearly as great as the breadth of the labium. The *abdomen* is elongate, about half again as long as broad, ovate; the *vulva* has the form of a rather large deep transverse fovea, the breadth of which equals the diameter of the hindmost tibiæ; the anterior margin of the fovea is somewhat drawn out forward in the middle, and also the hind margin is slightly prominent in the middle; behind this fovea is another much smaller one, over which the hind margin of the large fovea is arched. The *mamillæ* are rather short.

Color.—*Cephalothorax* black, the appressed hair with which it is clothed grayish, especially on the sides of the pars cephalica, in front, the more erect hairs being black; the clypeus and the narrow eye-rings are grayish-white; the long hairs with which the margin of the clypeus is covered are of a purer white color. *Sternum*, *maxillæ*, and *labium* black, black-haired, the latter pale at the apex. *Eyes* of the front row greenish-yellow, the hindmost eyes blackish. *Mandibles* shining green, with metallic luster, the claw piceous, rusty-red at the apex. The *palpi* are yellowish-brown, paler yellowish at the base, darker at the apex, and covered with shorter whitish and long black and white hairs, the

apex being thickly black-haired. The *legs* are black, the posterior ones more piceous, especially the under part of the *coxæ* and the posterior side of the hindmost thighs; they are all covered, though not very thickly, with grayish-white appressed hair, as also with longer black and whitish more erect hairs; the spines are black. The back of the *abdomen* is orange-red, with a longitudinal broad dark greenish or bronze-colored middle band, stretching along the hinder two-thirds of its length, and with a somewhat triangular patch of the same color in front of this band, separated from it by a narrow red isthmus; the red color forms two teeth in each margin of the band, one somewhat behind its middle, the other toward its apex, where the red color ends. The sides of the abdomen, as also the belly, are black. Besides the appressed red hair with which the back is clothed, it is strewed with longer whitish and black hairs; the belly has, along the sides, more backward, two lines formed of whitish hairs and curved toward each other behind. The *vulva* is dark brown, with two small oblong whitish spots in the bottom close to its anterior extremity; the *mamillæ* are black.

Length of body 14, of cephalothorax $5\frac{1}{2}$ millim.; breadth of cephalothorax $4\frac{1}{3}$ millim. Length of abdomen somewhat more than 9, breadth of same 6 millim. Length of mandibles 2, breadth nearly $1\frac{1}{2}$ millim. Length of legs: I $11\frac{1}{2}$, II 10, III $9\frac{1}{2}$, IV $13\frac{1}{2}$; pat. + tib. IV $4\frac{1}{2}$ millim.

A single female of this large and beautiful species, which appears to be closely allied to *Ph. auctus* C. L. Koch* from Pennsylvania, was captured at Denver, Colo., July 10. I have kept for it the generic name *Phidippus* (of which I consider it as the type), as it appears to differ from *Phileus* Thor.† (*Philia* C. L. Koch) at least by having the interval between the eyes of the second and third rows comparatively much greater than in *Phileus*, about double as great as the interval between them and the fore lateral eyes. The mandibles are not geniculated at the base in this spider, as they are in the females of the genus *Phileus* known to me.

Order OPILIONES.

Section PALPATORES.

Fam. PHALANGIOIDÆ.

Gen. MITOPUS Thor., 1876.

31. *M. biceps* n.

Body blackish or brownish above, densely mottled with small yellowish or grayish spots; first cephalothoracic segment with a longitudinal yellowish middle line forked in front, the following part of the back with two parallel rows of black spots, continued posteriorly by a few pale spots; frontal margin of cephalothorax elevated into two denticulated tubercles; two supramandibular teeth; eye-eminence with two

* Die Arachn., xiii, p. 148, tab. cccclvi, fig. 1204.

† Conf. Simon, Arachn. de France, iii, p. 46.

rows of about 6 teeth in each; only the femoral and patellar joints of the palpi provided with some teeth; joints of legs all rounded, the thighs and patellæ beset with small spinules—♂ *ad.* Length about $5\frac{1}{2}$ (♂)— $7\frac{1}{2}$ (♀) millim.

Female.—The *body* (truncus) is inversely ovate, densely and rather coarsely granulate above, smooth below; seen in profile, it is strongly arcuato-convex from behind the eye-eminence to the anus, the first cephalothoracic segment being nearly horizontal; the furrow which separates the second and third cephalothoracic segments is rather faint, that between the first and second segments very deep and strong and curved backward, as is also the furrow or articulation between the third cephalothoracic and the first abdominal segments; moreover, the first cephalothoracic segment shows a shorter straight furrow a little behind the eye-eminence, and its hind margin is somewhat elevated. The furrows between the 1st–6th abdominal segments are very faint; the following three segments are limited by strongly marked furrows or articulations. The first cephalo-thoracic segment is nearly half-moon-shaped, truncated in the middle in front, sinuated in the sides above the coxæ, convex transversely; in front, at the very margin, it is elevated into two large very obtuse or truncated tubercles separated by a longitudinal furrow, and each surrounded above by a ring or crown of small conical teeth; under the frontal margin are two strong prominent conical teeth rather close together, and furnished each with a few very minute spinules. Along the lateral margins of the first segment is a row of depressions situated one above each coxa and above the mandibles; above the coxæ of the first pair, there is also a small but quite distinct foramen supracoxale. The transverse furrow behind the eye-eminence ends in a larger depression on each side. The *eye-eminence* is of moderate size, longer than broad; seen from the side, it is about half again as long as high, nearly perpendicular in front and behind, and rounded above; above each eye, it has a row of about six conical teeth. The following dorsal segments are all destitute of teeth or spines. The *mandibles* are slender, destitute of teeth and granules above, only strewed with short hairs. The *palpi* are of moderate length; their femoral joint is slightly incrassated at the apex (when seen from above), the patellar joint gradually somewhat incrassated toward the apex, about half again as long as broad, the tibial joint cylindrical, $2\frac{1}{2}$ times as long as broad; these joints are beset with short hairs or bristles, and the patellar joint is moreover, as is also the femoral joint at the apex, furnished with several small conical teeth. The tarsal joint is cylindrical, scarcely perceptibly curved downward, the claw smooth. The legs are rather short, slender, all the joints rounded, not prismatical; the coxæ have a small erect spine at the base, above, and one or two small teeth at the apex on the fore or hind side; the trochanters are strewed with some small teeth on the sides; the thighs are beset with very small spines, as are also (though less distinctly) the patellæ, which moreover

show a somewhat larger tooth at the apex above; the following joints are furnished with fine hairs. The metatarsi are all provided with several distinct false articulations.

Color.—The upper part of the *body* is blackish or brownish, very densely mottled with small yellowish or grayish spots, which on the sides of the abdomen are more regularly rounded (in general, with a black point in the middle), but more inward, often meet together into irregular patches or transverse bands, thus giving the back a yellowish ground-color, with black markings. The first *cephalothoracic* segment is more yellowish toward the sides, black in the middle, with a longitudinal yellowish middle line stretching from behind the eye-eminence to the frontal margin, and forked anteriorly, the eye-eminence and the frontal tubercles thus being yellow above, dark on the sides; their teeth are also yellowish, with dark tips. In the furrow between the frontal tubercles are two small, parallel, blackish lines. Behind the eye-eminence, the back shows two rows of black spots, forming two in general very distinct longitudinal parallel lines or bands, which stretch along two-thirds of the length of the body, or nearly so, and are continued posteriorly each by a few pale yellowish or whitish spots or streaks. The under part is paler, mottled with blackish and grayish or brownish-white. The *mandibles* are grayish-yellow, with a brownish or blackish patch above on the first article, and with short, oblique, brownish streaks in the sides; their fingers are black at the apex. The *palpi* have the patellar and tibial joints brownish, the tarsal joint and the base of the femoral joint grayish-yellow. The *legs* are of a dull or grayish-brown hue, with the coxæ and trochanters paler brownish or whitish. The patellæ and the tibiæ have a broad, blackish ring at the apex, and also the thighs are more or less distinctly darkened at the extremity.

The *male* differs by having the *palpi* somewhat thicker in the middle, the tibial joint being a little thicker than the patellar, and not cylindrical but evidently narrowing forward, and not fully two and a half times as long as broad. The femoral joint is provided with several stronger teeth along the outer side; the tarsal joint is curved downward, and, seen in profile, somewhat thickened toward the base and the apex. The *palpi* are in general pure black, only with the tarsal joint brownish-yellow. The shaft of the *penis* is rather broad and flattened, suddenly narrowed near the apex. The apical joint, which scarcely forms an angle with the shaft, is about double as long as broad at the base, not half as broad as the principal part of the shaft, but nearly as broad as its apex. It is tapering toward the apex, and, when seen in profile, truncated at the apex, which is provided with a fine spine, forming a very obtuse angle with the joint, and directed somewhat upward.

♀.—Length of body 7 millim.; breadth of same $3\frac{1}{2}$ millim.; length of second joint of mandibles $1\frac{1}{2}$, of palpi nearly $3\frac{1}{2}$ millim. Legs: I $17\frac{1}{2}$ (thigh $3\frac{4}{5}$), II 33, III $18\frac{1}{2}$, IV $26\frac{1}{2}$ millim.

♂.—Length of body $5\frac{1}{2}$ millim.; breadth of same 3 millim.; length of

second joint of mandibles nearly $1\frac{1}{2}$; of palpi $3\frac{3}{8}$ millim. Legs: I $15\frac{3}{4}$ (thigh slightly more than $3\frac{1}{2}$), II 27, III $16\frac{3}{4}$, IV 20 millim.

In *young* specimens, the upper part of the body is smooth, not granulate, and the eye-eminence, frontal tubercles, and legs also smooth, destitute of spines or teeth.

The collection contains several examples of this curious species, captured partly in Idaho, July 5, partly under stones on Gray's Peak, Colorado, a little below the summit, July 7.

ADDENDUM.

DESCRIPTIONS OF TWO NEW SPIDERS FROM COLORADO.

BY JAMES H. EMERTON.

(Figs. 18, 19.)



FIG. 18.—*Epeira aculeata*, Emerton, n. sp., ♀.

EPEIRA ACULEATA, n. sp.

Length 7^{mm}. Cephalothorax brown at the sides, light yellow on the head, covered with whitish hairs. Middle eyes nearly forming a square, the anterior a little farther apart than the upper, and with narrower rings around them; the front lateral eyes half their diameter higher than the middle.

Abdomen $1\frac{1}{2}$ times as long as wide, extending forward over the thorax as far as the dorsal groove, and backward a little beyond the spinnerets, marked with a row of triangular light yellow spots, the second widest, and with curved sides. In the center of these light marks, a light reddish-brown band. Sternum dark brown, mandibles light yellow with dark brown tips. Abdomen beneath, with a central straight band and two lateral bands curved forward in front of the spinnerets, yellow.

Legs yellow, with a reddish-brown ring around the middle of each tibia and metatarsus, and at the end of every joint. Upper side of the femora of the first and second pairs reddish-brown.

Epigynum with a curved and sharp-pointed hook, narrower and not so sharp as in *E. ceropygia*, but not so narrow as in *E. packardi*, light yellow-brown, and covered half its length on the outer side with stiff hairs.

One ♀ from Gray's Peak. It resembles *E. ceropygia* except in the epigynum.

DRASSUS COLORADENSIS, n. sp.

Length 10^{mm}; leg of fourth pair 15^{mm}; Colors probably light yellow on the cephalothorax and legs and gray on the abdomen. Legs of first pair longer than those of the fourth. Tibiæ of first and second pairs with only one spine beneath. Palpi as long as femur and half the patella

of the first pair of legs. Tibia as wide as long; on the outer side two curved processes, the outer seen from above or below, shaped like the point of a fish-hook, the inner rounded and widened at the end. Bulb of the palpal organ as thick as wide, the penis starting from the upper portion, and curved toward the point of the tarsus on the inner side, a soft whitish appendage lying parallel to the penis. On the opposite side of the palpal organ is a pointed tooth, extending over the edge of the bowl of the tarsus. Anterior row of eyes slightly curved downward, the lateral a little larger than the middle pair, placed a little lower and half as far from the middle eyes as these from each other. Upper row of eyes a little longer than the front row, the lateral eyes turned outward, and farther from the middle eyes than these from each other.

One ♂ from Gray's Peak.



FIG. 19.—*Drassus coloradensis*, Emerton, n. sp., ♂.

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ART. XVI.—COMPARATIVE VOCABULARY OF UTAH DIALECTS.

BY EDWIN A. BARBER.

To the group of Indian tribes known as the Shoshoni family belong the Utahs, or Utes, of Colorado and Utah. That the Utah is a very ancient tribe, there can be no doubt. Among their traditions is one which claims that they were the original people which drove the "ancient Pueblo" races from their fastnesses centuries ago. Don José Cortez wrote of this tribe, in the year 1799: "The Yutah Nation is very numerous, and is also made up of many bands, which are to be distinguished only by their names, and live in perfect agreement and harmony. Four of these bands, called Noaches,* Payuches, Tabiachis, and Sogup, are accustomed to occupy lands within the province of New Mexico,† or very near it."

The Utah language consists of at least *three* distinct dialects, which we shall call the *Uinta*, the *Yampa*, and the *Weminuche*. Our attention, at present, will be directed to the latter two of these, the *Yampa* and the *Weminuche*. The *Yampa* Utes are located in the northwestern portion of Colorado, and their agency is situated on the White River, a tributary of the *Yampa*, or *Bear*. The *Uinta* band of the Utah Nation occupies the *Uinta Valley* of Northeastern Utah, while the *Weminuche* branch of the tribe frequents that portion of the reservation which lies in the extreme southwestern corner of the State. The Utah language is subject to variations, resulting from surrounding influences; yet, while certain words employed by each band may vary slightly, there is not sufficient difference in construction and general form to warrant us in dividing the language into *seven* distinct dialects. The *Uinta* branch of the tribe is somewhat influenced by the jargons of the neighboring tribes. The *Weminuche* dialect has become adulterated with Mexican and impure Spanish, which all of the southern Indians employ to some extent. With the *Weminuches*, we may class the *Capotes* and *Muaches*, and probably the *Tabequaches*. With the *Yampa* band, we may group the *Grand River*, or *Piah* band, sometimes known as the *Middle Park* branch. The *Yampas*, *Grand Rivers*, and *Uintas* retain more of the original purity in their speech than the southern divisions, and this is accounted for by their greater isolation from the influence of foreign dialects.

* The Ute tribe of Indians, at present occupying the reservation, is divided into seven bands, as follows:—*Uinta*, *Yampa*, *Grand River*, *Tabequache*, *Muache*, *Capote*, and *Weminuche*. The *Noaches* of Cortez were probably the same as the *Muaches* the *Payuches* were the *Pai-Utes*, a closely allied tribe, and the *Tabiachis* were identical with the *Tabequaches*. The tribe now numbers between five and six thousand souls.

† Then including the Territory of Arizona.

The Utah language resembles closely that of the Shoshones, Snakes, and Pai-Utes. The Gosi Utes in Nevada and Utah speak a language closely allied to that of the Shoshones, and intermarry with the Utes. In this paper, however, I shall refer only to those branches which constitute the Ute tribe proper, occurring as they do within the limits of the reserve. This occupies the tract of land, along the western border of Colorado, included within the following boundaries:— “Commencing at that point on the southern boundary-line of the *Territory* of Colorado, where the meridian of longitude 107° west from Greenwich crosses the same; running thence north with said meridian to a point 15 miles due north of where said meridian intersects the fortieth parallel of north latitude; thence due west to the western boundary-line of said *Territory*; thence south with said western boundary-line of said *Territory*; thence east with said southern boundary-line to the place of beginning.” The population of the reservation Utes is below three thousand.

In preparing the following list of Indian words for publication, the author has followed as nearly as possible the instructions of the Smithsonian Institution, as set down in its “Miscellaneous Collections”, No. 160. Different values, however, have been substituted in some of the consonants, according to suggestions of Mr. A. S. Gatschet, as used by him in his vocabularies. The alphabetic notation employed in this limited paper, however, applies only to the dialects in question, and must necessarily be extended for other languages and jargons, which are not closely allied. The use of *j*, *q*, *x*, *w*, *z*, etc., varies in different languages, and while their values have been retained, such equivalents have been substituted in their places as to render the sounds to a certain extent cosmopolitan.

Syllables are not separated, and hyphens are only used in cases of hiatus, or between compounds.

VOWELS.

Ā or *ā* long, as in *father*.

á, as in *all*.

ü, as in *fat*.

Ē or *ē* long, as in *they*.

ě short, as in *met*.

Ī or *ī* long, as in *marine*.

ĩ short, as in *pin*.

Ō or *ō* long, as in *go*.

Ū or *ū* long, as in *rule*.

ů short, as in *full*.

ü, as in *but*.

u, as in *union*, *pure*, to be written *yu*.

Ai or *ai*, as in *aisle*.

Au or *au*, as *ow* in *now*, *ou* in *loud*.

When vowels have the long sound, the mark of length is omitted. The values of vowels are only indicated when other than *ā*, *ē*, *ī*, *ō*, and *ū*. The vowels *ü* and *ii* must not be mistaken for the German *umlaut*.

CONSONANTS.

For the most part, consonants retain their regular sound, as in the English; those to be altered or entirely omitted are as follows:

c not to be used, excepting in the compounds *ch*, *tch*; write *k* for the hard sound, *s* for the soft.

g hard, as in *gig*, never soft, as in *ginger*; for this sound use always *dsh*.

j not to be used; substitute *dsh*.

q not to be used; for *qu* write *ku*.

w not to be used; substitute *u*.

x not to be used; write *ks* or *gs*.

z not to be used; write *s*, *ds*, or *ts*.

ch hard, as in *church*; for the hard sound, write *tch*, for the soft, *dsh*.

kh, as in the German *ach*, *ich*.

By observing these rules in orthography, the majority of words in the Utah language may be properly sounded; and when any exceptional cases arise, the student may adopt some arbitrary mark of his own, describing fully its value or meaning, as suggested by the Smithsonian Institution.

The majority of the Yampa (Bear River) or White River words were collected by Dr. J. Dana Littlefield, at the White River agency, Colorado, in the years 1873 and 1874. Those Yampa words marked with an asterisk (*) were obtained by the author during the summer of 1874, and at the same place. The Weminuche words marked in the same way, I collected in Southwestern Colorado in 1875. The rest of the Weminuche words were furnished me by Capt. John Moss, of La Plata County, Colorado. This gentleman has resided among the tribe for many years, and speaks the language fluently. For the Uinta words, I am indebted to Mr. Richard D. Komas, a young man of the Uinta branch of the Utah tribe, who came east and studied for several years at Lincoln University, Chester County, Pennsylvania. He died in Philadelphia during the summer of 1876.

In the Bulletin of the United States Geological Survey of the Territories, vol. ii, No. 1, 1876, I published a short list of Yampa words, which were written according to the ordinary English alphabetic notation. In order to show the process of transition from this to the scientific notation, without changing the pronunciation, I will give the list in both forms:

	English notation.	Scientific.
Arm,	poór-ots,	púrëts.
Blood,	pwap,	puáp.
Friend,	tígaboo,	tígabu.
Knife,	wetch,	uíteh.

	English notation.	Scientific.
Tobacco,	quap,	kuáp.
Sun,	táhby,	tábi.
Water,	pah,	pa.
Dog,	sarrích,	sarítch.
Wolf,	youóge,	yuódsh.
Beaver,	pówinch,	páu-íntch.
That, this,	inch,	íntch.
Black,	tóquer,	tókuër.
Small,	maypootz,	méputs.
You,	em,	em.
All,	mahnónee,	mánóni.
To-morrow,	waytchook,	uétchuk.
Yes,	óoah,	úa.
No,	katsh,	katch.
One,	súis,	súis.
Two,	wyune,	uái-un.
Three,	píune,	paí-un.
Four,	wátshuenee,	uátshuini.
Five,	mánigin,	mánigín.
Six,	navíne,	navaín.
Nine,	surrómsuenee,	surámsuini.
Ten,	tómshuenee,	támshuini.
To look,	póonekee,	púniki.
To go,	piequay,	paí-ikue.
To come,	piéka, or pejée,	paíka, pidshí.
Antelope,	wánzitz,	uánsíts.
Another,	kermúsh,	kürmüsh.
Wild-cat,	móosets,	músëts.
Mule,	móorets,	mürëts.
Otter,	pantchóok,	pántchúk.
Willow couch,	sáh-up,	sá-üp.
To trade,	narrowap,	náro-uap.
All gone, gone away,	topicquay, katsh-kárra,	topíkue, katsh-kára.
Brother,	babbítz,	babíts.
Indian cradle,	cún,	kün.
Flour,	tushúkent,	tushúkünt.
Paper, letter,	pókent,	pókünt.
How many?	áhnápine?	ánápain?
In the future,	penúnk,	pinünk.
In the past,	wéetish,	uítish.
Salutation!	mike tígaboo,	maik tígabú.

COMPARATIVE VOCABULARY OF YAMPA AND WEMINUCHE WORDS.

English.	Yampa.	Weminuche.
I, or me,	nínna,	nínni, or nía.
Boy,	aípëts,	aípäts.
Girl,	nánsíts,	nángíts.
Man,	to-uáts,	tu-uáts.
Old man,	ná-puts,	näpiüts.
Doctor,	putüskui-ünt,	póa-ünt.
Bear,	kuíant,	kuíogant.
Horse,	kavá,†	kaváts.†
Mule,	muráts,‡	muräts.‡

†From the Sp. *caballo*.‡From the Sp. *mulo*.

English.	Yampa.	Weminuche.
Fire,	kun,	kun.
Moon,	maitó-uats,	mia-atóts.
Night,	to-uán,	túguan.
Rain,	pa-ánguos,	ó-ür.
Star,	púchíp,	pútsík.
Sun,	tábi,*	tabapiúts.
Water,	pa,*	pa.*
Mountain,	kíb,	kaíbi.
Valley,	yú-uap,	yúno-uip.
Pine,	yuúmp,	yu-uúmp.
Road,	po,	paú.
Kettle,	pämpúni,	pämpúni.
Shirt,	ta,	ta.
Powder,	kútsa-uar,	kútcha-ua.
House,	kän,	känni.
Hat,	kátsots,	kaítchots.
Cap (gun),	nínáu-ichap,	üngo-u-unüp.
Breeches,	kasúna,	gúsi.
Wagon,	iuúmpünk,	ívenábángo.
Blanket,	tópänasüf,	mógo.
Tobacco,	kuáp,*	kuáp.*
Grass,	o-uíf,	munúmp.
Knife,	uíteh,*	uíteh.
Letter, paper,	póként,*	pókuént.
Flour,	tushúként,*	tushúpünt.
Pipe,	tehunts,	tehung.
Mirror,	návornümp,	nabúninümp.
Saddle,	kárinümp,	kárianümp.
Talk,	ümpa,	ümpágër.
Small,	méputs,*	míapodsh.
Large,	abát,	húkunt.
Hot, warm,	kutavrútchi,	kutáts, or kutúruts.
Red,	ankár,	üngágër.
White,	so-uár,	toshágër.
Black,	tókuër,*	tókuarüü.
How many,	ánapain,*	hana-uüni.
Yes,	úa,*	úi.
No, or not,	katch,*	kaúteh.
All gone,	topíkue,* or katch-kári,*	kaúteh-kári.
In the future,	pinünk,*	pinünk.*
To sit,	kári,	kári.
To come,	pídshi,* paíká,*	pítchi.
To look,	püniki,*	büniki.*
To eat,	tíki,	tíki.
To give,	márgi,	mükki.
To catch, grasp,	tsai-ái,	kaí-i.
To trade,	náro-uap,*	nádo-uap.*
To want,	áshenti,*	íshanto.

Tábi, in the Yampa dialect, signifies *sun*; in the Weminuche, *day*.

At White River agency, in Northwestern Colorado, I could not discover that any word exists in the Yampa dialect for *horse*, nor have I since been able to find any such word in the Shoshoni vocabularies which have already been published. Many of the southwestern tribes

employ the Spanish words for *horse* and *mule*. Thus, the Pimas use *kávai-o*; the Utes, *kavá-i*, or *kavá*. The Coco-Maricopa for *mule*, however, is *mělákolish*; for *horse*, *akuáktüs*. The Cuchan for *horse* is *huts*, and for *dog* the diminutive *hu-úí*.

English.	Weminuche Utah.
What are you hunting?	Hímpa bűshshagěr?
Where is your house? Literally, <i>where, house, you</i> .	Hogába känni ēm?
On the other side of the mountain my house is. Literally, <i>mountain, other side, my, house, sits</i> .	Káibi mǎongopi nía känni kári.
Where is the water? Literally, <i>where, water, sits</i> .	Hogába pa kári?
Did you see my horse? Literally, <i>you, my, horse, see</i> .	Ĕmm nǎnni kaváts búniki?
I did not see him. Literally, <i>not see, me or I</i> .	Kautch búniki nǎnni.
Which way are you going? Literally, <i>where, go</i> .	Hogába páikue?
Which way are you coming? Literally, <i>where, come</i> .	Hogába paik?

English.	Yampa.
I do not want it.	Nǎnna katch áshěnti.
Hand it to me!	Núriiak!
Hold up your hand!	To-útuk!
Light the fire!	Kúnanaíti!
Shut the door!	Túk!
Put it up!	Uatú-uai-ak!

YAMPA VOCABULARY.

English.	Yampa.	English.	Yampa.
Antelope,	uánsíts.*	Eagle,	kuanátchíts.
Buffalo (bison),	kuítsún.	Fish,	pankuýtch.
Beaver,	páu-ítch.*	Fox,	ta-uínsíts.
Badger,	onümpüts.	Ground-squirrel,	síputs.
Black-tailed rabbit,	kǎmmatúksíts.	Grasshopper,	árangüts.
Black cricket,	maísuts.	Gray wolf,	seníf.
Chicken,	kǎrrümpüts.	Hen,	karümpüts.
Crow, raven,	táukuěnts.	Hog,	kotchuněr.
Crane,	sükuár.	Lice,	tchárni.
Colt,	ko-uáro-uats.	Mountain-sheep,	nagáts.
Cat,	músěts.*	Musk-rat,	pa-vant.
Coyote,	íáko-uíts.	Otter,	panchúk.*
Rabbit (cotton-tail),	tábúk.	Skunk,	poní.
Dog,	sarítch.*	Plover,	kuíts.
Duck,	tchig.	Sage-fowl,	síkarmputs.
Elk,	parür.	Sheep,	kǎnnarutch.

English.	Yampa.	English.	Yampa.
Trout,	atěmpárgar.	Thunder,	onónüs.
Frog, toad,	kúaniif.	Apple,	müissána.
White-tailed deer,	sukúfish.	Another,	kürmüsh.*
Wolf,	yuódsh.*	All,	mánóna.*
Wild goose,	obínüink.	Awl,	uí-iids.
Goose,	kuánatchits.	Boundary-line,	tigaküint.
Goat,	sěrántun.	Straight line,	tomfkuat.
Panther (mountain- lion),	tok.	Hole,	pükédsh.
Sucker (fish),	tchans.	Well,	orúkuat.
Pony,	punk.	Boat,	obishak.
Mouse or rat,	póintchits.	Bridge,	pa-shá-ákěr.
Snake,	toab.	Bed,	shamüp.
Arm,	púrěts.*	Buffalo-skin,	kuitsúnpu.†
Blood,	puáp.*	Bridle,	tímpu-aup.
Cut-throat,	korět-skübíněr.	Bread,	pan, těshütcüp.
Child,	to-uátsěa.	Underbrush,	po-uáp.
Devil,	shínnab.	Bottle,	kináutchits.
Friend,	tígabu.*	Trunk, chest,	oiěmpatsüp.
Heart,	pi-in	Cottonwood,	sürvíp.
Hair,	tatsiba-u-üb.	Choke-cherry,	tonüp.
Head,	tatsüěnt	Cedar,	nap, naráp.
Interpreter,	tínněnt,	Coat,	tóta.
Liar,	túsurükěnt.*	Cheese,	kíasuar.
Myself,	tämmi.	Center,	tótěrrivant.
Mother,	bírdsan.	Cane,	nánsítóp.
This, that, it,	intch.*	River, creek,	nokúínt.
Yourself,	naína.	Dust,	okúmp.
Son,	to-uátechín.	Fight,	nahúkui.
Back,	ping, pink.	Fence,	iuínkuíp.
Belly,	säppún.	Ford,	paráf.
Side,	iargán.	Feather,	pif.
Cheek,	tá-a-uüing.	Gradual ascent,	pännüink.
Hip,	tchiümp.	Gambling,	ná-ue.
Thigh,	tóvüs.	Grease-wood,	tóníf.
Tooth,	to-u-ümp.	Handkerchief,	pánshia.
Nose,	mábitümp.	Gun-sight,	púuinak.
Chin,	karlákümp.	Hill,	kárrür.
Neck,	kurüm.	Iron,	pännüekěri.
Leg,	püinkabú.	Indian tobacco,	sáüero-uap.
Lip,	tímpáú.	Lead (metal),	tímpyú.
Whiskers,	müntchümp.	Lodge-pole,	urá.
Fingers,	me-yúmp.	Medicine,	maishórtikuíp.
Father,	mump.	Milk,	tarf.
Sister,	pártchín.	Mud,	páu-üiíf.
Brother,	páruitchín, babíts.*	Potatoes,	nitchún.
Cloud,	ótíp.	Pistol,	tárpídsh.
Earth,	tiuíp.	(<i>Piñon</i>) pine-nuts,	tüp.
Ice,	tishüp.	Rope,	tcháp.
Morning,	uětechuk.	Rabbit-brush,	shpump.
Noon,	tótabi.	Ramrod,	tchap.
Spirit,	mup.	Resurrection,	shamp.
Snow,	nú-uap.	Salt,	oábbít.
Sunrise,	tábi marúchi.	Bag, sack,	kúnab.
Sunset,	tábi úkue.	Service-berries,	tóém.
		Sinew,	tümmo.

English.	Yampa.	English.	Yampa.
Shield,	pápo-oa.	Never,	katch-pinüink (not in the future).
Stone,	tímp.	To-morrow,	uétchuk.*
Shot-gun,	tímpo.	Last night,	uefttis.
Shadow,	uábab.	Yesterday,	kunif.
Tail,	kuársitch.	To-day,	arf.
Watermelon,	shánticüit.	To break,	kopók.
Willow,	kännäf.	To bite,	kiá.
Whisky,	kúna-pa (fire-water).	To cut,	skäbínër.
Brass,	uákër.	To chew,	kunasincha.
Matches,	o-úfgan.	To die,	i-ai.
Cañon,	uíarünt.	To dig,	orá.
Agency,	távarvu.	To dance,	uípi.
Arrow,	hu.	To encamp,	míabitchër.
Belt,	nanútechüp.	To move,	miabíkiue.
Meat,	to-uáp.	To move camp,	miabíkinni.
Whistle,	súkuërai.	To go,	pai-ikue.*
Stench,	kuána.	To glean,	stói.
Bad,	kátchuat (not good).	To go home,	pai-ikuevân.
Dead,	iaikue.	To go fast,	pünkërókua.
Deaf,	nínkáruat.	To go slow,	saritchíp.
Equal,	toanáuër.	To grow,	naná.
Enough,	ónëshümp.	To hobble,	maitchukür.
Forgotten,	káshumi.	To kick,	täng.
Foolish,	katsúe.	To load (a gun),	tau-adsh áka.
Good,	at, tútchat.	To lie down,	ábikue.
Heavy,	püttínt.	To laugh,	kiárni.
Light (weight),	spünni.	To live,	norfa.
Licentious,	nasúntchar.	To lend,	io-úfni.
Mine,	núna.	To make,	inëk.
Many, much,	haván.	To hurry,	ta-u-úni.
New,	átura.	To marry,	pivá.
Old,	uífnümp.	To pack (on horses),	nok.
Roan,	uashir.	To run,	pünküé.
Ripe,	kuásha.	To ride,	pür.
Sick,	pükkánga.	To sing,	kai.
Slow,	shániuitch.	To sleep,	ipóv.
Soft,	kútechínguër.	To shoot,	kokúí.
Strong,	tuidshgitchër.	To stand,	u-üni.
Stinking,	píkakuana.	To fly,	mábinüink.
Tired,	u-uón.	To baptize,	a-úna.
Wrong,	kóturak.	To think,	túni.
Yonder,	mába.	To tie,	täppúchi.
Brass,	nákür.	To cook,	tehai.
Certain,	tu-nëdshshümp.	To trot,	apúna.
Thin (in flesh),	i-ikue.	To walk,	nampá-igue.
A great way off,	túdishim.	To wash (clothes),	tatsháka-ue.
Long time ahead,	tuidsh-pinüink.	To wash (hands),	múna-uátisa-ue.
Long time ago,	tuidsh-itísh.	To sneeze,	a-u-úsi.
In the past,	uítísh.*	To spit,	kátchiana.
Not any,	katcháno.		

Miabíkinni, to move camp, from *miabíkiue*, to move, and *kán*, house or lodge.

Me-yúmp, fingers, is derived from *mänig'n*, five.

Katch-pinüink, never, from *katch* and *pinüink*, not in the future.

Káitch-uat, bad, from *katch* and *at*, not good.

Uétchuk signifies both *morning* and *to-morrow*.

In the Yampa dialect, a number of words occur which are derivatives of *pa*, *water*:—*kúna-pa*, *whisky*, a compound of *kun* (*fire*) and *pa*, literally *firewater*; *pa-shá á-kër*, *bridge*; *pa-ánguos*, *rain*; *pa-vánt*, *muskrat*; *pa-kúaniif*, *frog*; also *páu-ünteh*, *beaver*; *pantchúuk*, *otter*; *pan-kúitch*, *fish*.

Substantives, representing objects of European introduction, frequently terminate in *nümp* :

Axe,	kuipännümp.
Beaver-trap,	pauünteh-yúinümp.
Comb,	nänsurñnümp.
Chair,	karúnümp.
Candle,	náitinümp.
Drum,	pampúněpännümp.
Fish-hook,	pa-gěranümp.
Finger-ring,	panamáguanümp.
File,	uñirñnümp.
Looking glass,	návornümp.
Needle,	tcharáunümp.
Plate,	tíkarnümp.
Small bells,	täppariümp.
Saddle,	kárinümp.
Stirrup,	táranümp.
Spy-glass,	púniümp.
Spoon,	monsítkanümp.
Table,	tíkarnümp.
Spur,	tárganümp.
Ink,	pěřernümp.

The words for *chair* and *saddle* are almost identical; they are derived from *kári*, *to sit*. *Tíkarnümp* seems to be used for *table* and *plate*, since both objects are employed for the same purpose, *i. e.*, to eat from; hence they are derived from *tíki*, *to eat*.

Of the different forms of optic glasses, the Ute Indian seems to have a confused idea. Thus, Mr. Littlefield obtained the word *návornümp* for *mirror* and *púniümp* for *spy-glass*. The latter is derived from *púniki*, *to see*, *to look*. Captain Moss, however, gives *nabúniümp* for *mirror*, the word being derived from *búniki* (Wenimuche), *to look*.

The prefix *tudsh* or *tuidsh* denotes emphasis or increase in strength; as, *pinüink*, *in the future*, *tuidsh-pinüink*, *a long time ahead*; *uitish*, *in the past*, *tuidsh-itish*, *a long time ago*; *túshim*, *a great way off*; *tuidsh-gitchěr*, *strong*; *tu-úđsh-shümp*, *certain*.

WEMINUCHE VOCABULARY.

English.	Weminuche.	English.	Weminuche.
You,	em,* or ümmar.	Other side,	mänangopi.
Woman,	mamáts.	This side,	ínüingopi.
Old woman,	mamasóats.	Nothing,	navásh.
Deer,	tíäts	What,	hïmpa.
Summer,	tets.	When,	hännúk.
Autumn,	yúan.	Which,	hogába.
Day,	tábi.*	Here,	íba.
Winter,	tam.	Tall,	pant.
Spring,	támün.	Lean,	kännibítch.
One year,	támtopi.	Light (brightness),	táshni.
Wood,	kókuap.	Green, or blue,	sau-uágër.
Plenty,	ávan.	Yellow,	ho-uákër.
Bullets,	tïmbaho.	Cold,	shitíá,
Tin-cup,	bännokutchits.	Not much,	káutch ávan.
Moccasins,	páds.	To sit down,	kari-úa.
Clay-bank,	ho-uásikër.	To smoke,	kuap-tïki.
Butte,	kamp.	To drink,	híbi.
Plug-tobacco,	táu-kuáp.		

Ho-uásikër, clay-bank, is derived from *ho-uákër*, yellow; hence, yellow clay. *Kuap-tïki*, to smoke, is a compound word formed of *kuap* (tobacco) and *tïki* (to eat); the literal meaning is to eat tobacco.

From an examination of Lient. A. W. Whipple's vocabularies, it will be seen that a similarity exists between the Utah and the Comanchi and Chemehuevi dialects; between the former and the latter especially. There is no doubt that the three tribes belong to the extensive group known as the *Shoshoni* family. I will avail myself, therefore, of this opportunity to make a brief comparison of the dialects as spoken by branches of the three above-mentioned tribes, employing, however, only such words as have a marked affinity:—

English.	Comanchi.	Chemehuevi.	Yampa.
House,	cáh-ne,	cá-ni,	kan.
Kettle,	pimoró,	pampuin,	pampuni.
Man,		tawátz,	to-uáts.
Girl,		nai-ítsit,	nánsíts.
Boy,		áípatz,	áípëts.
Father,		múo,	mump.
Brother,		parvítch,	páruítchïn.
Nose,	móbi,	muvi,	mábitümp.
Tooth,	táman,	tow-wá,	to-u-ümp.
Beard,	omórtzon,	mutzá,	müntchümp.
Neck,		curánmin,	kurüm.
Belly,	usáp,	shapúnim,	sáppún.
Leg,		puncáwim,	püinkabú.
Heart,	apíh',	pi-in,	pi-in.
Blood,		paí-i-pi,	puáp.
Friend,		tégibu,	tígabu.
Bow,		atz,	ach.
Knife,	wih',	ouitz,	úítch.
Pipe,	tóh'i,	tshu,	tchunts.

English.	Comanchi.	Chemehuevi.	Yampa.
Tobacco,		co-áp-e,	kuap.
Star,		pútsip,	púтчíp.
Night,	túcan',	tu-wün,	to-uán.
Fire,	cun,	cun,	kun.
Water,	pa,	pah,	pa.
Earth,		tewip,	tiúip.
Hill,		caib,	kíb.
Stone,		timp,	tímp.
Salt,		u-áve,	oäbbít.
Beaver,		pah-wínch,	páu-íntch.
Elk,		pari,	parír.
Antelope,		wántzit,	uánsíts,
Mountain-sheep,		nahgt,	nagáts.
Bison,		coócho,	kuítsún.
Dog,		sharích,	sarítch.
Good,		at',	at.
Yes,		u-wai,	úa.
No,		cach,	katch.
One,		shuish,	súís.
Two,		wai-i,	uaíun.
Three,		pai-i,	paíun.
Four,		watchú,	uátshuini.
Five,		manú	mänigín.
To eat,		tecába,	tíki.
To sit,		caré,	kári
To go,		paíque,	pai-íkue.
To come,		paí-ik,	paiká.
To see,		puníca,	púniki.

English.	Chemehuevi.	Weminuche.
Sun,	tábaputz,	tabapüts.
Moon,	miágoropitz.	mia-atóts.
Spring,	tamán,	támün.
Autumn,	yo-wün,	yúan.
Valley,	unowip,	yúno-nip.
Wood,	coúcüp,	kókuap.
Deer,	té-e,	tíäts.
Plenty,	avát,	ávan.
To drink,	hebíba,	híbi.

For the purpose of comparison, I subjoin a few words in *three* dialects of the Utah tongue:—

English.	Yampa.†	Uinta.‡	Weminuche.§
One,	súís,	súís,	súísh,
Two,	uaíun,	uaíen,	uai,
Three,	paíun,	paíen,	pai,
Four,	uátshuini,	uátsuín,	uátsui.
Five,	mänigín,	mänigín,	mäníga.
Six,	naváin,	naváin,	navái.
Seven,	na-uátchioni,	navíkávün,	naváisuini (<i>six and one</i>).

† Collected by the author.

‡ Furnished by Richard D. Komas, a Uinta Ute.

§ Collected by Capt. John Moss.

English.	Yampa.	Uinta.	Weminuche.
Eight,	uarátchuini,	uáutsuñ.	máutchuini.
Nine,	sürrámsuini,	suromatámpsuñ (near ten),	tusuñsuini.
Ten,	támshuini,	támpsuñ,	másuini.
Foot,	nämp,	nümbáv,	
Hand,	movíf,	mo-óv.	

HIGHER CARDINAL NUMBERS.

English.	Yampa Utah.
Eleven,	súgüs spñkor.
Twelve,	uák spñkor.
Thirteen,	paík spñkor.
Fourteen,	uátsuk spñkor.
Fifteen,	mänig spñkor.
Sixteen,	narvík spñkor.
Seventeen,	narvita-uěrk spñkor.
Eighteen,	uarátchuk spñkor.
Nineteen,	surámpasuk spñkor.
Twenty,	uámüssurin.
Twenty-one,	uámüssurin súgüs.
Twenty-two,	uámüssurin uák.
Twenty-three,	uámüssurin paík.
Twenty-four,	uámüssurin uátsuk.
Twenty-five,	uámüssurin mänig.
One hundred,	súkuaměř.
Two hundred,	uarúkuaměř.
Three hundred,	paíkuměř.
Four hundred,	uatsúkuaměř.
Five hundred,	mäniguměř.
Six hundred,	narvítiuměř.
Seven hundred,	naruítchěřkuměř.
Eight hundred,	uarátutchukuměř.
Nine hundred,	surámpasukuměř.
One thousand,	tump�úkuaměř.

The terminal *měř* occurs in numerals to designate a hundred-fold value: *súts*, one; *súkuaměř*, one hundred. *Spñkor* corresponds with the English suffix *teen* or *ten*: *mänigñ*, five; *mänig spñkor*, fifteen.

From a careful study of these vocabularies, the following points will be observed:—

f occurs but rarely, if at all. The sound indicated by *f* is perhaps between the English *f* and the German guttural aspirate *ch* in *ach*, and this is only found in a few words, as given me by Dr. J. D. Littlefield. In the words which I gathered myself, *f* does not occur, and I found that the Yampa Utes pronounced the sound with great difficulty, almost invariably substituting *p*. The *f* sound may be rendered by *v*, and it might not be inaccurate to make this substitution wherever words have been spelled with *f*.

l does not exist in these lists.

d occurs but rarely, except in the combination *dsh*, the equivalent of *j*.

Any typographical errors which may unavoidably have crept into this paper, I hope to be able to correct in a future and fuller edition.

Appendix.

<i>Moqui</i> (Tequa).		<i>Seminole</i> (Indian Terr.)	
Ngúmni,	flour.	Shěláko-páika,	mule (horse with long hair).
Tumlákh(i)ni,	food-cakes of dried fruit, meat, and straw.	Shěláko,	horse.
		Ifá,	dog.
Kúshiva,	salt-cellar.	Hĩtchi,	tobacco.
		Hĩtchi-bŭkúá,	pipe (tobacco-house).

ART. XVII.—METHODS OF MAKING STONE WEAPONS.

BY PAUL SCHUMACHER.

[PLATE 29.]

I.—THE MANUFACTURE OF STONE WEAPONS. [*]

During my rambles among the remnants of our Pacific coast aborigines I had an opportunity, among the Klamath Indians, of gaining information of the manufacture of stone weapons, for which my interest was not a little stimulated by extensive collections made by our party among the deserted hearths of the coast tribes. I had the good luck to meet the last arrow-maker of the tribe, located on the right bank and near the mouth of the Klamath River, who has since joined his forefathers in the happy hunting-ground. He showed me the mode of making stone weapons, of which the following is a description.

For the manufacture of arrow- and spear-points, knives, borers, adzes, etc., chert, chalcedony, jasper, agate, obsidian, and similar stones of conchoidal fracture are used. The rock is first exposed to fire, and, after a thorough heating, rapidly cooled off, when it flakes readily into sherds of different sizes under well-directed blows at its cleavage. The fragments are assorted according to shape and size best corresponding to the weapons desired; the small ones, best fit in shape and thickness, are used for arrow-heads; similar sherds, but larger in size, for spear-points; the long narrow pieces for borers, and so on. To work the flakes into the desired forms, certain tools are required, one of which is represented in Fig. 1. It consists of a stick (*a*), which is in form and thickness not unlike an arrow-shaft and about $1\frac{1}{2}$ feet in length, to one end of which a point (*b*) is fastened, of some tough material, as the tooth of the sea-lion, or the horn of elk, and even iron among the present Klamaths, although the rock does not work as well, and brittles where the edge ought to be sharp. The point is represented in natural size in Fig. 2 to better illustrate its beveled curve, which form admits a gradual press-

[* Translated by the author for the Bulletin from an earlier publication in *Archiv für Anthropologie*, vol. vii, page 263 *et seq.* The article may be considered supplementary to Arts. II. and III., by the same author, in the first number of this volume.—Ed.]

ure to a limited space of the edge of the sherd. During the operation, the rock is partially inwrapped in a piece of buckskin for better manipulation, its flat side resting against the fleshy part of the thumb of the left hand, only the edge to be worked being left exposed (Fig. 3). The tool is worked with the right hand, while the lower part of the handle, usually ornamented, is held between the arm and the body so as to guide the instrument with a steady hand. The main movements are shown at *a*, *b*, and *c* of Fig. 4. With the movement as illustrated at *a*, larger flakes are detached, and the rock is roughly shaped into the desired form; while with the movement shown at *b* long flakes are broken, which frequently reach the middle of the sherd, producing the ridge of the points or knives; and, with movement illustrated at *c*, the smaller chips of the cutting-edge are worked. The work proceeds from the point, the more fragile part of the weapon toward the stronger end, as illustrated by the unfinished borer, the form of which, as frequently found, is shown by dotted lines. To work out the barbs and the projections of the arrow or spear-points (Fig. 5), a bone needle is used, as pictured in natural size in Fig. 7, about 4 to 5 inches long, without a shaft. The movements are those as illustrated at *b* and *c*.

II.—STRAIGHTENING OF THE ARROW-SHAFT.

On the coast of California and Oregon especially, the common willow was used for shafting the arrow of the aborigines, although any other tough straight twig may have supplied the want. The arrow of these tribes is usually about 2½ feet long; the shaft is worked round to a diameter of about $\frac{5}{16}$ of an inch, and tapers slightly toward the ends, to one of which is fastened the point, while the other one is winged with the guiding-feathers. The aboriginal warrior was well aware of the advantage of a straight arrow-shaft over a crooked one, and when therefore nature did not provide the desired perfection, ingenuity was resorted to by which it was attained. The way it was accomplished I learned from living witnesses and by the many implements found which were used for the purpose of straightening the arrow-shaft.

The twigs were cut into the proper length, worked by scraping into the desired thickness, and were left to dry in the shade. When partially dry, such bends and crooked parts which resisted the common practice of straightening were subjected to the action of the arrow-straightener. This utensil is made of steatite, a rock that well resists the destructive power of the fire to which it is subjected during the process of straightening the shafts, and retains the heat long. It is usually oval in shape, and slopes toward both ends and sides, ending in a flat base, upon which it rests when in use. Across its ridge passes a groove (sometimes two and even three), corresponding in its width to the thickness of the arrow-shaft, while the depth varies often to twice its width, according to the service it rendered, by which the grooves are deepened and at its edge even enlarged. The size varies from the one illustrated to about 5 inches in

Fig. 1



Fig. 2



Fig. 3



Fig. 4

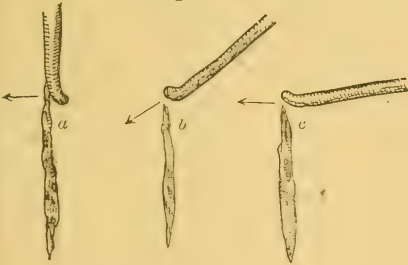


Fig. 5

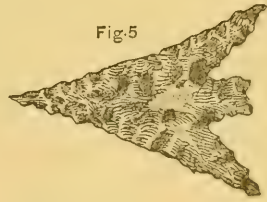
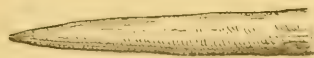


Fig. 6



Fig. 7



Method of Making Stone Weapons.

length and $2\frac{1}{2}$ in width.* Into the groove of the heated utensil, the crooked part of the shaft is pressed, and by heating or steaming the wood becomes very flexible, and is easily bent and straightened, which position it will retain when cooled off. It is the same principle now employed in the manufacture of furniture, wagon-wheels, etc., of bent wood, brought into almost any shape by the process of steaming.

*A beautiful specimen of this size with three grooves was received, among other implements, from Dr. Hays in San Luis Obispo, and is now in the National Museum.

ART. XVIII.—ON A PECULIAR TYPE OF ERUPTIVE MOUNTAINS IN COLORADO.

BY A. C. PEALE.

Since the summer of 1873, the United States Geological Survey of the Territories has been engaged in the survey of Colorado, the field-work being finished during 1876.

In reviewing the areas covered by the explorations of the Survey, many additional facts in regard to the geologic structure of the Rocky Mountains have been brought to light, none more interesting than the one I propose to consider in this paper, viz, the occurrence in Colorado of *eruptive mountains* of a peculiar type.

By eruptive mountains I mean those igneous and yet non-volcanic mountain masses, due to sudden or catastrophic action as contradistinguished from the uniform and long-continued action, the result of contraction and lateral pressure, by which, in general, mountain chains and ranges have been produced. That they are the result, secondarily, of the same causes I shall endeavor to point out in a subsequent portion of this paper. There are a number of eruptive areas, which, from a general resemblance in their rocks and in their mode of occurrence, should be classed together. They do not form mountain chains, but are isolated masses, although, in a few cases, their proximity to mountain ranges is at first the cause of some difficulty in recognizing them as distinct.

The object of this paper is to present briefly and connectedly what are conceived to be the principal features in regard to these areas, the material being drawn from the results of the observations of my colleagues and myself, as detailed in the various Reports of the Survey. Future investigation in more detail than our limited time for observation allows, will doubtless add much to the knowledge of these isolated eruptive mountains.

In the first place, let me present briefly a description of them, commencing in the eastern part of Colorado.

SPANISH PEAKS.

The Spanish Peaks are two beautiful isolated mountains situated east of the Sangre de Cristo Range, at the sources of the Apishpa and Charas, two tributaries of the Arkansas River. They were studied by Dr.

F. M. Endlich in 1875, and from his manuscript report for 1875 (in press) I condense the following description.

East Spanish Peak is entirely composed of trachyte, rising high above the surrounding country. On the east and northeast, the Dakota sandstones are seen dipping to the eastward, and penetrated by dikes radiating from the peak. On the west and south, Carboniferous red sandstones prevail, also penetrated by dikes radiating from the same center.

West Spanish Peak is probably the result of a dike directly connected with the mass of trachyte forming the *East Peak*. The trachyte has evidently spread laterally on the summit, and rests on changed sandstones of Carboniferous age. Each spur leading from the peak marks the presence of a dike radiating from a common center. The longest of these dikes have a general direction north and south.

The present shape of the Spanish Peaks is due largely to erosion, the igneous material resisting erosive influences more readily than the surrounding softer sedimentaries.

Six miles west of the *West Peak*, the Dakota group of the Cretaceous and remnants of the overlying shales are seen standing in vertical position. The sedimentary strata all around the peaks have not only been much disturbed, but have also been subjected to considerable metamorphism. All that can be said about their age is that it is Post-Lignitic (Tertiary), as some of the dikes extending southward from the *West Peak* penetrate Carboniferous, Cretaceous, and Lignitic strata.

The rocks present considerable variety, but are generally porphyritic, and consist of a feldspathic base, inclosing crystals of oligoclase, sanidine, mica, and acicular hornblende.

HUERFANO AREAS.

Northwest of the Spanish Peaks and southwest of the Huerfano River are several small areas of the same porphyritic rock that is seen in the Spanish Peaks. They seem to occur as masses that have come up through fissures in the Dakota sandstone, and then spread out on the eastward-dipping strata. Only one of the areas has radial dikes like the Spanish Peaks, and this area, with another which lies immediately west of it, are on the Carboniferous sandstones, the Dakota group touching the trachyte only on the north.

At the southern extremity of the Greenhorn Mountains, on the north side of the Huerfano River, is another small area of eruptive material similar to those on the south. It rests partly on Triassic strata and partly on granitic rocks.

These areas will be fully described in Dr. Endlich's report for 1875.

MIDDLE PARK AREAS.

In Middle Park are two trachytic areas, which, from the character of the rock and the mode of occurrence, are included with the eruptive mountains, although they form comparatively low hills. The difference

between them and some of the areas to be described is only in degree. They are fully described in Mr. Marvine's report for 1873.*

The first of these areas is in the valley of Blue River, on the east side, about five miles south of the Grand. Here at one point the hills of Cretaceous shales are covered with a large mass of eruptive rock. Southwest of this are two dikes of light gray or greenish-white porphyritic trachyte, which intersect each other at their southern end. One of these dikes is vertical, toward which the other inclines, probably connecting with it below the surface. Mr. Marvine says:—"The trend of these two dikes is toward a hill which lies about eleven miles from the Grand, and which, in its isolation and abruptness, presents a unique topographical feature on the otherwise regularly formed valley, and therefore indicates some equally unique geological fact".† This hill is composed of massive beds of trachyte separated by layers of soft Cretaceous shales. The "intrusive masses" of trachyte, Mr. Marvine says, are "of Post-Cretaceous age, which, instead of breaking across the strata, here followed along their planes of bedding, and forcing apart and upward the strata between which they wedged themselves, caused them to incline eastward at a steeper angle than those on either side".‡ In one place, three of the beds of trachyte are united in one, and near this is what appears to be the side or edge of a flow, against which the undisturbed slates abut on the south, dipping 10° east. From this point north, the trachyte becomes a layer, and resting on it are the slates that have been turned up by it. The beds included between the trachyte layers gradually increase their dip in ascending the hill.

On the west side of Blue River is a massive hill, also apparently of trachyte, a remnant of the thickening dike, with the capping slates eroded away. The rock throughout is a handsome porphyritic trachyte with a tendency to very large feldspar crystals. The lower bed of trachyte rests on the sandstones of the Dakota group (No. 1 Cretaceous). The sedimentary rocks seem to have been but little affected by any heat that may have accompanied the eruption.

Park View Mountain is in the divide between Middle and North Parks. From the description given of the rock, and a certain resemblance to the Spanish Peaks, I have included it in the eruptive class. Mr. Marvine says of it and an adjacent hill that they are composed of horizontal Lignitic rocks, with dikes of a handsome porphyritic trachyte. Where several dikes intersect or occur near one another, their combined resistance to erosion has formed a hill, every spur of which contains a dike. The rock is a grayish-green paste, with numerous large well-formed crystals of white orthoclase and short hexagonal crystals of a soft dark green chlorite. In physical appearance, it resembles the rock of West Spanish Peak.

* Annual Report United States Geological Survey for 1873, 1874, pp. 174, 185, 186.

† Annual Report United States Geological Survey for 1873, 1874, p. 186.

‡ *Ibid.*

MOUNT GUYOT AREA.

Northwest of South Park, in the divide between it and Middle Park, is a group of mountains that, topographically, are connected with both the Park and Front Ranges, the continental divide following its crest from one range to the other. Geologically, however, this group is distinct from them, being of later origin and due to eruptive action. The mountains are composed of gray eruptive granite, porphyritic trachyte, and metamorphosed sedimentaries, with interbedded igneous rocks. There are two sub-groups, viz, Mount Guyot and Silverheels.

Mount Guyot.—The rock of Mount Guyot is compact and light-colored, not to be distinguished in appearance from fine-grained granite. It lies on the slopes of the peak in slab-like masses, with rusty-colored surfaces, and rings beneath the blows of the hammer. Near the summit of the peak, it is intersected by a dike-like mass of very compact green rock, in which crystals of feldspar are porphyritically imbedded. Between the peak and the metamorphic Archæan rocks that prevail to the eastward in the Front Range, are fragments of metamorphosed sandstone and argillaceous slate. They could not be traced north or south of the saddle in which they are exposed, and appear to have been caught during the upheaval of the mountain and wedged between the Archæan rocks and the eruptive rock of the mountain (see page 213, Report United States Geological Survey, 1873). South of Mount Guyot, the mountains are composed of porphyritic trachyte. It weathers like the rock of Mount Guyot, and, like it, is phonolitic. On the east side of Tarryall Creek, above the village of Hamilton, it rests on the Dakota sandstones, which dip under it, changed into quartzites.

Silverheels.—The Silverheels group is separated from the Mount Guyot group by Tarryall Creek. Silverheels is the principal peak, and is composed of stratified rocks of probable Upper Carboniferous age, with interlaminated igneous rocks. The strata dip approximately to the eastward at an angle of 30° , and are much metamorphosed. From the summit of the peak, the outcrops can be traced, extending southward into South Park, where the sections show them to be unchanged.* At the head of Tarryall Creek, dikes penetrate the sedimentaries, and are doubtless connected with those of Silver Heels Mountain. East of Silver Heels is a comparatively low rounded hill of porphyritic rock, and in the Park are several igneous ridges, all probably of the same age and alike in general character. The Park Range in the region of Mount Lincoln and southward presents abundant evidences of the same igneous action in the intrusion of porphyritic igneous rocks in schists and rocks of Palæozoic age.† The proximity of the Sawatch Range, of which the Park Range is really a part, tends to complicate matters, and leaves us

* Annual Report United States Geological Survey for 1873, 1874, pp. 214-219.

† *Ibid.*, pp. 41-47, 225-236.

in doubt as to the amount of elevation in the latter to be attributed to the force which caused the uplifting of Mount Guyot and Silverheels Mountain.

ELK MOUNTAINS.

It is obviously impossible in the space at command here to give a complete description of the Elk Mountains. For details, the reader is referred to the Reports of the Survey for 1873 and 1874.

Topographically, the Elk Mountains might be considered merely as a spur from the Sawatch Range, separated only by a high saddle. When we study them closely, we find that geologically they are entirely distinct. The Elk Mountains consist of four areas of igneous rock separated by synclinal depressions filled with sedimentaries. The eruptive force seems to have acted along a line possessing a trend northwest and southeast, thus giving the mountains the character of a small range, from which the beds dip away to the northeast and southwest. Along this line there are four areas of igneous rock, which seem to mark foci of greatest force. These areas are named from their prominent peaks as follows, commencing at the southeast: Italian, White Rock, Snow Mass, and Sopris. Between them, the peaks composed of sedimentary beds rise to an equal and in some instances to even a greater altitude than do those of igneous rock. The eruptive material appears to have carried up the sedimentary series, breaking and bursting through the strata. Subsequent erosion has removed an immense amount of material, and strata that may have continued uninterruptedly across the mountains have been removed. This erosion would naturally have the most effect over the centers of greatest force, the disturbance of the strata breaking them and rendering them more readily affected by the eroding agents. The sedimentary rocks between the areas are much disturbed by a fault-fold fully described in Mr. Holmes's report for 1874,* caused by the same igneous rock which has not reached the surface. I shall now take up the areas as named above.

Italian area.—At Italian Peak a small mass of the eruptive material has forced its way through the primordial rocks, carrying a portion of them to the summit of the mountain. The quartzites at the base of the series are highly metamorphosed, and irregular layers of the igneous rock that have been thrust between the strata can be distinctly traced to the junction with the main mass. On the east side of the peak, a small patch of quartzites has been caught between the eruptive rock and the adjacent metamorphic Archaean rocks, as in the case near Mount Guyot, already mentioned.

In the Italian area, we have the only instance in the Elk Mountains of visible contact between the eruptive granite and the Archaean rocks, and the two are seen to be utterly different. The rock of Italian Peak is fine-grained, and has all the appearance of granite. It is identical

*Annual Report United States Geological Survey for 1874, 1876, pp. 68-70.

in appearance with that of Mount Guyot. In a dike extending south of east from the peak, it is trachytic.

White Rock area.—This area is named from White Rock Peak, and is the most irregular, from the fact that on the center of the mass a portion of the Palæozoic strata still remain. The igneous rock is exposed around the base of the stratified mass. The Palæozoic rocks have been carried up with the eruptive mass, and now rest upon it in almost horizontal position, forming the Castle group of peaks. Castle Peak has an elevation of 1,415 feet, while White Rock Peak, the highest peak of igneous rock in the area, has an elevation of 13,357 feet. West of the Castle group, the connection with the beds that dip to the northeast from the mountains is not broken. On the south and west sides of the area, the general dip of the strata is to the southwest, although near it there is considerable confusion in the beds from the presence of the fault-fold, to which I have already referred. They are penetrated by dikes and sheets of igneous rock, and in places are completely overturned. In the synclinal between the White Rock and Snow Mass areas, the strata are of Carboniferous age. There are numerous dikes, and the beds are considerably metamorphosed. The peaks into which these sedimentaries are eroded attain as great an elevation as do the eruptive peaks in the adjacent areas. The eruptive rock is generally granitic in appearance.

Snow Mass area.—This is by far the largest of the eruptive areas of the Elk Mountains, containing about forty square miles. On the south and southwestern sides of the area, the stratified rocks are much disturbed.* On the southwest, the Cretaceous is in contact with the eruptive granite. On the north and east, the Palæozoic rocks rest on it. East of the area is a dike or sheet of igneous rock between layers of the Palæozoic formations. It was once doubtless connected with the mass of the main area. Erosion of the valley of Snow Mass Creek has cut across it and broken the connection. Between the Snow Mass area and Sopris area is a synclinal of sedimentaries.

Sopris area.—This is the most northern and most symmetrical of the Elk Mountain areas. The sedimentaries are seen dipping away from it on all sides. On the west, erosion has removed a portion of them, so that a tongue of the igneous rock extends westward from the mass of which Sopris Peak is the center. In the areas just described, the rocks are generally compact and fine-grained, like the granite (?) of Mount Guyot. In the dikes radiating from the central masses, the trachytic character is prevalent. In some of them, however, the rock cannot be distinguished from that of the central eruptive areas.

West Elk groups.—Southwest of the Elk Mountains are a number of isolated mountain groups, those nearest the main range being generally included with it. As we recede from the Elk Mountains, they be-

* See sections D and E on sheet opposite p. 72, Annual Report of United States Geological Survey for 1874.

come more and more isolated. The principal mountain-masses close to the main Elk Mountains are Crested Butte, Gothic Mountain, and Cinnamon and Treasury Mountains, from which they are separated by Rock Creek and East River.

Crested Butte and Gothic Mountain are both trachytic, and are probably connected by a dike. The eruptive material appears to have been pushed up through a fissure, and spread in sheet-like masses between the Cretaceous layers, especially at Gothic Mountain.* The latter is named from the Gothic spires into which its rocks have been eroded. This is a common form of weathering in these isolated mountains.

Cinnamon and Treasury Mountains are composed mainly of sedimentary beds much metamorphosed. The former is of Cretaceous shales intersected by dikes. Treasury Mountain is an oval-shaped quaquaversal, composed of Palaeozoic rocks, with Jurassic and Lower Cretaceous reaching high up on the arch, while Cretaceous shales are ranged around and support the base. The entire series up to the Middle Cretaceous is highly metamorphosed and intersected by numerous dikes.

West and southwest of these groups are those described in the Report for 1874 (pp. 163-168). In these the isolated character is beautifully shown. They stand like islands in a sea of Cretaceous rocks. The latter are tipped against the eruptive nuclei to a greater or less extent around the margins of the mountains. Only one of the groups (Anthracite group†) has the appearance of a range. The most western group is about forty miles from the central portion of the Elk Mountains. The rocks in these areas differ somewhat among themselves, although there is a general resemblance in all to those of the Elk Mountains. In Mount Marcellina, and in the large area adjacent on the north, it cannot be distinguished from the Elk Mountain granite (‡), and yet in some places it grades into a porphyritic trachyte. In the more southern and western areas, the trachytic character prevails, especially so in the dikes and intrusive sheets. Mount Owen is composed of highly metamorphosed shales and sandstones with intersecting dikes, closely resembling Cinnamon Mountain. From the igneous masses, both dikes and intrusive sheets radiate, intersecting and separating the sedimentary strata. The most western large area † seems to have had three centers of elevation, connected by narrow belts of igneous rock. Fragments of the shales have been caught in the eruptive rock. West of this area, between two low hills, is a finger like mass of trachyte rising several hundred feet above the surrounding almost horizontal Cretaceous shales.

SIERRA LA SAL.

The Sierra La Sal is in latitude $38^{\circ} 30'$, longitude $109^{\circ} 15'$, about 120 miles west of the Elk Mountains. Although composed of three groups,

* See sections J and G on sheet opposite p. 72, Report United States Geological Survey, 1874.

† Area A on map opposite p. 166, Report United States Geological Survey, 1874.

‡ Area F on map opposite p. 166, Report, 1874.

it is the result of one uplift, the sedimentary saddles separating three eruptive centers each having a much greater elevation than the surrounding country. Compared with the Elk Mountains, its structure is simple.

As we approach the mountains, the sedimentary strata are seen rising on their bases, and in the northern group the red beds (Trias?) dipping eastward 50° to 60° form a portion of some of the outlying peaks. In the middle group, remnants of Cretaceous strata are found, resting horizontally on the highest peak. In the southern group, the sandstones of the Dakota group dip steeply from the east, west, and south sides, and curve over the summits of several of the lower peaks.

The peaks of the Sierra La Sal have an elevation of from 11,000 to 13,000 feet, rising from 7,600 to 9,000 feet above the level of Grand River, which lies on the north, and from 7,300 to 8,500 feet above the Dolores, which is on the east. These rivers flow through cañons that are from 1,500 to 2,000 feet below the level of the surrounding country. The area occupied by the mountains is about 100 square miles, only a small part being of the eruptive rock. The rock is composed of a light gray feldspathic matrix, with crystals of feldspar and acicular hornblende, porphyritically imbedded. The igneous peaks are sharp, and connected by narrow ridges separating amphitheaters which head the drainage of the mountains.

The Sierra La Sal has been formed by the upheaval of an igneous mass, which has broken through the lower strata, carrying up their broken ends. When the Cretaceous beds were reached, the resistance seems to have been small enough to allow portions of the strata to be carried to the top of the mountains. In some of the peaks of the middle group, there are included fragments of the shales. As far as noted, there are no radial dikes in the Sierra La Sal.

SIERRA ABAJO.

The Sierra Abajo is a little west of south from the Sierra La Sal and about forty miles distant. It was visited during the summer of 1876 by Mr. Holmes, and from his report I condense the following description:—

The mountains consist of a number of small groups of volcanic summits. The trend is not sufficiently marked to make a well-defined range. The individual groups are more like small ranges, but collectively they are rather a group. The eruptive material, although probably from the same nucleus, seems to have forced its way through the lower sedimentary strata by a number of channels. When the yielding Cretaceous shales were met with, it appears to have carried them up, and to have intruded sheets between the strata. Portions of the shales are still found in all parts of the group, having been caught in the eruptive material. The low saddles between the groups are invariably composed of metamorphosed Cretaceous shales.

On the slopes of the mountains, the Dakota group and overlying shales

are seen dipping away from the eruptive nucleus. Compared with the Sierra La Sal, there is, in the Sierra Abajo, a tendency to more rounded summits. There is a general uniformity in height, and some of the mountains are even flat topped. Their general height above the sandstone of the Dakota group being so nearly the thickness of the Cretaceous shales, leads to the supposition that the trachyte never reached the surface, but was stopped by the massive sandstone at the base of the Upper Cretaceous, which doubtless once prevailed over the whole area.

The rock of the Abajo is a porphyritic rock, like that of the Sierra La Sal. Dr. Newberry visited the eastern side of the Sierra in 1859, and also considered it to be locally upheaved.*

SAN JUAN AREAS.

Under this head I arrange the groups lying between the San Juan Mountains and the San Juan River. They were studied by Mr. Holmes in 1875 and 1876, and are as follows: San Miguel, La Plata, El Late, and Carriso. The San Miguel area is nearest to the Elk Mountains, from which it is distant nearly 100 miles.

SAN MIGUEL AREA.

This area is some sixty miles east of the Sierra Abajo, and consists of four or five groups of comparatively simple structure. They are the Mount Wilson group, the Bear Creek group, the Dolores group, and the Lone Cone group. They lie between the heads of the San Miguel, Dolores, and Animas Rivers. The Mount Wilson and Bear Creek groups were visited by Dr. Endlich in 1874.† He recognized them as isolated eruptions. The eruptive rock is a greenish paste, with innumerable white crystals of oligoclase, which are set off to advantage by accompanying black crystals of hornblende. In general, the igneous rock rests on the sedimentaries, with, in some places, intruded sheets between the strata. The western groups were visited by Mr. Holmes in 1876. The rock is similar to that already described, and is generally found resting on the Cretaceous shales, which are usually metamorphosed. There are numerous dikes in the region, and fragments of shales are often included in the igneous rock, as at Lone Cone. The sources of the eruptive material are generally obscured, but the probability is that it came through fissures and spread out in the shales.

LA PLATA AREA.

The La Plata Mountains, lying from 20 to 30 miles south of the San Miguel Mountains, are of more than ordinary interest, on account of the relations of the igneous rocks to the sedimentaries and the degree to which the metamorphism of the latter has been effected by contact with the erupted material. Mr. Holmes's report for 1875 describes the area in detail. The mountains are composed in part of eruptive material and

* Exploring Expedition to Junction of Grand and Green Rivers, p. 100.

† Annual Report United States Geological Survey for 1874, 1876, pp. 207-208.

metamorphosed sedimentaries. The latter are so changed in places that their original character is entirely lost, and it is only by tracing them continuously from points where they are unchanged that they can be recognized as sedimentary. There are, perhaps, two areas of the porphyritic igneous rock, and they were once doubtless connected. From the central nuclei there are radiating dikes and intruded sheets. On the north, Carboniferous rocks prevail between the La Plata Mountains and the San Miguel Mountains. Carboniferous also prevails to the east, while on the west and southwest the Cretaceous rocks are in contact with the igneous rock. On the south, the Cretaceous and underlying formations, as far as the Triassic, are seen dipping away from the mountains. In the region of the La Plata Mountains, there is a general dip of the stratified beds to the westward. In the immediate vicinity of the mountains, there is a local dipping away from the eruptive centre or centres. The rock of the La Plata area resembles that of the areas already described.

EL LATE AREA.

The El Late area is 32 miles west of south from the La Plata Mountains and about 48 miles east of south from the Sierra Abajo. It is composed of trachyte of considerable variety in color and texture, being light and dark, fine-grained and coarse. There is a general uplift of the sedimentaries surrounding the group of mountains, and immediately at the base the edges of the strata are sharply upturned, except at the north, where the sandstones of the Dakota group pass under the erupted material. There appears to have been a spreading of the trachyte here at the time of its pouring out. The area of trachyte is somewhat oval-shaped, being 4 miles long and about $1\frac{3}{4}$ miles in width, with a north and south axis. There is one principal peak—Ute Peak—at the northern end of the area. On the east side, the Cretaceous shales prevail, extending a short distance around the northern and southern ends. On the west, the Dakota group outcrops, with the underlying variegated shales appearing as we go south. There are included masses of the Cretaceous shales, distorted and metamorphosed, in all parts of the trachyte. The erupted material appears to have been forced out through fissures, causing a general uplift, and on reaching the Cretaceous shales it spread laterally. How far it reached vertically, we cannot now tell. There is but one point—the Ute Peak—where there is sufficient thickness to have penetrated the sandstones of the Upper Cretaceous; but we must remember that the erosion subsequent to the eruption affected not only the sedimentaries but also the trachyte itself. At the north is a dike extending northward from the main mass.

CARRISO AREA.

The Carriso is another of the groups studied by Mr. Holmes. It is 32 miles, a little east of south, from the Sierra Abajo and 28 miles southwest of El Late, and is a good example of the isolated mountain struct-

ure. It is an island of trachyte in a sedimentary sea. The surrounding formations belong to the Lower Cretaceous, Jurassic, and Triassic, with perhaps two small outcrops of the Upper Carboniferous. There is a central nucleus of trachyte, from which the sedimentaries dip away to a limited extent, and then flatten out, *i. e.*, become horizontal. On these sedimentaries, and dipping with them, is a bed of trachyte of similar character to that of the central nucleus. In the uplift, great fragments of the stratified beds have been caught and are held as in a vise. In most of the areas already described, the trachyte has been in the Cretaceous shales. In the Carriso, erosion has removed the shales, and we have an opportunity of seeing what occurs in the underlying strata.

The trachyte resting on the sedimentaries lies on the Lower Cretaceous, and probably represents a portion of a mass that was pushed from the nucleus to the sides and forced between the strata. By erosion, the connection with the central mass has been broken, as in a similar case mentioned when describing the Snow Mass area of the Elk Mountains. Whether the original flow ever reached the surface, it is of course impossible to say, on account of the enormous amount of subsequent erosion.

In reviewing the descriptions given above, it will be noticed that, although the areas differ somewhat, they still possess points of general resemblance, and that in the Elk Mountains and adjacent groups we can find examples of the structure seen in the other groups.

It is a question in the case of the areas in Blue River Valley, at Silverheels, and in the Park Range, whether the intrusive layers noted between the sedimentaries came through fissures, and thence followed the planes of stratification, or were intruded laterally from some central mass, as is the case in the southwestern or San Juan groups and at various places in the Elk Mountains. Mr. Marvine believed the former in regard to the Blue River area, and notes places where the strata were broken across to the extent of several feet. On the west side of Blue River is a hill of trachyte, which is the central mass from which these intrusive sheets may have come, if we take the other view. At Silverheels and in the Park Range, we have not, so far as known, any such centre. The following are the principal points of resemblance between the various areas:—

1. Their isolation. On glancing at a map containing all the areas colored, the first thing noticed is their isolation. They seem to be scattered about without any system. This isolation is distinctly recognized in the Spanish Peaks, in the Middle Park, West Elk, and San Juan areas, and in the Sierra La Sal and Sierra Abajo. In the case of the Elk Mountains and the Mount Guyot area, the proximity to the great mountain ranges is apt at first to disguise the fact of their isolation, which, however, is evident on a closer study. Beyond the mountains, however, they stand like islands rising high above the surrounding sedimentaries.

2. The areas all present abundant evidence of their eruptive char-

acter. This is distinctly noted in the descriptions just given, and in the reports, where they are described in detail.

3. There is a general resemblance in their rocks.

4. They occur in regions of sedimentary rocks rather than in those where the metamorphic rocks prevail.

They differ as follows:—

1. The amount of disturbance in the sedimentaries caused by the eruption of the igneous material differs very considerably. In the Elk Mountains, the sedimentaries have been carried up, broken off, overturned, intersected by dikes, and forced apart by intrusive sheets. In other areas, the erupted material appears to have forced its way through the strata and spread out with scarcely any disturbance. Again, in some localities, on reaching the shales, the igneous rock has pushed its way between the layers, causing an uplift in the upper layers by the wedge-like lateral intrusion, while the lower rocks are undisturbed. In other cases, both the lower and upper strata are tipped up at the ends by the passage of the igneous material through them. Sometimes, however, it appears to follow the planes of stratification instead of breaking across.

2. In some areas, the sedimentaries are highly metamorphosed, and in others seem to have been but little affected by any heat that may have attended the eruption.

3. Although there is a general resemblance in the rocks, individually they differ. Some of the groups are trachytic, others are apparently granitic; in a few, we seem to have diorite, and other areas combine within their limits the different varieties.

These differences are only in degree, and prove the propriety of classing the different areas together.

Although modified in several instances, the general plan appears to be the same. The igneous material came up through fissures in the sedimentaries, sometimes tipping up their ends, and sometimes passing through without disturbing them. On reaching the Cretaceous shales, it generally spread out in them, and pushed into and across them dikes and intrusive sheets of the same igneous rock. The elevation in some cases appears to be due to the lateral intrusion, but in others, a portion, at least, of the elevation is due to actual upheaval caused by the eruptive force. The mountains as they now exist are doubtless largely the result of erosion, the hard igneous rock opposing greater resistance to erosive influences than do the surrounding soft sedimentary beds.

Did the eruptive material originally reach the surface? A study of the southwestern areas would seem to give a negative answer to this question; but what is true in regard to particular areas cannot be necessarily predicated of all the areas. If the mass of eruptive material did not come to the surface, it may have sent out dikes that did. In Park View Mountain, the dikes occur in the lignitic beds. Perhaps, if we could go far enough below the surface there, we might find a con-

dition in the lower strata similar to that seen in the isolated groups of the southwest, and perhaps, before the removal of the Tertiary in the latter region, we might have found mountains similar to Park View.

I have noted the fact that, although there is considerable difference among individual specimens of the rocks, there is a general resemblance. Specimens intermediate between the most diverse can be found, forming connecting links. In the descriptions of the areas, the rock is sometimes called trachyte and sometimes granite?, and in the reports of the Survey the names trachyte, rhyolite, and eruptive granite are all used. A piece of the granite? from the Elk Mountains or from Mount Guyot, compared with the trachyte of Middle Park or any of the West Elk groups, or with the feldspathic hornblendic rocks of some of the southwestern areas and the Spanish Peaks, seems utterly different; yet, as I have said, we can find specimens that connect them, and in the Elk Mountains, rocks like those of the other areas can be found occurring near each other and in the same manner. In the larger areas of the Elk Mountains, the rock is compact and homogeneous, resembling a fine-grained granite or syenite. In the smaller areas and in the dikes, the trachytic character prevails. In the southwest, there is a greater abundance of hornblende, and free quartz does not appear so frequently. Mica is abundant in some specimens, but oftener does not show. Until a chemical and microscopic examination is made, we have, of course, but imperfect data upon which to proceed in treating of the rocks. They are all light-colored, and generally porphyritic. They are feldspathic and acidic rather than basic. The differences may be due partly to different conditions of cooling or different degrees of pressure, or perhaps to differences in the material from which they are derived. Their general resemblance, however, points to some common origin.

In the Reports for 1873 and 1874 I was of the opinion that if the trachytic dikes could be traced to the junction with the granitic? masses, the two would be found grading into each other; and in the Report for 1873 I referred to the possibility of the Elk Mountain eruptive granite being remelted metamorphic rocks. I am more than ever inclined to this opinion. If these rocks are the result of the fusion of granitic material, we would naturally expect to see differences in them. It is a curious fact that in the San Juan groups, beds of Cretaceous age alone are found included in the igneous mass. It would seem that, in passing through the older rocks, a portion of them at least, would be included in the mass. Mr. Holmes suggests that they have been so included, but have become a part of the igneous material, and are no longer recognizable. In the La Plata group, he assures me that it was very difficult in places to distinguish the igneous rock from the changed shales, where the latter penetrated it. In an almost vertical dike running north from the Cariso group, the rock is a dark green micaceous rock, closely resembling a micaceous schist, and yet it is igneous. Whether derived from the fusion of metamorphic rocks, or having come from the infra-Archæan

region, they are still igneous in all their history. Another interesting question is as to the age of the eruptions. In most of the areas, all that can be positively said is that they are Post-Cretaceous.

In one of the West Elk areas,* the rocks on the north are mainly of Upper Cretaceous age. On the south, a volcanic breccia is in contact with the igneous area, and on this breccia, a short distance farther south, is a layer of rhyolitic rocks with obsidian at the base. This layer dips somewhat steeply to the south, and the only explanation of the dip is to be found in the eruption of the igneous mass of the area under consideration. The layer becomes horizontal as we go south. The breccia, which presents evidence of deposition in water, rests on the upturned edges of the Cretaceous shales and the sandstones of the Dakota group, between the eruptive area and the Gunnison River, and south of the river is on the granite, gradually thinning out until the rhyolitic layers are superimposed to the granite.† These facts show that after the Cretaceous strata were deposited, there was a period in which they were above water, and subjected to considerable erosion. Then followed a subsidence, during which the breccia was deposited. Then came the flow of the rhyolitic layers from some point south, spreading out on the breccia, and subsequently the eruption of the trachytic mass of the West Elk groups followed, tipping up the rhyolitic layers. Here we have a clew to the age of at least one area, whether or not it can be applied to the others. Not only was the eruption post-Cretaceous, but it was subsequent to considerable erosion that was also post-Cretaceous. In Park View Mountain and at Spanish Peaks, the trachytic dikes intersect horizontal lignitic strata; and, if we accept a Tertiary age for the latter, we have a Tertiary or post-Tertiary age for the eruption. I think it probable that the eruptions are all of the same age, and that they occurred after the elevation of the mountain ranges. If that be so, we may sketch the following as the probable plan:—

1. Progressive subsidence of the region, accompanied by the deposition of sediments, the successive formations overlapping each other; ‡
2. Following this subsidence, the contraction accompanied by lateral pressure, resulting in the formation of the mountain ranges;
3. Attending the plication of the strata, heat resulting in the fusion of the metamorphic and other rocks; and, also,
4. Causing fractures and fissures in the sedimentary strata, through which the igneous rock resulting from the fusion of the metamorphics was forced, forming, in connection with subsequent erosion, the mountain masses under consideration in this paper.§

*Area F, on map opposite p. 166, Annual Report United States Geological Survey for 1874.

† Annual Report United States Geological Survey for 1874, 1876, pp. 168-171.

‡ See article on Age of Rocky Mountains in Colorado, in Silliman's Journal, March, 1877, pp. 172-181.

§ It is due to myself to state that this article was prepared in February, 1867.

ART. XIX.—REPORT ON THE GEOLOGY OF THE REGION OF
THE JUDITH RIVER, MONTANA, AND ON VERTEBRATE FOS-
SILS OBTAINED ON OR NEAR THE MISSOURI RIVER.

BY E. D. COPE.

[Plates 30-34.]

LETTER OF TRANSMITTAL.

PHILADELPHIA, *March 15, 1877.*

SIR: I send you herewith a synopsis of the results of an examination of a portion of the region of the Upper Missouri, conducted by myself during the past summer. The expedition was fitted out at Fort Benton, and commenced geological work and collecting near the mouth of the Judith River. The exploration was conducted eastward of this point, on both sides of the Missouri, as far as Amell's Creek, 130 to 150 miles east of Fort Benton, following the general course of the river. I afterward descended the Missouri by steamboat as far as Yankton, Dak., and took advantage of many delays to examine the geology of the neighborhood of its shores. The survey was much facilitated by the accounts heretofore given by yourself of these regions, and I was able to fully corroborate your observations. Especial attention was given to the relations of the lignite beds of the Judith River and of localities along the course of the Missouri, and some important additions to the paleontology of the formation were made. To descriptions of these fossils are added some accounts of species from the Niobrara Cretaceous of Kansas.

I am, very truly, yours,

E. D. COPE.

Dr. F. V. HAYDEN,

United States Geologist-in-charge.

I.—GEOLOGY OF THE JUDITH RIVER FORMATION.

The formation through which the Missouri cuts its way from a short distance east of Cow Island, for several hundred miles, is, as was originally pointed out by Dr. Hayden,* the Fort Pierre, or No. 4, division of the Upper Cretaceous. Throughout this immense extent of territory, it appears as a soft blackish or lead-colored shale, occasionally varied by beds of soft sandstone and lignite. Some of the layers are saturated

* Transactions Amer. Philos. Soc., 1860, p. 123.

with salts of soda and magnesia, and there are few springs which rise through it in which these substances are not dissolved. Where these strata are exposed, they form barren tracts, whose surface is cracked and crumbling, as though the access of moisture had occasioned a swelling of the mass. Their consistence is soft, so that the limbs of horses sink into them sometimes for their entire length, thus rendering it difficult to traverse them with pack-animals, or, indeed, impossible where they constitute steep hills. Although to be found in other localities and horizons, notably in the Wahsatch Tertiary in Wyoming, these "alkali beds" are nowhere so numerous or so extensive as in the region of Cretaceous No. 4, on the Upper Missouri. The remains of Molluscs and Vertebrates are chiefly confined to the soft sandstones, but they are also abundant in the rusty-brown concretions which are scattered through the shale. These round or oval bodies are fissured, and the cracks are occupied with usually crystalline calcite. The dark shales are covered by a layer of rusty sandstone of variable but not great thickness, which generally contains many molluscos fossils. At the base of the shales is another bed of sandstone of a lighter color, usually buff, and softer and less laminated character. It readily wears into bad-land scenery, and does not contain fossils in the few localities where I observed it. Below this, the brown clay-slate reappeared at the only localities where I saw the underlying bed, *i. e.*, on Dog and Birch Creeks. The thickness of the lower sandstone varies from 40 to 100 feet. Not far above it, in the shale of No. 4, sometimes lying almost on it, is a bed of lignite, which varies in thickness between 6 and 10 feet. In some places, for instance on Dog Creek, this lignite possesses some value as fuel, burning with a yellow flame, and giving out considerable heat, although it lights slowly. In most other localities it is very impure, and contains dicotyledonous leaves badly preserved. The characteristic shale which overlies this bed is from 50 to 200 feet in thickness in the region of the Judith River, while on the lower river, for example in the Round Butte, near Fort Peck, Mont., it exhibits a thickness of nearly 1,000 feet above the water-level. Its layers are thin, and usually so soft as to yield readily to the action of the weather; it is cut by drainage-ravines into rounded hills, excepting where the overlying rusty sandstone protects it, when it forms bluffs with steep naked sides. Important drainage-channels cut deep cañons into it, and the Missouri engulfs huge masses whenever its current impinges for a time against it.

After passing through an uninterrupted body of this formation for 100 miles, the water of the river, at about 60 miles above Fort Buford, exchanges its purity for the muddiness which gives it its name, and which it keeps to its mouth, even giving character to the Mississippi to its delta. The river receives so much of this material from its banks that it is necessarily depositing it at every point where the rate of the current is diminished; hence the immense sand bars which everywhere obstruct its navigation. From the same source is no doubt derived a large portion of the sediment which forms the delta of the Mississippi.

Dr. Hayden has already pointed out the great extent of this formation traversed by the Missouri. He remarks (l. c., p. 126):—"Near the mouth of the Niobrara River, No. 4 appears upon the summits of the bluffs, surmounting No. 3. At the foot of the 'Big Bend', No. 3 passes beneath the water-level of the river, and is succeeded by No. 4, which occupies the country to Grand River, where No. 5 makes its appearance on the summits of the hills. Near the mouth of the Cannon Ball River, the Lignite Tertiary begins to overlap the Cretaceous strata, but does not entirely conceal them along the banks of the river until we reach Square Buttes, about 30 miles below Fort Clarke. From this point to Milk River, in latitude 48° , longitude 106° , only the Miocene beds of the great lignite basin are exposed. . . . The Tertiary beds continue to overlap the Cretaceous, gradually thinning out upon the summits of the hills until we reach the mouth of the Muscleshell River, where the Cretaceous bed No. 4 occupies the whole country." This account of the distribution of the strata is confirmed by my own observations, but I would add that it does not include clear mention of the extensive exposure of the Pierre formation over the country between the Poplar River, 80 miles above old Fort Union, and the Round Butte, 220 miles farther up.

In approaching the mouth of the Judith from the northwest, the bluffs were observed to have the section represented by Fig. 1, Plate 30.

The section represented by Fig. 2, Plate 30, was taken from a bluff formed of strata uplifted at an angle of 40° , dipping northeast. It is on the north side of the Missouri, twelve miles east of the above locality:—

An exposure very similar to the last was observed on Dog Creek, three or four miles from its mouth, where the thick bed of lignite already mentioned occurs. In the black shale at its summit, I obtained considerable numbers of a small and elegant *Baculites*.

These sections resemble very closely two given by Dr. Hayden (l. c., p. 127) as occurring on the eastern border of the Judith Basin near Amell's Island, 60 miles distant. This identity of structure of the opposite borders of the basin has an important bearing on the question of the relative age of the Fort Union beds lower down the river.

As regards the homotaxy of the black shale No. 4, some light is thrown on it by the Vertebrate fossils which I obtained, although these are not numerous at any locality that I visited. I obtained bones of several species of *Pythonomorpha*, one of which is a *Mosasaurus*. Another is represented by a humerus which resembles that of a *Clidastes* or *Platecarpus*. The greater part of the skeleton of a huge *Elasmosaurus* was discovered,* whose vertebræ so strongly resemble those of *E. orientalis* that I am unable to distinguish them. The premaxillary bone of *Enchodus* is a common fossil. Now *Elasmosaurus orientalis* is character-

* And obtained chiefly through the assistance of George B. Clendinning, of Carroll, and Capt. Nicholas Buesen, of Yankton, to whom I must express my sense of the obligation I am under.

istic of No. 4 in New Jersey, as is also the only species of *Clidastes* from that region, neither having yet been found in No. 5.

The following *Mollusca* which I procured from this formation were identified for me by Mr. Meek a short time before his death. A melancholy interest attaches to this work, as it is the last ever done by our late colleague:—*Inoceramus crispus* var. *barabini*; *Inoceramus*, sp. undet.; *Baculites compressus* Say (?).

A question remains as to the age of the light-colored (buff or white) sandstone underlying No. 4. I did not procure any fossils from it, and Dr. Hayden did not bring any from his early expedition to this region. He states, however, that he has always been accustomed to regard it as the Dakota, or No. 1. He describes it as constituting the bad lands between the Judith Basin and Fort Benton, which have been described by Lewis and Clarke, Prince Neuwied, and others. I saw but an outlying portion of this region on the north side of the Missouri near to Eagle Creek. The sandstone is not so hard as that of No. 1, which I have observed in Wyoming, but resembles much that of No. 3 as it exists in New Mexico. Like No. 3, it is underlaid by a dark and soft shale (see Fig. 2), which perhaps represents No. 2. Geographically considered, it is appropriately No. 3, since it occupies a region between that occupied by Nos. 4 and 5, and Fort Benton, where No. 2 is extensively exposed. Dr. Hayden expresses the view that Nos. 2 and 3 are wanting from the region of the Judith (p. 128), and it is true that the lithological character of this rock is different from that of No. 3 as seen in Nebraska and Kansas.

The ferruginous soft sandstone of the Fox Hills group is everywhere the line of demarkation between the black shales of No. 4 below and the Judith River beds above. Its thickness is so much less than that of the other formations that it seems to be less significant than either, and there is nothing yet known of its Vertebrate palæontology in the West, of sufficient importance to warrant its separation from No. 4. Lithologically, it is identical with several sandstone beds of the Judith River lacustrine series, although its fossils are marine. It is a soft sandstone, varying from dark rusty to brownish buff in color, usually from 25 to 30 feet in thickness. At a locality on the high bank of a small stream 10 miles west of Amell's Creek, I obtained the following Vertebrate fossils from it:—

Sauropterygia:—*Uronautes cetiformis* Cope, Proc. Acad. Phila., 1876, p. 346, vertebræ, limbs, and ribs.

Rhynchocephalia:—*Champsosaurus*, sp. indet., a single vertebra.

Isospondyli:—*Enchodus*, teeth.

Elasmobranchii:—*Lamna* and *Otodus*, sp.

The *Mollusca* were identified by Mr. Meek, and comprise the following species. They are from several localities:—

Baculites ovatus Say, northwest border of Judith deposit.

Baculites anceps Say, Judith River.

- Scaphites cheyennensis* O., Battle Creek, Dakota.
Inoceramus pertenuis M. & H., Judith River.
Tancredia americana M. & H., northwest border and Cow Island.
Cardium speciosum M. & H., Cow Island.
Cardium subquadratum Ed. & Shum., northwest border.
Mactra formosa M. & H., Cow Island.
Mactra alta M. & H., northwest border.
Mactra warrenana M. & H., Battle Creek.
Lunatia concinna M. & H., Battle Creek.
Lucina occidentalis Morton, northwest border.
Tellina scitula M. & H., Battle Creek.
Cucullæa shumardii M. & H., Battle Creek.
Plestochilus scarborovii M. & H., Battle Creek.
Pyropsis bairdii M. & H., Battle Creek.

In the Judith region, the relation of the Fox Hills sandstone to the superincumbent strata is everywhere observable. I select as an example a bluff of some 800 feet elevation on the north side of the Missouri, which is in proximity to the one represented in Fig. 1. The sandstone forms a ledge of 25 feet thickness, elevated say 50 feet above the plain. Resting upon it is a thick bed of sandy and alkaline marl, at the base of which, and so immediately above No. 5, I found the following *Vertebrata*:—

Reptilia.

Crocodylia:—Procœlian vertebræ, and teeth with opposite cutting carinæ.

Sauropterygia:—Fragments of vertebræ.

Pythonomorpha:—Fragments of vertebræ.

Testudinata:—Fragments of *Trionyx* and an Emydoid.

Pisces.

Isospondyli:—*Ischyrrhiza* teeth; *Enchodus* teeth and jaws.

Holocephali:—Chimæroid jaw.

Elasmobranchii:—*Otodus* sp.; *Lamna* sp.

In all ten species, which are mostly of characteristically Cretaceous type. Mingled with them were fragments of large bones much resembling those of *Dinosauria*, but not characteristic. This light-colored bed has a depth of from 100 to 115 feet, and is sometimes divided by a thin layer of sandstone 15 feet from the base. The upper portion of the stratum is more arenaceous; the lower more argillaceous and alkaline. The whole is capped by a thin bed of sandstone, which varies from straw-colored to rusty in color and from 3 to 8 feet in thickness. In and immediately below this stratum occur the bones of *Dinosauria*. From this point upward, we have undoubted deposits of the Judith River epoch, or Cretaceous No. 6, which, near the Judith River, attain a thickness of from 100 to 500 feet. The bed which rests on the sandstone just

described is a sandy marl of ashy color, and of 80 or more feet in thickness. This is interrupted below the middle, in the locality under consideration, by two thin beds of impure lignite, of from 2 to 4 feet in depth and 10 feet apart; stems and fragments of leaves are abundant in them; the color is of various shades of brown. On the summit of the gray beds is another stratum of rather soft pale brown or rusty sandstone, of from 12 to 20 feet in thickness, which contains great numbers of shells, usually of small size, but occasionally larger.

From the horizon of undoubted Dinosaurian remains above mentioned to and including the sandstone just described, the deposits are of fresh-water character.

Immediately above the basal sandstone, teeth of herbivorous and carnivorous *Dinosauria* occur, with *Champsosaurus* and scales of Gar-fishes and bones of numerous Turtles, presumably of lacustrine habitat. Immediately below the upper sandstone, a bed of *Uniones* is constantly present, which varies from 1 to 60 or 70 feet in thickness, and sometimes replaces the small *Viviparas* and *Physas* which fill more or less of the sandstone. In some places, the *Uniones* and their *débris* occupy the entire depth of the formation, the shells being in some places broken up and scattered, having somewhat the effect of mica mingled with the arenaceous marl. Fragments of Vertebrate animals are abundantly mingled with the *Uniones*, the greater part of the species described in this report having been found at this horizon; perfect bones are rare in it, and the skeletons appear to have been separated and the single bones often broken up before being deposited. The teeth are usually found separated from the jaws, but only occasionally do they exhibit any appearance of having been rolled.

There are in some places thin beds of a reddish-brown cherty rock in this series, which break up and cover the slopes and ledges with thousands of angular fragments. This feature, with the alternating marly and sandstone beds, with their light colors, together with the fractured condition of the fossils, constitute points of resemblance to the Wahsatch formation of New Mexico. A section of the Judith River beds as they appear in the bluff, adjoining that represented in diagram in Fig. 2, is represented by Fig. 3, Plate 31.

As already observed, the beds, here called No. 6 (Judith River epoch), acquire toward the center of the basin a much greater relative thickness. The section now given derives interest from the fact that it represents the beds near their borders, where the transition from the marine to lacustrine deposits can be studied. The locality is also interesting from the fact that both classes of Vertebrate fossils were found in place on the same escarpment. This cannot always be observed, since, in the very few cases where the series of rocks is complete, fossils may be wanting from the one or the other horizon. Thus the *Vertebrata* of marine character already enumerated as occurring immediately above the No. 5 sandstone, belong to the same bed (which is more than 100 feet in thick-

ness), from the summit of which I obtained a sacrum and various other vertebræ and fragments of limbs of *Dinosauria*, with an ilium of the form of that of *Hadrosaurus*. There is no interruption in this bed, the occasional thin layers of sandstone existing in a few localities, being of far less importance than those found in No. 6 at various horizons.

Where the beds display their greatest thickness, the shell-bearing sandstone above described reaches a depth of 50 to 60 feet, containing immense numbers of Molluscs in good preservation. In fact, this bed contains the species of the formation, excepting the *Ostrea subtrigonalis*, which occurs higher in the series; some of the *Uniones* also are found at other horizons. The species as identified by Messrs. Meek and White are the following:

Physa.

Physa copei White.

Viviparus leidyi var. *formosus* M. & H.

Viviparus (*Campeloma*) *vetulus* M. & H.

Sphærium subellipticum M. & H.

Cyrena cytheriformis M. & H.

Anodonta.

Unio.

Unio.

Unio.

Unio.

Unio danai M. & H.

Above the sandstone are soft arenaceous and clayey beds, of varying extent, which amount at one point on Dog Creek to 30 feet in thickness. They are often striped with red, and are less fossiliferous than the strata below them, but contain a larger quantity of petrified wood. Large logs are frequently seen projecting from the façades of this bed. At a point on Dog Creek, 20 miles from its mouth, this bed is about 50 feet in thickness, and is overlaid by a layer of rusty sandstone of 15 feet. Above this is a repetition of the arenaceous marl of 20 feet, on which a reddish shale of 10 feet reposes. This stratum supports a bed of black impure lignite of 5 feet depth, which is followed in the ascending order by 7 feet of shale, $2\frac{1}{2}$ feet of lignite, a foot of black shale, and a bed of densely packed Oysters, of the species *Ostrea subtrigonalis*, of about 15 feet in thickness. At other localities to the north and east of this one, the bed of *Ostrea* was observed overlying the lignite; but at others, once on Dog Creek and once near Cow Island, these shells were found in the soft sandstone at the summit of the bluffs, without any lignite being visible beneath. This bed of *Ostrea subtrigonalis* is the summit of the series observed by me in this region, and it stands at the top of the section given by Dr. Hayden in the memoir already quoted.*

* Transactions of the American Philosophical Society, 1860, p. 129.

The description of the Judith River formation given in the preceding pages may be summarized in Fig. 4, Plate 31.

In this section, the beds of the Judith formation are represented with a thickness of 332 feet, but, as already observed, they are in some places 500 feet thick. The increase is chiefly to be seen in the beds between the first and third sandstones. Hayden gives a thickness of 200 feet to this part of the series, and his subdivision of it differs somewhat from the one I have given above. The sections of the overlying beds agree closely in the two accounts, but all the beds are variable according to locality. It is from this part of the series that Dr. Hayden and myself obtained the *Vertebrata* which give such a decided character to this formation. I now give a list of these, with references.

REPTILIA.

DINOSAURIA.

Goniopoda.

Troödon formosus Leidy Proc. Acad. Phila., 1856, p. 72; Trans. Amer. Philos. Soc., 1860, p. 147. This species I did not find.

Laelaps cristatus Cope, Proc. Acad. Nat. Sci. Phila., 1876, p. 344.

Laelaps falcatus Cope, l. c., 1876, p. 249.

Laelaps lævifrons Cope, l. c., 1876, p. 344.

Laelaps explanatus Cope, l. c., 1876, p. 249.

Laelaps hazenianus Cope, l. c., 1876, p. 343.

Laelaps incrassatus Cope, l. c., 1876, pp. 248, 341.

Aublysodon horridus Leidy, Proc. Acad. Phila., 1868. *Dinodon horridus* Leidy, l. c., 1856, p. 72; Trans. Amer. Philos. Soc., 1860, p. 143.

Aublysodon lateralis Cope, l. c., 1876, p. 248.

Zapsalis abradens Cope, l. c., 1876, p. 345.

Paronychodon lacustris Cope, l. c., 1876, p. 256.

The systematic position of this and the last-named genus is uncertain.

Orthopoda.

Palæoscincus costatus Leidy, Proc. Acad. Phila., 1856, p. 72; Trans. Amer. Philos. Soc., 1860, p. 146, exclusive of *vertebræ*.

Dysganus peiganus Cope, Proc. Acad. Phila., 1876, p. 252.

Dysganus bicarinatus Cope, l. c., 1876, p. 252.

Dysganus encaustus Cope, l. c., 1876, p. 250.

Dysganus haydenianus Cope, l. c., 1876, p. 251. *Trachodon mirabilis*, part., Leidy, Trans. Amer. Philos. Soc., 1860, p. 142, pl. ix, figs. 18-20.

Diclonius pentagonus Cope, l. c., 1876, p. 253.

Diclonius perangulatus Cope, l. c., 1876, p. 254. *Trachodon mirabilis* Leidy, l. c., p. 142, pl. ix, figs. 7-15.

Diclonius calamarius Cope, l. c., 1876, p. 255.

- Trachodon mirabilis* Leidy, Proc. Acad. Phila., 1856, p. 72. *Trachodon mirabilis* Leidy, Trans. Amer. Philos. Soc., 1860, p. 140, pl. ix, figs. 1-6.
Hadrosaurus mirabilis Leidy, l. c., 1868, p. . . .
Monoclonius crassus Cope, Proc. Acad. Phila., 1876, p. 255.

CROCODILIA.

Proceelia.

- Crocodylus humilis* Leidy, Proc. Phila. Acad., 1856, p. 154; Trans. Amer. Philos. Soc., 1860, p. 146.

Crocodylus.

TESTUDINATA.

̄ *Cryptodira.*

- Trionyx foreatus* Leidy, Proc. Acad. Phila., 1856, pp. 73-312; Trans. Amer. Philos. Soc., 1860, p. 148.
Trionyx ragans Cope, Bull. U. S. Geol. Surv. Terrs., ii, 1874; Report U. S. Geol. Surv. Terrs., 4to, ii, p. 96.
Trionyx mammilaris Cope.
Plastomenus punctulatus Cope, Bull. U. S. Geol. Surv. Terrs., ii, 1874; Report U. S. Geol. Surv. Terrs., 4to, ii, p. 94.
Polythorax missuriensis Cope, l. c., 1876, p. 253.
Compsemys victus Leidy, l. c., 1856, pp. 73-312; Trans. Amer. Philos. Soc., 1860, p. 152.
Compsemys lineolatus Cope. *Adocus lineolatus* Cope, Report U. S. Geol. Surv. Terrs., ii, p. 92.
Compsemys imbricarius Cope, Proc. Acad. Phila., 1876, p. 257.
Compsemys variolosus Cope, l. c., 1876, p. 257.
Emys obscurus, Leidy, l. c., 1856, pp. 73-312; Trans. Amer. Philos. Soc., 1860, p. 153.

LACERTILIA.

Species indeterminata.

RHYNCHOCEPHALIA.

Choristodera.

- Champsosaurus profundus* Cope, l. c., 1876, p. 350.
Champsosaurus annectens Cope, l. c., 1876, p. 351.
Champsosaurus brevicollis Cope, l. c., 1876, p. 352.
Champsosaurus vaccinsulensis Cope, l. c., 1876, p. 353.

BATRACHIA.

URODELA.

- Scapherpeton tectum* Cope, l. c., 1876, p. 355.
Scapherpeton laticolle Cope, l. c., 1876, p. 356.

Scapherpeton excisum Cope, l. c., 1876, p. 357.

Scapherpeton favosum Cope, l. c., 1876, p. 357.

Hemitrypus jordanianus Cope, l. c., 1876, p. 358.

PISCES.

ACTINOPTERI.

Ginglymodi.

Lepidosteus occidentalis Leidy; *Lepidotus haydeni* et *Lepidotus occidentalis* Leidy, Proc. Acad. Phila., 1856, 73; Trans. Amer. Philos. Soc., 1860, p. 149.

? DIPNOI.

Arotus hieroglyphus Cope; *Ceratodus hieroglyphus* Cope, l. c., 1876, p. 260.

? *Arotus eruciferus* Cope; *Ceratodus eruciferus* Cope, l. c., 1876, p. 259.

? ELASMOBRANCHII.

Myledaphus bipartitus Cope, l. c., 1876, p. 260.

Hedronchus sternbergi Cope, l. c., 1876, p. 259.

Subsequent to the deposit of the Judith River beds, they, with the underlying formations, were subjected to great disturbances, which appeared in lines of elevation running generally east and west. The strata rise to these axes at various angles, and are sometimes thrown up so as to be vertical. The summits of the axes are thus frequently composed of the shale of the Fort Pierre epoch, or of the rusty Fox Hills sandstone capping it, leaving the Judith River beds in synclinal troughs. These are cut through by the Judith River and Dog and Birch Creeks, where the stratification is well exhibited. Fig. 4 represents a butte of No. 6, between bluffs of No. 4 on Dog Creek, three miles from its mouth. Fig. 5 represents a bluff of No. 4, which descends beneath the border of No. 6, at a locality on the west side of Birch Creek. At several localities near and below Cow Island, axes of elevation run nearly north and south cross the Missouri River, elevating the beds at high angles. These disturbances were probably connected with the elevation of the Bear Paw and Little Rocky Mountain Ranges on the north side of the Missouri River, as has been remarked by Hayden.*

From what has preceded, the general conclusion is reached, that the series of beds from the lowest of the Fort Pierre epoch to the summit of

* In the geological portion of Captain Ludlow's Report of an Exploration from Carroll to the Yellowstone Park, by Messrs. Dana and Grinnell, p. 125 (1875), it is stated that "a careful examination will, however, serve to convince the observer that all the beds are really horizontal, and that the apparent bendings and twistings of the rocks referred to by Dr. Hayden are due simply to the action of running water". My observations, prolonged over two months, enable me to fully confirm the statements of Dr. Hayden.

the Judith River is continuous and uninterrupted by any non-conformity or hiatus. They appear to have been deposited in regular sequence, and without any other disturbance than that oscillation of the bed of the sea which causes change in the character of the sediment. As has already been shown by Hayden in other localities, the transition from the marine to the lacustrine stage has been gradual, and the observation here recorded of a bed of Oysters at the summit of the lacustrine series indicates a return by subsidence to the brackish condition at least. In this view of the history of the deposits, the striking and abrupt change in the animals becomes interesting. The *Pyrules* and *Neritas* are replaced by *Unios* and *Melanias*. The Sharks, Chimæroids, and *Enchodus* are succeeded by *Lepidosteus*. The *Sauropterygia* and *Pythonomorpha*, with their paddle-like extremities adapted for marine life, utterly disappear, and are followed by a numerous population of *Dinosauria*, whose pillar-like limbs bespeak support on firm ground. The Crocodiles and Turtles, whose habitat is on the shore, taking to land or water with equal facility, are present in both, although the excess of Turtles is largely in the fresh-water formation.

That this marked change was due to extinction of the marine forms on the one hand is highly probable, but that it was produced by the new creation of terrestrial types on the other cannot be admitted until the evidence in favor of the entrance of the land animals into the newer portions by migration from the older regions of the land has been explained away. The *Dinosauria* formed part of the terrestrial animal population of the northern hemisphere from the period of the Trias, and it is to be supposed that regions peopled by them during the time in which the country of the Missouri was beneath the ocean, furnished the immigrants for the new territory so soon as it rose above the waves.

Such a change in the physical condition of the surface of the earth as is exhibited in the region above described, is regarded by geologists as a time-boundary, such as defines the close of one period and the commencement of another. The question to be solved in the present instance is whether this boundary separates entire formations, or only the epochal divisions of one formation. Dr. Hayden, Mr. Lesquereux, and others, have given an affirmative answer, believing that the change from the marine to lacustrine deposits marks the passage from Cretaceous to Tertiary time. Others, including the writer, have maintained that the fresh-water beds represent but a phase of Cretaceous time, and that the separation of this formation and the Eocene Tertiary is between this horizon and that of the Wahsatch epoch. In support of this view, I have heretofore* cited the presence of the Mesozoic types of *Reptilia*, the *Dinosauria* and *Sauropterygia*, as having been found in the Lignitic beds of this epoch at various localities. The only opposing evidence which is to be found in the Vertebrate fauna is the presence of the genus *Lepidosteus*, which is only known to occur otherwise in Tertiary formations.

* Trans. Amer. Philos. Soc., 1869, p. 243; Bull. U. S. Geol. Surv. Terrs., ii, 1-74 (2).

This evidence is, however, of little weight, since that genus is the last remnant of an ancient type, which dates not only from Mesozoic, but also from Palæozoic times. The immediate extinct allies of *Lepidosteus* have not yet, it is true, been ascertained with sufficient accuracy.

The results of the investigation into the Judith River fauna are the following:—The genera are nearly all peculiar; such as are not, excepting *Lepidosteus*, having a range through Cretaceous and Tertiary time, as *Crocodylus*, *Trionyx*, and *Emys*. Of the orders, besides those which everywhere range from Triassic or Jurassic through Tertiary time, there are three exceptions. The one which is represented by the greatest abundance of species and individuals, the *Dinosauria*, is Mesozoic, ceasing with Cretaceous time. The ordinal position of the group I have called *Choristodera* is somewhat uncertain; but its species must be withdrawn from the *Sauropterygia*, where I have hitherto placed them. The division is, so far, peculiar to the formation, and I suspect that the *Ischyrosaurus* from the Fort Union beds of Dakota must be placed in it. The *Choristodera* are of Mesozoic cast in their relationship to the *Rhynchocephalia*; but one genus of this order persists until the present time in New Zealand. Its Mesozoic character is therefore not so strong as is that of the *Sauropterygia*. Thirdly, the Urodele *Batrachia* have been chiefly found heretofore in the Tertiary formations. It is true that Professor Gaudry has found two genera in the Coal-Measures of the Rhine, which he regards as *Urodela*, but the structure of the skull of these animals is not sufficiently well ascertained to definitely settle this point.* The value of the evidence derived from the Salamanders *Scapherpeton* and *Hemitrypus* cannot therefore be satisfactorily estimated at present. The positive evidence then as to the age of the Judith River fauna is, that it is Cretaceous, but, as might be supposed from its position, with some Tertiary affinities.

The stratigraphical evidence is moreover not opposed to this determination. Since the existence of extensive areas of fresh water on the surface of the earth, the faunæ of their shores have been those of the ages that have preceded them. At the close of each great period, an elevation of the ocean bed has inclosed tracts of water which became fresh. These elevations have not destroyed the terrestrial animals, so that the remains preserved in these lakes have revealed to us the inhabitants of the land which probably existed during the preceding ages. On the other hand, the inhabitants of the ocean have been lost in such localities. The destruction of the land animals has followed at a later period. Such is the conclusion to be derived from the determinations of European geologists. Thus the Coal-Measures succeeded the deep-sea epoch of the Subcarboniferous. This formation is a part of the Carboniferous, not of the Trias. In the United States, a still higher bed closed the Carboniferous, representing perhaps the Permian. It is characterized by peculiar genera of Lizards, *Cricotus* Cope, *Clepsydraps* Cope, a *Ceratodus*, and a

* For a synopsis of the characters of the orders of *Batrachia*, see Paleontology of Ohio vol. ii, p. 352.

Carboniferous *Diplodus*. In the Trias, we have the marine Muschelkalk, followed by the elevation which inclosed the estuaries and lakes of the Keuper, with its land fauna of Saurians. At the summit of the Jurassic stands the Wealden, which is attached to the epochs below it by modern paleontologists, and is not arranged with the Cretaceous above it. It is in harmony with these views of European paleontologists that the Lignitic beds should be placed at the summit of the Cretaceous formation, within its boundaries, as the Vertebrate paleontology so strongly indicates. Although more extensively developed in the United States than in Europe, this formation is not wanting in the latter region; it occurs there in Provence, under the Garumnien system of M. Leymerie. In this bed are found *Dinosauria* (*Rhabdodon priscum*), *Crocodylia*, and Tortoises near to *Emys* and *Trionyx*, a Reptile fauna with the *facies* of that of the Judith River beds. Professor Gervais remarks of this fauna that it also occurs in the Gosau Basin, near Neustadt, near Vienna, Austria, and that the *Iguanodon suessii* Bunzel, found there, is identical with the *Rhabdodon priscum*.* He also informs us † that “M. Matheron, of Marseilles, has recognized the necessity of associating with the superior part of the Cretaceous formation certain strata which other authors had at first regarded as belonging to the Tertiary period”. These beds are thus alluded to by Count Gaston de Saporta in a letter to Dr. Hayden: ‡—“Nevertheless, in Provence even, and quite at Aix, we have a small agglomeration of what is known under the name of lignite of Felveau, which my friend Matheron has determined as the equivalent of the fresh-water Upper Cretaceous formation (Santonien), which passes by degrees in its upper part into strata incontestably of Tertiary age.”

I will remark in conclusion, that it is probable that the Lignitic formation will come to be regarded as a primary division of the Cretaceous, and equivalent as a whole to all or part of the older marine series. It will include as subdivisions the Judith River and Fort Union epochs, as already defined by Mr. Meek from the Invertebrate fossils,§ and probably the Laramie or Bitter Creek epochs as distinct from them.

2.—VERTEBRATA FROM THE NIOBRARA CRETACEOUS.

ELASMOSAURUS Cope.

Proc. Acad. Phila., 1868, p. 92; Ext. Batr. and Rept. North America, 1869, p. 44.

The addition of a third species to this genus renders it proper to furnish a table of the more prominent characters which distinguish them. This can be more readily done, since I have come into possession of the

* If this be true, *Rhabdodon* is distinct from *Cionodon* or *Diclonius*.

† Comptes Rendus, January 22, 1877.

‡ American Naturalist, 1877, March, p. 186.

§ Report United States Geological Survey Territories, Invertebrata, by F. B. Meek, p. xlvii.

fine specimen of the *E. orientalis* from the Upper Missouri, as above described.

Posterior cervical vertebræ all furnished with a lateral angle, and all much compressed; many anterior dorsals with sessile ribs; anterior caudals strongly ribbed below.....E. PLATYURUS.

Posterior cervical vertebræ not compressed, and without lateral angle; median cervicals somewhat compressed; few anterior dorsals with sessile ribs; anterior caudals with weak angles below,

E. SERPENTINUS.

Posterior and median cervicals all depressed, and furnished with a lateral angle.....E. ORIENTALIS.

ELASMOSAURUS SERPENTINUS Cope, species nova.

Established on one specimen in good preservation, which includes the following parts of the skeleton:—The entire vertebral column, with the exception of a few anterior cervical and distal caudal vertebræ; the pectoral arch, with the clavicles a good deal broken; the greater part of the anterior limb of one side; the greater part of the pelvic arch, with a large part of both posterior limbs.

The cervical series is estimated to cease where the first articulated rib appears, which is attached to the first dorsal vertebra. The dorsal vertebræ are reckoned to continue as far as the first centrum which bears a chevron-bone, which is the first caudal. The numbers of the three series which are preserved are: cervicals, 56; dorsals, 29; caudals, 18; total, 103. It is probable that not more than two or three cervicals are wanting, and perhaps ten caudals. This would give a total of 126 vertebræ. In the *Elasmosaurus platyurus* first described, there were 103 vertebræ preserved, divided as follows: cervicals, 68; dorsals, 14; caudals, 21. To these were to be added, cervicals, 4; dorsals, 10; caudals, 30: totals, cervicals, 72; dorsals, 24; caudals, 40: grand total, 136. The column of the *E. serpentinus* presents then a greater number of dorsals and a smaller number of cervicals; as preserved, the latter are 56 to 68½, and as estimated 59 to 72.

The forms of the cervicals are strikingly different from those characteristic of the *E. platyurus*. This difference is seen in the centra, as the flat, decurved, coössified diapophyses are similar to those of that species. Throughout the entire series, the articular surfaces are broader than high. This is especially marked in the anterior and posterior centra. Near the middle of the series, the vertical diameter is but little less than the transverse. In *E. platyurus*, the vertical and transverse diameters of the anterior cervicals are nearly equal, but the superior diameter soon becomes the greater, and continues so to near the posterior part of the series.

The difference between the two species is especially marked behind the middle vertebræ, where the transverse diameter in the *E. serpen-*

tinus is nearly double that in the *E. platyurus*, while the vertical diameter is subequal in the two. In the *E. serpentinus*, the centra of the cervicals are somewhat less elongate. In the four anterior preserved, the transverse diameter exceeds the longitudinal; in the seven following, the transverse and longitudinal diameters are equal; in the twenty-one which succeed, the longitudinal exceeds the transverse diameter. In the ten following, the two diameters are equal, while the transverse exceeds the longitudinal in the remainder of the cervical column. There is a longitudinal lateral angle of the centrum on all the cervicals excepting some of the posterior. It is weak on some of the smaller ones. On the thirty-seventh, this angle is more than an inch above the base of the parapophysis, and is very obtuse on the posterior half of the centrum. On the thirty-eighth, it is obscure on the anterior part of the centrum, and on the thirty-ninth is obsolete. The posterior eighteen cervical vertebræ are then in this species without the lateral angle, a character which distinguishes it well from both the others. In them, this angle is distinct up to the point of origin of the ribs. The articular faces of the centra of the median and anterior cervicals of the *E. serpentinus* are slightly concave. In all except the last cervicals, the sides are more or less concave. The two large inferior foramina are continued in two longitudinal grooves of the inferior face.

The first dorsal differs from the last cervical in the greater truncation of the protuberance, which takes the place of a diapophysis. It is situated on the plane of the inferior surface of the centrum. On the succeeding vertebræ, its position gradually rises until, on the seventh dorsal, its base stands on the neural arch, half of it being above the neural canal. On the twelfth, the base of the diapophysis is entirely above the neural canal, but, on the sixteenth, its position is a little lower. On the twenty-fifth, it is altogether situated on the centrum. These processes increase in length to the eighth, and maintain their greatest prominence to the sixteenth inclusive; they then shorten until, on the twenty-sixth, they are nearly sessile. Where longest, the diapophyses are stout, and overhang the centrum by three inches. Their articular extremities are subround. The last dorsal only differs from the first caudal in the absence of facets for the chevron-bones. The sides of the dorsal centra are without angles, and are concave antero-posteriorly; an obtuse angle separating the lateral from the inferior face appears on the twenty-ninth.

The caudal vertebræ are wider than long, and the transverse and vertical diameters of the articular faces are about equal. The facets for the free pleurapophyses are large and nearly sessile; the anterior are horizontally oval, the posterior round. An obtuse angle extends from the chevron-facet anteriorly, but it does not reach the anterior articular border before the ninth vertebra; they separate a flat plane as far as the sixth, where the surface begins to be concave. This concavity increases somewhat to the eighteenth, but is nowhere strongly marked. In this respect, it differs from the *E. platyrus*, where the inferior ridges

and included concavity are pronounced from near the beginning of the caudal series.

The surfaces of the vertebral centra differ somewhat in different portions of the column. In the cervicals, it is lined with obscure ridges, which become more prominent as they approach the articular faces. Here they break up into series of small irregular tubercles. On the posterior cervicals, the ridges are most prominent in the infero-lateral region. The corresponding surfaces in the dorsal vertebræ are smooth. In the caudals, the rugosities reappear, and have on the general surface a reticulate character. This is pronounced on the distal caudals, so that they are almost pitted in places.

A number of ribs are preserved, some of them nearly in place, and imbedded in the matrix. They are robust, and the heads are expanded to the articular faces. The shaft at and below the curve is in section a triangle with rounded angles. Those attached to the twenty-fifth, twenty-sixth, and twenty-seventh dorsal vertebræ are straight and short, at least their distal extremities appear in the present state of the specimen to be unbroken. They are the forerunners of the free caudal diapophyses, which they exceed in length.

The limbs, which have not been previously seen in this genus, are characterized by the shortness of the proximal and medial elements, as compared with the length of the manus and pes. The anterior limbs are a little the larger. The humerus is very robust; its shaft is subcylindric, and the distal extremity is greatly expanded, so that the width is but little less than the length. The proximal end of the shaft turns inward to the oblique head; the external face of the shaft continues in a plane without curvature, which terminates in a broadly truncate tuberosity with prominent lateral angles. The surface then contracts from this trochanter, and forms the short inwardly-directed neck. The ulna is a flat bone broader than long, of a subquadrate outline, with the inner border deeply concave. The radius is a little smaller, broader than long, and six-sided. The proximal and ulnar sides are longest, and the latter is moderately concave. The ulnar carpal is the largest, and is subquadrate in form. The intermedium is large and suboval; its contact with the radius is greater than with the ulna. The radiale is subround and quite small; it is in contact with the external distal facet of the radius, and is separated from the intermedium by the first phalangeal carpal, which is adjacent to the median distal facet of the radius. There are four of the phalangeal carpals, or those of the second series, of which the first, or external, is in line with those of the first series. It is followed by a metacarpal, which is in the second transverse series of the carpals. The two external carpals of the first series each support a corresponding one of the second series; the third in the same line above described is followed by two bones, the third of the second series and the first metacarpal. Of the second series, the fourth and third are subround and a little broader than long; the second is longer than broad,

and is transversely divided, but whether by a fracture or a true separation I am not sure. The metacarpals are five in number, and are longer than wide and rather stout, but contracted at the middle. The third is opposite the second and third phalangeal carpals. Of the others, each is opposite the corresponding bone of the preceding series. The number of phalanges in each digit is not ascertainable, as the manus is partially broken off.

The femur is much like the humerus, but is not so expanded distally, its width equaling three-fourths the length. The bones of the second segment are short, the tibia (if the limb be in its normal position on the block) being the wider of the two. It is wider than long, subquadrate, and but little emarginate on the fibular side. The fibula is longer than wide, and has an oblique suture with the femur. The three proximal tarsals are subround and subequal in size. The bones of the second row are not preserved. The phalanges are rather elongate, but stout and contracted medially; articular surfaces subround. They diminish in size as far as preserved, the pes being broken off at the end of the fifth.

Measurements.

VERTEBRAL COLUMN.

	M.	
Length of cervical series preserved	5.570	
Length of dorsal series preserved	3.070	
Length of caudal series preserved	1.165	
Diameter of first cervical centrum {	antero-posterior	0.041
	transverse	0.045
	vertical	0.035
Diameter of twelfth cervical centrum {	antero-posterior	0.068
	transverse	0.064
	vertical	0.047
Diameter of twenty-fourth cervical centrum {	antero-posterior	0.095
	transverse	0.073
	vertical	0.064
Diameter of thirty-sixth cervical centrum {	antero-posterior	0.107
	transverse	0.110
	vertical	0.085
Elevation of anterior zygapophyses above centrum	0.023	
Antero-posterior diameter of neuropophysis	0.050	
Antero-posterior diameter of parapophysis	0.045	
Diameter of forty-eighth cervical centrum {	antero-posterior	0.112
	transverse	0.125
	vertical	0.095
Total elevation, with neural spine	0.285	
Antero-posterior diameter of parapophysis	0.005	
Width between bases of parapophyses	0.105	
Diameter of thirteenth dorsal centrum {	antero-posterior	0.100
	transverse	0.113
	vertical	0.115
Diameter of neural canal	0.025	
Elevation of diapophysis above centrum	0.025	
Length of diapophysis	0.110	

Vertical diameter of extremity of diapophysis.....	0.055
Diameter of twenty-first dorsal centrum { antero-posterior	0.090
{ transverse	0.115
{ vertical	0.082
Length of diapophysis.....	0.018
Vertical diameter of extremity of diapophysis.....	0.042
Diameter of twenty-ninth dorsal centrum { antero-posterior	0.065
{ transverse	0.100
{ vertical	0.070
Total vertical diameter, with spine	0.225
Diameter of thirteenth caudal centrum { antero-posterior	0.057
{ transverse	0.072
{ vertical.....	0.080
Antero-posterior diameter of neural spine at middle.....	0.035
Antero-posterior diameter of diapophysis at base.....	0.040

SCAPULAR AND PELVIC ARCHES.

Diameter of coracoid { antero-posterior (posterior border wanting).....	0.610
{ transverse.....	0.305
{ of glenoid cavity.....	0.018
Diameter of clavicle { transverse.....	0.311
{ across base	0.145
{ of glenoid cavity.....	0.070
Diameter of pubis { antero-posterior (anterior border wanting)	0.323
{ transverse	0.308
{ at acetabulum.....	0.170
Diameter of ischium { antero-posterior	0.304
{ transverse.....	0.240
{ at acetabulum.....	0.135

EXTREMITIES.

Length of humerus	0.360
Long diameter { of head.....	0.150
{ of shaft	0.120
{ of distal extremity.....	0.280
Short diameter { of head.....	0.123
{ of shaft	0.081
Diameter of ulna { longitudinal	0.115
{ transverse.....	0.135
Diameter of radius { longitudinal	0.125
{ transverse.....	0.115
Length of carpus	0.195
Width of carpus.....	0.195
Length of first metacarpal.....	0.098
Width of first metacarpal	0.055
Length of third metacarpal	0.110
Width of third metacarpal	0.055
Length of femur	0.370
Long diameter { of head.....	0.126
{ of shaft	0.106
{ of distal extremity.....	0.260
Short diameter { of head.....	0.070
{ of distal extremity.....	0.060
{ of shaft.....	0.058

Diameter of tibia	{ longitudinal.....	0.130
	{ transverse.....	0.140
Diameter of fibula, longitudinal.....		0.135
Length of tarsus.....		0.160
Length of first phalange.....		0.081
Width of first phalange.....		0.040
Length of second phalange.....		0.070
Length of third phalange.....		0.065
Length of fourth phalange.....		0.059
Width of fourth phalange at extremity.....		0.030
Width of fourth phalange at middle.....		0.018

From the above measurements, it appears that the skeleton of this animal as preserved measures 9 meters 805 centimeters, or 32 feet 5½ inches. Perhaps 5 feet should be added for missing vertebræ and cranium, giving as a total 37 feet. The specimen is of interest as exhibiting, for the first time, the structure of the limbs. Their proportions conform closely to those of the restoration of the *E. platyurus*, which I published in 1869 in the Extinct Batrachia and Reptilia of North America.

This fossil was discovered in the blue shale of Cretaceous No. 3, in a bluff in Nebraska, on the southwest side of the Missouri, between Sioux City, Iowa, and Yankton, Dakota.

CLIDASTES Cope.

Report U. S. Geol. Surv. Terrs., (4to), ii, p. 130.

CLIDASTES TORTOR Cope.

Loc. cit., p. 131.

A nearly complete specimen of this Saurian was found by Mr. Sternberg in Western Kansas, which confirms the characters already ascribed to this species, excepting as to the number of the palatine teeth. These should be counted as eighteen in number; although it is probable that not more than eleven, the number I originally gave, are in functional use at any one time. The centra of the cervical vertebræ, like those of the typical specimen, present round articular faces.

This specimen, like the one first obtained, was in a coiled position when found.

CLIDASTES DISPAR Marsh.

Edestosaurus dispar Marsh, Amer. Journ. Sci. Arts, 187-, p. —.

CLIDASTES CINERIARUM Cope.

Rep. U. S. Geol. Surv. Terrs., (4to), ii, p. 137.

This species is characterized by the length and slender proportions of the diapophyses of the posterior lumbar vertebræ. In one specimen, fifty-eight caudal vertebræ are preserved, of which twenty-eight possess

diapophyses, and thirty are without them. The anterior caudal diapophyses are broad and flat; the distal caudals have free chevron-bones. The extremity of the muzzle is conic and depressed.

LIODON Owen.

Cope, Rep. U. S. Geol. Surv. Terrs., (4to), ii, p. 160.

LIODON, species undetermined, and

LIODON, second species undetermined, from Western Kansas, from Mr. Sternberg.

PLATECARPUS Cope.

Rep. U. S. Geol. Surv. Terrs., (4to), ii, p. 141.

PLATECARPUS ICTERICUS Cope.

Loc. cit., p. 141.

PLATECARPUS CORYPHÆUS Cope.

Loc. cit., 142.

All of the above species from Western Kansas.

ANOGMIUS Cope.

Proc. Amer. Philos. Soc., 1871, p. 170; Rept. U. S. Geol. Surv., Hayden, ii, p. 240.

A nearly complete skeleton of a species of this genus enables me to give its characters in much greater completeness than has been possible heretofore. It appears that it is, in several primary characters, Physostomous and Isospondylous; *i. e.*, the maxillary bone enters the arcade of the mouth; there are no anteriorly-placed ventral fins, and the scales are cycloid; the anterior vertebræ are unmodified, and the parietal bones are not separated from each other by the supra-occipital. The dorsal fin originates above the base of the pectoral, with a number of strong osseous rays; it continues as far as the specimen is preserved in that region, *viz.*, to above the fifteenth vertebra, behind the scapula, and the rays regularly diminish in strength. The inter-neural bones continue further. A dorsal fin, whether the first or a second, is not determinable, terminates a short distance in advance of the caudal fin. Pectoral fin attached by two stout bones to the upper part of the scapular arch. Anal fin posterior, below a part of the dorsal fin, furnished with one stout, compressed, anterior spine. Five vertebræ included within the space inclosed by the anterior projection of the borders of the caudal fin, forming a series slightly curved upward. They diminish rapidly in size, and the last is confounded with its neural spine. The terminal hæmal spines are all coössified into a nearly equilateral fan-shaped body with a convex posterior border.

The vertebræ are shorter than wide, but not excessively short; the neural spines are long and slender; and there are no diapophyses. The ribs are long, and there are long superior supernumerary ribs. I have not been able to find the lateral line, which may be because many of the scales are not well preserved.

The cranium is flat above and without superior crests. The parietals are small and in contact on the median line; the epiotics are small, and the pterotics are large. The postfrontals are of moderate size, and the frontals form the greater part of the cranial roof, and are completely ossified. There is a large superciliary bone on each side, which connects the pre- and post-frontals. If any part of the ethmoid is exposed, it must be small. The premaxillary is coössified and transverse. The maxillary bone is vertically compressed, and becomes, with its superior supernumerary bone, widened in the distal portion. Proximally, it is narrowed, and overlaps extensively the superior surface of the premaxillary. There is an elongate preorbital bone extending downward and backward, and there are several large postorbital bones which extend nearly to the free border of the preoperculum. The latter, like the other opercular bones, terminates in a thin, entire edge. Six branchiostegal rays have left their impressions, the inferior one with the lower edge broken away.

The inner face of the maxillary bone, the inferior faces of the premaxillary and vomer, and the inner superior aspect of the dentaries are covered with acute bristle-like teeth *en brosse*. The vomerine patch is wide and transverse.

To the remarks already made as to the affinities of this genus, it may now be added that the dentition, with the superior position of the pectoral fin, resembles the characters of the *Mugilidae*. This genus must doubtless be placed near *Syllumus*, as combining characters of the Physostomous and Physoclystous divisions. It differs from that genus in the elevated position of the pectoral fins and the long dorsal fin. In the latter point, it is similar to *Apsopelix*, but that genus has the deeply-pitted vertebrae. *Pelycorapis* differs in its ctenoid scales and inferior pectoral fin.

ANOGMIUS ARATUS Cope.

The type-specimen on which this species rests was, when living, a fish of about fifty pounds in weight. It is preserved in a mass of chalk of the Niobrara formation, which is straw-colored internally and lead-colored externally. This relation of these colors, which form two horizons of the formation, shows, with other facts of the same kind, that there is no important geological distinction between them.

The head is wide and flat above in front. Behind the line of the orbits, the superior surface displays three planes, the median narrowing and rising posteriorly, terminating in a roof-shaped posterior border. The muzzle is short and truncate; the premaxillary transverse and horizontal, and in the same slightly sloping plane as the front. The maxillary is abruptly decurved, and the dentaries rise to meet the premaxillary. The postorbital bones are much enlarged, as in *Amia*; the superior cuts into the border of the pterotic; they number five, of which the superior is above the line of the prominent superciliary border. The operculum is extended backward and upward, and the suboperculum

and branchiostegal radii are wide and thin-edged. All the bones of the head are marked by parallel or radiating ridges, which radiate from the point of attachment to the free border, or from the center to the circumference, in the case of the superior cranial bones. In the maxillary bone, the radii extend parallel from the anterior margin horizontally backward.

The vomerine patch extends almost entirely across the roof of the mouth. The orbit is longitudinally oval; its long diameter entering the cranium five and a half times, and the part of the same in advance of it one and a half times. The orbit enters the interorbital width two and a half times. The length of the head enters the depth of the body one and one-quarter times. The pectoral fin is acuminate in form, and, being laid against the fish's side, passes above the vertebral column for the greater part of its length, reaching the line of the nineteenth vertebra which is visible from the line of the scapular arch. It has 15 or 16 rays, the first stout, curved, and segmented at the extremity. The number of anal radii is uncertain, but not large. The ventrals are imperfect, and reach to the base of the anal. The caudal fin had a narrow peduncle, and expands abruptly from the base.

The vertebral column is interrupted by a fracture, but it is probable that few, if any, vertebræ are lost at the break. If this be true, there are thirty-four vertebræ between the scapular arch and the first chevron-bone, all of which bear long subequal ribs. The centra are rough with rather irregular longitudinal striæ. The scales are badly preserved; where visible, they are thin, without sculpture, and not small. About twelve longitudinal series intervened between the vertebral column and the base of the dorsal fin, and six or eight rows extended along the caudal peduncle.

Measurements.

	M.
Length of head.....	0.227
Length of body to first caudal vertebra (with a break).....	0.390
Depth at scapular arch.....	0.230
Depth at anal fin.....	0.265
Depth at caudal peduncle.....	0.055
Depth of skull at superciliary border.....	0.050
Width of skull at superciliary border.....	0.110
Length of postorbital bones.....	0.045
Width of border of premaxillary bone.....	0.055
Length of pectoral fin.....	0.210
Vertical diameter of a dorsal scale.....	0.010
Longitudinal diameter of free part of the same.....	0.009

3.—VERTEBRATA FROM THE FORT PIERRE FORMATION.

PELYCORAPIS Cope.

Report U. S. Geol. Surv. Terrs., ii, p. 182.

This genus of fishes is one of the type so common in the Cretaceous formation, which present a combination of Physostomous and Physo-

clystous characters. It possesses ctenoid scales, and a spinous dorsal fin, but the ventral fins are abdominal in position. The femoral bones are triangular, and in contact on the median line, and their external border is thickened, and produced freely as a rod in advance of the inner plate. The pectoral fin has an inferior position on the scapular arch. The abdomen is simple, and the lateral line traverses a row of scales which is above the middle of the side.

The anterior part of the femoral bone is yet concealed in the typical specimen of the species now referred to this genus; this reference is therefore not final. The typical species, *P. varius* Cope, is from the Benton group of Kansas; the present species is from the succeeding horizon, or the Pierre epoch.

I inadvertently, in the work above cited, spelled the name of this genus with an *e* instead of a *y* in the second syllable. It is derived from $\pi\epsilon\lambda\upsilon\zeta$, *pelvis*, and $\rho\alpha\pi\iota\varsigma$.

PELYCORAPIS BERYCINUS sp. nov.

This fish is represented in the collections by the mineralized body, which includes the scapular arch and femoral bones, but wants the other parts. It is covered with the scales in place, and the basal portions of the dorsal and pectoral fins are preserved. The osseous parts have been nearly all replaced by chalcedony, so as to be transparent in section, while the surface is of the dark color of the matrix in which it has been imbedded.

The body is somewhat compressed and the abdomen rounded. The epiclavicle is quite wide and the humeral angle is moderate. The origin of the pectoral fin is but a short distance below the latter. The femoral bones are wide posteriorly, and the thickened external border is decurved and separated by a groove from the laminar portion. The first dorsal spine preserved originates above a point measuring one-fourth the length between the scapular arch and the posterior border of the femoral bones. The spines of the dorsal fin are deeply excavated in front, so as to fold into each other.

The number of the scales between the points above mentioned is $\frac{51}{7}$ ⁴, counting from the base of the dorsal fin to the middle line of the abdomen. The tubes of the lateral line are quite prominent, and are acuminate at the extremity, resembling those of some *Beryces*. A rather narrow band of the border of each scale is sharply and closely radiately grooved; the central part of the surface is in the chalcidonic pseudomorph, smooth, but it is generally covered with a thin, dark layer, which has a finely reticulate-punctate sculpture. The scales are thick at their middles and thin at the borders. The numbers of the fin-rays cannot be given, owing to the imperfection of the specimen. There are eight of those of the spinous dorsal remaining.

Measurements.

	M.
Length between scapular arch and posterior border of femora	0.165
Depth at front of dorsal fin	0.074
Width of epiclavicle	0.013
Width of femoral bones behind	0.036
Length of bases of eight dorsal radii	0.023

The interior of this fossil is exposed by the disorganization of one of the sides. It is filled with a chalcedony, whose minutely botryoidal semi-transparent surface is an elegant imitation of ova.

I add here, that having had an opportunity, through the kindness of Dr. Isaac Lea, of examining the typical specimen of *Saurodon leanus* Hays, I find that my *Daptinus phlebotomus* belongs to the same genus, and its name must therefore be written *Saurodon phlebotomus*. The teeth in the New Jersey species are not so cylindric as published figures indicate, and the internal foramina of the dentary are not isolated as in *Saurocephalus*.

I also add, that a consideration of the skeleton of the genus *Chirocentrus* shows that it is the nearest living ally of the *Saurodontida* in the structure of the palatal and oral bones, the posterior skull, pectoral spine, and vertebræ. The femora are materially different.

4.—FOSSILS FROM THE JUDITH RIVER BEDS.

1. *Cranial bones of a Dinosaurian*.—A number of the bones of the skull of a large Dinosaurian Reptile were found in the second bed of lignite above the lower bed of sandstone represented in Fig. 3 as belonging to the Judith River beds, or Cretaceous No. 6. The locality where they are found is on the north side of the Missouri River, nearly opposite to the mouth of Dog Creek. The bones were lying in immediate contact, and with them was found a fragment consisting of two and part of a third teeth. These present the characters of the genus *Diclonius*, and of either the species *D. calamarius* or *D. perangulatus*, or one not described.

These bones exhibit anomalous characters, and, with one exception, their identification presents a difficult problem. They were numbered in the order of their discovery from 1 to 12, but I commence the description with No. 8, as the one which furnishes the basis for the determination of the others. This portion of the skull includes the united occipital and sphenoid regions, with some lateral elements in close contact with them. The sutures separating the basioccipital and basisphenoid, the exoccipital and proötic, and the proötic and basisphenoid are distinct and squamosal in character. Other sutures are not visible. The bones are generally thin, especially their superficial dense layer.

A remarkable peculiarity of the basal axis of the cranium is its obliquely ascending direction, as its plane makes with that of the posterior occipital surface an angle of forty degrees. The latter plane was also directed forward, as indicated by the position of the occipital con-

dyle, so that the posterior portion of the skull rose like the abutment of an arch from the vertebral column. This structure also contracts the space occupied by the brain, a deficiency which is compensated by its elongation forward.

The *basioccipital* is, in its axial portion, exceedingly short, the condyle and its peduncle including two-thirds of its length. In front of this is a considerable expansion, consisting of two huge cup-shaped postero-inferior processes, which spread out laterally and inferiorly from the neck of the condyle, partially concealing it from an inferior view. They are separated by a deep emargination immediately below the condyle. These processes are doubtless the insertions of powerful muscles, and appear to be homologous with those found on each side of the *basis cranii* anterior to the occipital condyle in the Emeu. Their borders are separated from those of the exoccipitals by a deep notch on each side. This element may be the true sphenoid, although sutural distinction from the basioccipital is not clear. (See Figs. 7, 7a.)

The *exoccipitals* have an aliform lateral expansion, which extends beyond the lateral walls of the brain-case. Each one consists of two principal ribs, which terminate in projections which are separated by a concave thin margin. The anterior is curved forward, the posterior is straighter, and is directed outward and a little backward. The supra-occipital is narrow, and is bounded by an elevated ridge on each side, which approach each other upward. The postero-superior face is deeply concave, and is divided by a strong median carina, or crest, of the same elevation as the lateral crests. The foramen magnum is relatively large, and is a little higher than wide. It is probable that the supraoccipital bone does not form part of its border, although, a very small portion having been broken from its posterior edge, the question is not positively decided. The occipital condyle is relatively large, and consists exclusively of the basioccipital bone. It is a portion of a globe, the superior convexity being interrupted by a small plane. It is supported on a short neck, on the superior face of which are two lateral shallow concavities.

The *presphenoid* or *sphenoid* bone is simple and of remarkable length, resembling that of a Bird or Snake rather than that of a Lizard. It has no posterior lateral processes corresponding to those in front of the basioccipital bone, but embraces the base of the former equally all round by a squamosal suture. The notch separating the occipital processes is continued as a wide groove, which rapidly contracts to an acute termination on the posterior part of the basisphenoid bone. It is bounded on each side by an elevated ridge. These are bounded externally by an open groove on each side, which unite farther forward on the basisphenoid. These are in turn bounded on the outer side by an obtuse ridge, which are not continued on the sphenoid. The median portion of the basisphenoid is convex from side to side. The anterior portion is narrower, and the cranial cavity is here strongly compressed. (See Fig. 8.)

Four foramina are situated on the posterior part of the walls of the cranial cavity. These probably represent the *fenestra ovalis*, the *foramen lacerum posterius*, and the *foramen carotideum*. The first named is quite large, and perforates the posterior part of the exoccipital bone, a part of its posterior border being formed by the crested sphenoid, and a small part of its interior lower margin being probably contributed by the basisphenoid. An inferior tongue-like prolongation of the exoccipital bone separates it from a large foramen in front of it, which it bounds in conjunction with the presphenoid and proötic. This foramen is oval, with the long axis directed upward. Between it and the *fenestra ovalis*, the exoccipital is pierced by a much smaller round foramen, at a point below the middle of the former. The proötic bone is prolonged forward, and at a point much anterior to the exoccipitals, and the remaining part of the supraoccipitals bounds another foramen of not large size. This perhaps gave exit to one of the branches of the *trigeminus*. The anterior extremity of this part of the skull is very peculiar. The sphenoid, from an ascending direction, turns horizontally, while the supraoccipital rises apparently as a median ascending process free from the inferior walls. The latter acquires another roof, which incloses an open cavity with the supraoccipital, which expands forward, and has its lateral borders composed of the united produced lateral angles of the inferior and superior bounding surfaces. The brain-chamber turns forward, and the superior part of it terminates rather abruptly. The inferior part of the cast of the matrix, which occupies it, is continued with a subtriangular section, resembling the hypophysis, or the united peduncles of the olfactory lobes. The roof of this chamber rests on an osseous mass in front, which is concave above from side to side; below, its broken section is transverse, its vertical diameter small, and least in the middle.

There is some uncertainty attending the determination of the elements which compose the mass above described. It is possible, as already observed, that the recurved, cup-shaped basal bone is the sphenoid, and not the basioccipital. This interpretation receives some countenance from those offered in explanation of the few crania of *Dinosauria* hitherto found. These are two, or perhaps three, viz, one described by Mr. Hulke, and a second by Prof. H. G. Seeley in the Quarterly Journal of the Geological Society of London; and another published near the same time by Dr. Bunzel in the quarto of the K. K. Mineralogische Anstalt of Vienna.

In all of these, the basicranial axis is deflected immediately in front of the occipital condyle, in Dr. Seeley's specimen to a very great extent, as much as in the *Crocodylia* of later periods. In the other two crania, the deflection is less marked, and it terminates in an angle, from which the axis continues forward. In Mr. Hulke's specimen, it rises somewhat as in the Montana animal. In none of the crania is the element in front of the condyle recurved as in the latter, though they display in their angle a rudiment of the prominent crest above described.

In none of the European crania is the supraoccipital region directed obliquely forward as in the *Diclonius*, but the lateral constriction is seen in Dr. Seeley's specimen.

It is then possible that the bone which I have called a downward prolongation of the exoccipital is the proötic, although I cannot certainly detect any suture separating it from the former. In that case, the large foramen in front of it becomes the *foramen ovale*, the bone in front of it the alisphenoid, and the anterior *foramen* the *foramen opticum*. In view of the form of the brain, this identification is not without probability.

The cast of the brain does not display any median fissures. Its vertical depth is greatest a little anterior to the *foramen magnum*, where it is compressed, the sides being shallowly concave, and separated from the superior surface by a longitudinal angle. In front of this position, it is subcylindric and the anterior extremity comes to an obtuse termination, which is convex in cross-section and concave in the vertical sense, the lower portion continuing downward and forward, possibly to the hypophysis.

Before describing the remaining cranial bones, the significance of the characters above recorded may be considered. As regards the form of the brain, the superior elevation of the posterior region above the anterior is a point of resemblance to Birds rather than to Reptiles; the apparent absence of prolongation of the hemispheres into the olfactory lobes is also a character of Birds rather than of Reptiles. The brain-cavity is in fact closed in front above, as in Mr. Hulke's skull already mentioned, which also presents no prolongation for the olfactory lobes. This is present even in those Reptiles where the chamber is closed in front, *e. g.* *Ophidia*, while it is absent in Birds. When viewed from above, there are other affinities indicated. The absence of indication of lateral optic lobes points to Reptiles and not to Birds, while the small diameter of the hemispheres is not like either class, but resembles more the state of things in *Batrachia* and Fishes. The characters of the osseous structure present some Avian affinities. Such are the simple, semiglobular occipital condyle, the infero-posterior processes of the basi-occipital, and the short thin lateral processes of the exoccipital bones. The great prolongation of the basisphenoid, the lack of lateral processes of that bone, and the absence of overhanging lateral margin of the superior cranial walls may be looked upon as Ophidian or Avian characters. Lacertilian characters are completely wanting. The anterior termination of the brain-case and its basis resembles nothing else.

In close contact with the side of the mass above described was found a bone of peculiar form, which doubtless belongs to the suspensorium. There could be no doubt of this were the bone sutureally united with the cranial element proper. It is, however, only applied to it by the intervention of a body of hardened matrix, of the peculiar color of that which occupies the cranial chamber, and which differs much from the lignite in which I found the bones imbedded. Almost in contact, I

found a corresponding piece of the opposite side of the skull, but with a more extensive attachment of an adjoining bone. I therefore describe this bone in preference to the first named. It consists of two bones, one a tabular mass, the other a projecting body resembling a horn-core, standing on one of the extremities of the table, and at right angles to its plane. The tabular part of the bone is thick, and its free border (opposite to the horn-like bone) is excavated, so as to be double. The two plates are connected by cross-pieces, which inclose three fossæ. Both the marginal and inferior faces of the bone display smooth surfaces, as though for synovial articulations. The external surface is roughened with tubercles. The horn-like bone rises from the probably exterior border of the tabular bone, which embraces part of its base in a fixed articulation. It is a rather short and stout cone, with a subtriangular section, much rounded on the inner side. The apex is rather abruptly contracted from the inner and from what I suppose to be the superior sides. Its base is continuous with that of the tabular bone, and terminates externally, *i. e.*, on the side away from the tabular bone, in a thick projecting rim. The surface of the horn-like portion is deeply grooved and scored, probably for nutritive vessels, as the grooves are continuous. The texture of these bones is for some distance dense, but is more spongy in the center. The corresponding bone of the opposite side does not differ from it. (See Figs. 5, 8, 8a.)

These bones are evidently lateral; but little can be asserted as to their true nature. The position in which one of them was found would lend support to the view that they are the united opisthotic and squamosal, or either of those bones plus the quadrate. Certain it is that none of those bones are attached suturally to the posterior part of the cranium in this animal, in which it differs from all other Reptiles. The infero-anterior surface of the exoccipital resembles much more that of the same region in Birds, and the proximal faces in the anomalous bones described are of similarly smooth character. One result is certainly derived from this examination, *viz.*, that the *Dinosauria* (if this genus belong to that order) do not pertain to the division of *Reptilia* with fixed *os quadratum*. This is a realization of an anticipation published in 1870,* in the following words:—"Those (*Reptilia*) which consolidate the periotic elements but retain the partial freedom of the quadrate, on the other hand, lead to the Avine class. These are the *Ornithosauria*, and perhaps, when we come to know the cranium, the *Dinosauria*. At least this may be predicated, if the structure of the foot and ear-bones are correlated in this group as they are elsewhere." It is probable that the horn-like processes were directed forward, and also, if the position in which the attached one was found be normal, in a line extending below that of the sphenoid. This position would relate it to the quadrate. This subject may be considered in connection with the structure of the mandible, discussed farther on.

* *Proceed. Amer. Assoc. Adv. Sci.*, 1870, p. 231.

The next bones, marked as Nos. 1 and 2 in my notes, are from the median line of the skull, and of very peculiar form. They were found in contact, but it is very doubtful whether the relation they present to each other is the normal one. No. 1 is an L-shaped bone, the short limb of the L being recurved, and with the extremity pointing nearly in the direction of the longer limb. The region at the junction of the L is the thickest, being very massive and solid, and the limbs contract regularly to their extremities. The shorter limb becomes compressed toward the end. The longer narrows more gradually, and is convex transversely on the face next the shorter limb. The other face of the long limb exhibits two longitudinal excavations, separated by a vertical septum. The opposite face of the short limb is transversely truncate. The posterior part of the inferior face of the long limb is also flat, and joins that of the short limb at a transverse solid angle which is a little less than right. In profile, the adjacent faces of the two limbs of the L form a deep, rounded sinus. These and the adjacent lateral surfaces are roughened with grooves, some of them of large size, apparently for blood-vessels. The convex side of the long limb is still rougher, being transversely wrinkled, and pierced by numerous pores. Its distal third is equally divided by a strong median groove.

Bone No. 2 is composed of two elements, one of them entire, the other incomplete. The former consists of two triangular plates united by their longest borders so as to give a V on section, and to inclose together a deep groove whose sides are elevated at one end and gradually descend to the other. The line of junction is a narrow, obtuse keel, and the external surface is furrowed by grooves which are parallel to the shortest sides. This sheath-bone incloses a slightly curved longitudinal element, which extends freely from it at its long angle, as a rod with an oval section, and is nearly continuous with the keeled angle of the embracing bone. In the other direction, it becomes wider and deeper, to the posterior border of the broken sheath-bone. Here it does not fill the sheath-bone, but roofs over the inclosed space, which forms a conical axial cavity of the mass, which is now filled with matrix. The surface away from the sheath-bone is gently concave, and is divided longitudinally by the base of a septum, or keel. The opposite surface of the free part of the median bone is equally divided by a longitudinal groove.

Positive determination of these elements is at present impracticable, as they do not resemble the corresponding bones in any animal known to me. No. 1 approximates in form the ethmoid of the Gull (*Larus*), but appears, in part at least, to have been a bone of the external surface. The long limb has nearly the appearance of those parts of the Bird's skull which are inclosed in a horny sheath; the inferior septum is not appropriate to that element. Its proper position at the front of the basicranial axis is less probable, because bone No. 2 is more appropriately placed there. If we then suppose No. 1 to be the *septum narium* and adjacent part posterior to it, we are met with the anoma-

lous recurved short limb of the bone, which thus becomes a horn-like projection directed upward and forward at the base of the muzzle. This may be considered in connection with the rising projection of the supra-occipital bone, and with the fact that this short limb is entirely filled with moderately coarse cellular tissue. As to bone No. 2, its sheath-like portion may be parasphenoid, and the axial part presphenoid or sphenoidal rostrum; or the former may be the vomer, and the latter the *septum nasi*, or basitrabecular.

From the preceding, it is evident that the only comparisons which throw any light on the probable positions of these bones are those made with cranial elements of Birds.

Bone No. 3 was found in contact with No. 2. It is flat and subparallelogrammic in shape. One side (the thickest) is excavated by a regular arch, with smooth free border at right angles to the other surfaces; a part of the opposite side exhibits a free narrow edge. All the other borders are sutural, generally partly squamosal, without serrature or roughness. This bone is lateral, and the segment of a circle may be a portion of the orbit. There are several other bones belonging to this series, but their description is postponed until their identification is practicable. No elements of the skeleton not cranial were found, excepting a rib, a humerus, and a portion of the transverse border of the episternum. The latter resembles the corresponding piece in the *Monoclonius crassus* Cope;* and a similar fragment of large size was found with the remains of the *Agathaumas sylvestre* in Wyoming.

2. *Mandibles of herbivorous Dinosauria*.—Mandibular rami of numerous herbivorous *Dinosauria* were found by the expedition, five of which are especially instructive. Two of them are occupied with teeth of *Diclonius*; close to another a tooth of *Diclonius pentagonus*† was found; and near to another a tooth of *Dysganus haydenianus*‡ occurred.

The first ramus I will notice was found by my assistant, Charles H. Sternberg, who did not procure any teeth in connection with it. It is the dentary bone of the right side, without its inner wall, so that the alveoli are exposed as to their outer halves from the fundus to the mouth. These represent closely placed, parallel, vertical grooves, whose basal portion turns inward to continue upward again on the inner wall. The space thus inclosed is filled with vertical columns of teeth, which are not separated by transverse septa, but which are kept in place as they rise in the process of growth and protrusion by the grooves just described. In the ramus in question, this magazine could not have contained less than one hundred and eighty teeth, perhaps more; so that the total number contained in the mouth of this Saurian must have been at the least seven hundred and twenty. In the distal portion of the jaw, the tooth-grooves are not so deep as

* See Proc. Acad. Nat. Sci. Phila., 1876, p. 251.

† See Proc. Acad. Nat. Sci. Phila., 1876, p. 256.

‡ See Proc. Acad. Nat. Sci. Phila., 1876, p. 253.

toward the middle, and contained four teeth in a vertical column; the longer grooves contained at least five. This estimate is based on a specimen containing teeth described below. The vertical body containing the magazine is separated below from the walls of the dentary bone by the large, open fissure of the Meckelian cartilage. This fissure is open anteriorly as far as the middle of the dentigerous region, and rises on the outer side of the magazine as it extends backward. Thus it occurs that the magazine behind hangs freely suspended from its superior border, and a portion of it extends even posterior to the posterior extremity of the extero-superior border. This is due to the fact that a huge coronoid process rises from the external plane of the dentary bone, in front of the posterior extremity of the dental series, the latter passing to its inner side in a manner not heretofore observed among Reptiles, but as is found in many Rodent Mammals. This process is directed at right angles to the axis of the dentary bone, is quite elevated, and is narrowed at the summit. Its base is concave behind, its section forming nearly a half-circle. This concavity is continuous with that already described as the place of Meckel's cartilage, but it is also pneumatic in its functions. The dental canal enters, at its upper part, the outer wall of the magazine, and traverses the bone between the latter and the external surface of the dentary bone. The great excavation of the posterior extremity of the dentary bone in connection with the elevated hook-shaped coronoid give all these jaws an entirely unique appearance. In this one, where the posterior border of the coronoid process is completely preserved, I see no signs of suture for coronoid, surangular, or other bone. The base of the coronoid process has such an extensive transverse diameter as to cause a great widening at this region. The external face of the dentary is moderately convex, and is perforated by rather distant foramina near the alveolar margin. Viewed from the external side, the coronoid process is of nearly equal and not great width, with rounded apex. From behind, it narrows rapidly from a wide base, leaning somewhat inward, with convex outer and plane inner faces. The posterior concavity contracts and runs out upward.

Measurements.

	M.
Length of fragment of dentary bone.	0.280
Depth of same at middle	0.100
Depth of magazine in front.....	0.065
Depth of magazine at middle.....	0.080
Width of dentary below at middle	0.035
Elevation of coronoid process.....	0.120
Diameter of coronoid process { antero-posterior.....	0.070
{ transverse	0.070
Diameter (transverse) of six vertical grooves.....	0.040

Ramus No. 2 was found by my assistant J. C. Isaac. It belonged to a rather larger individual than the last described, and agrees in general characters with it. It differs in the anterior continuation of the external

projection of the base of the coronoid process, so that the external face of the dentary bone exhibits two planes. The ramus is thus more massive than the one above mentioned, and probably belonged to a different species. A tooth found with it was referred to *Diclonius pentagonus*. (Fig. 9.)

The third ramus was found by myself, and is more instructive than the others from the fact that the symphyseal portion is preserved. It belongs to a distinct species, and may be *Dysganus haydenianus*, as above remarked. One of its marked characters is the form of the coronoid process. It is compressed more as in Mammals, and, as in them, its anterior ridge is continued as an angle along the outer side of the alveolar border for a few inches. Its posterior side is deeply excavated, and the external wall is extended farther backward than the interior. The magazine is not nearly so deep as in the rami above described, and therefore the number of teeth in a vertical column was less. This lends countenance to the view that the jaw is that of a *Dysganus*. The separation of the magazine from the external wall of the dentary is continued far forward in this species, so that the former hangs suspended from the superior portion of the latter. This gives the jaw a greater lightness than in those above described. The alveolar line extends but a short distance behind the posterior inner margin of the coronoid process. The posterior exterior border of this process is concave; below it, the posterior margin projects in an angle, which is separated by another concavity from the less prominent inferior angle. The inferior border of the dentary is straight and of nearly equal thickness. The jaw in front of the magazine diminishes in both diameters, and presents a thin edentulous superior margin like the diastema of the *Mammalia*. The terminal portion is somewhat expanded downward and thickened inward, but is edentulous and without symphyseal suture. The rami evidently were united by ligament only at the symphysis. The dimensions of this jaw are those of the one first described.

The fragment of the fourth lower jaw is instructive from the fact of its containing the teeth in place, and so split as to give a completely mineralized section of the teeth themselves. There are four in each vertical column, every second one with three. The faces of the teeth are directed inward, but that of the inner row is not exposed above the alveolar margin. They are concealed by the persistent roots of the old internal series, of which the crowns have been worn away. These roots have evidently continued to grow at their bases, as they extend downward for almost the entire lengths of the faces of the functional series. The teeth below those actually in use have hollow crowns, showing that a process of nutrition proceeds during protrusion, since the functional teeth are filled up with dentine round the central, branched, closed fissure.

A consideration of the preceding facts leads to the following conclusions:—Professor Owen early asserted that he believed the *Dinosauria*

to present points of affinity to the *Mammalia*. In 1867,* the writer stated it as his belief that they were connected by structural resemblances with the Birds, chiefly in respect to the tibia, fibula, and tarsus. In the following year, Professor Huxley, influenced by the same and a number of other, especially pelvic, characters, observed in English material, also came to the conclusion that the *Dinosauria* are related to the Birds. Since that time, Professor Seeley has expressed objections to this view, and Mr. Hulke has adduced facts respecting the structure of the pelvis in support of it. The material above described does not diminish the weight of evidence in favor of the opinion which I originally expressed, for the cranial structure displays Bird-like characteristics, as well as does that of the posterior limbs. I have additional evidence bearing on the characters of the pelvis, already discussed by Professors Owen and Huxley, which I will bring forward in a future article. But the existence of a great coronoid process of the dentary bone is an unexpected Mammalian feature, unknown among Birds and Reptiles, and confirmatory of Professor Owen's assertion of affinities to the *Mammalia*. The dentary, according to this learned author, takes part in such a process in *Iguanodon anglicus*, but to a small degree in comparison with what is seen in the Judith River *Dinosauria*.

The complex dentition, embracing such an enormous number of distinct pieces in the herbivorous genera, represents the highest development of this part of Reptilian organization. As already remarked, the separate teeth in some species of *Diclonius* was over seven hundred; in *Cionodon arctatus* of the Colorado Lignite, should the number of dental columns be as great as in the first-named form, the total number of teeth would be about two thousand, since they are more numerous in the transverse direction.

* In Contributions to the History of the Vertebrates of Mesozoic Periods in New Jersey and Pennsylvania, Proc. Acad. Nat. Sci. Phila., 1867, p. 74, (May), of which an abstract is given, loc. cit., 1867, p. 234.

CRET.No.5.

Rusty Sandstone, with shells.

30. ft.

Fine blackish Shale.

100,

CRET.No.4.

*Soft Alkaline beds
forming mud bank.*

100,

Fine Lignitic Shale.

10-20

Fig.1.

CRET.No.5.

*Rusty Sandstone containing
a Shell bed.*

25. ft.

*Black Carbonaceous and
Alkaline Shale.*

100,

*Soft white and
buff Sandstone*

CRET.No.4.

Brown Clay Shale

120,

50,

Fig.2.

PLATE 30.—Sections of Cretaceous Formations.

[N. B.—In Fig. 2, the lower bracket, after "Cret. No. 4", should include only "Black Carbonaceous and Alkaline Shale".]



CRET. No.6.

Dinosaurian teeth and Bones.

Rusty Sandstone, small shells.
Gray Marls and clays with *Unio* bed and two Lignitic beds with Saurians and Gars. Sandstone, Dinosaurian bones.

CRET. No.(?)

Light arenaceous Alkaline beds

CRET. No.5.

Thin Sandstone—Alkaline clays. Marine Vertabratu
Sandstone with marine shells and Vertibrata

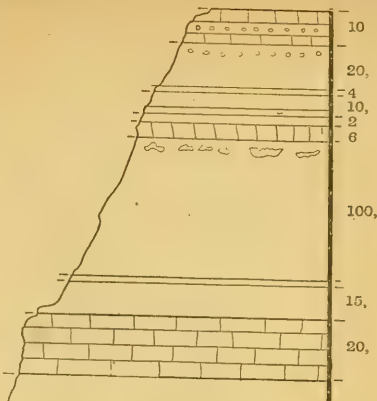


Fig.3.

SAURIAN REMAINS.

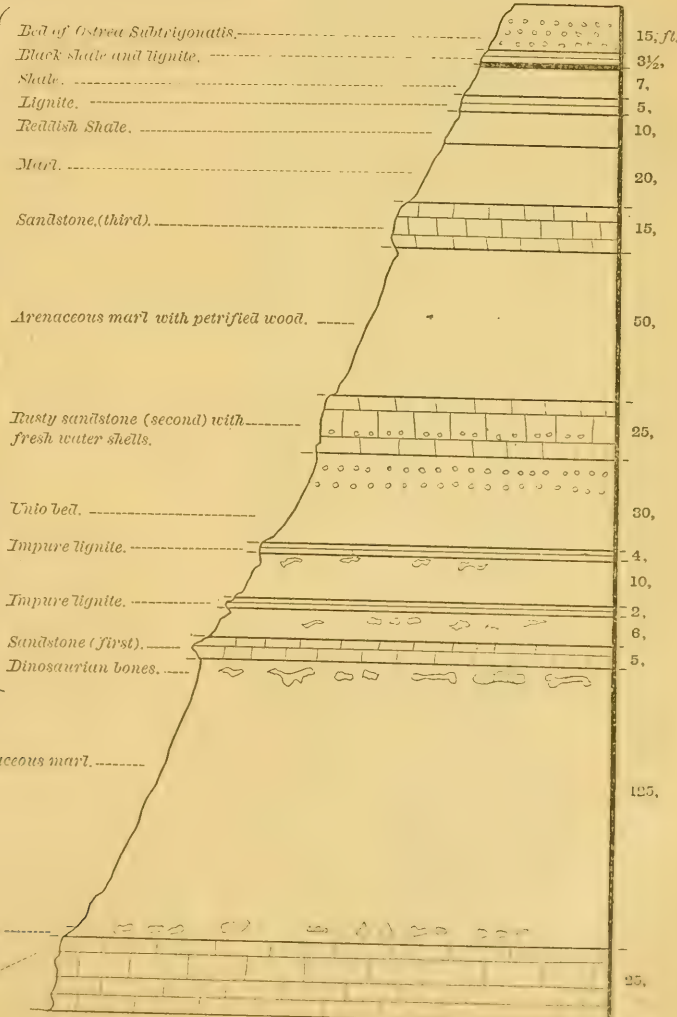


Fig.4.

317.77

PLATE 31.—Sections of Cretaceous Formations.

[N. B.—For "Vertabrata", and for "Vortibrata", in Fig. 3, read "Vertebrata". For "Subtrigonalis", in Fig. 4, read "subtrigonalis". In Fig. 4, "*Unio* bed" should follow the preceding line without interval.]

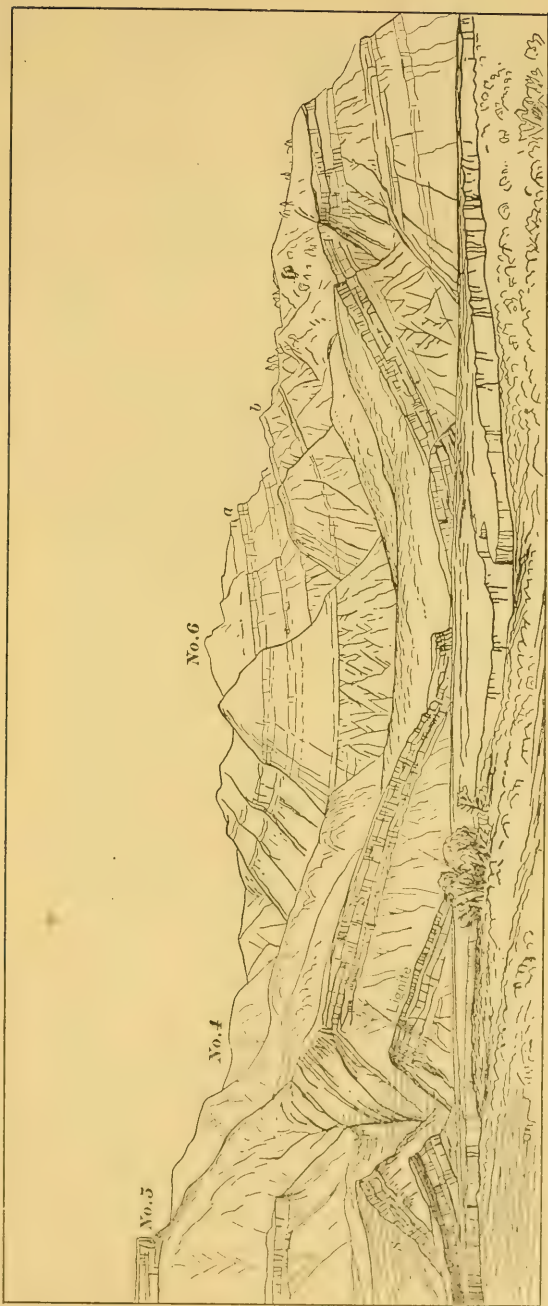


Fig. 5.

PLATE 32.—View on Dog Creek, looking east, showing a synclinal basin of Nos. 4 and 5 Cretaceous, occupied by a bluff of the Judith River epoch. The Lignitic and Sandstone at the base on the left.—*a*, Shell Sandstone; *b*, Yellow Sandstone.

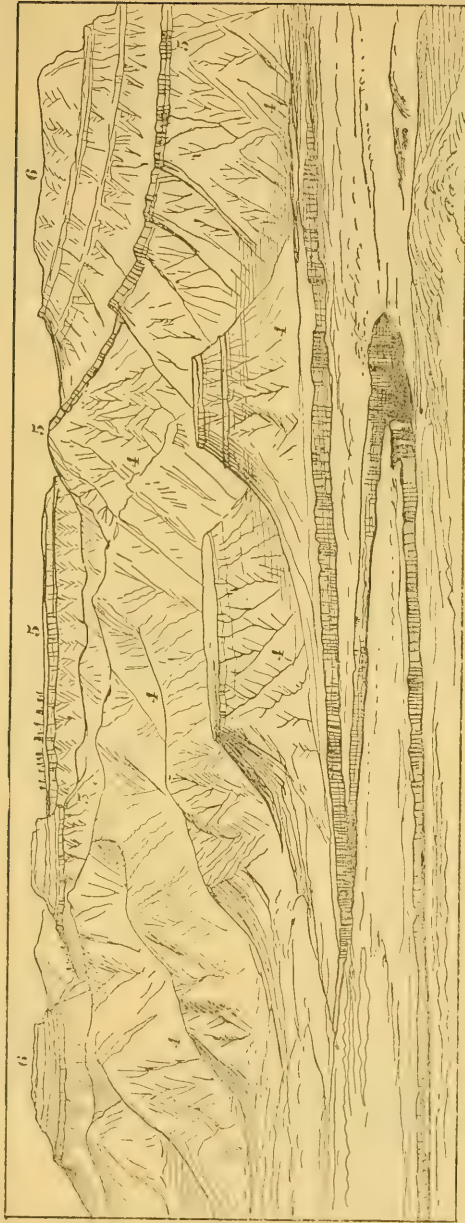


Fig. 6.

PLATE 33.—Elevation of the Fort Pierre and Fox Hills beds on Birch Creek, looking west.

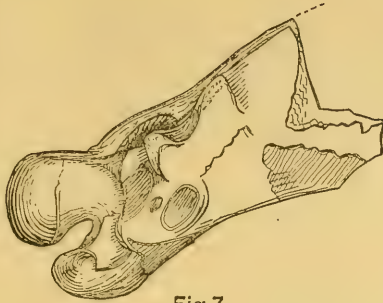


Fig. 7

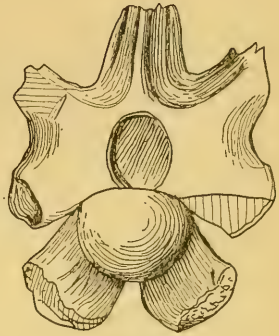


Fig. 7

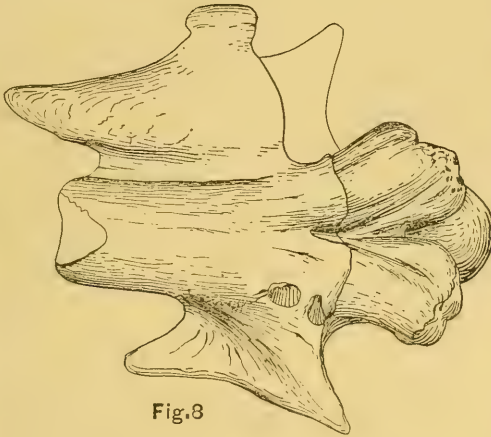


Fig. 8

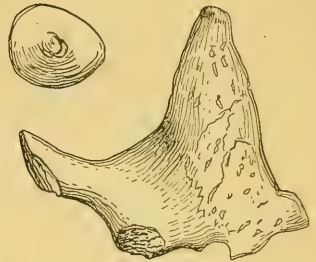


Fig. 8



Fig. 9

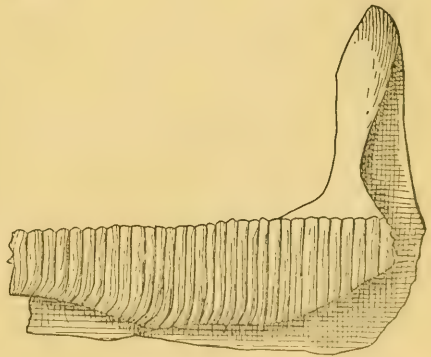


Fig. 9

ART. XX.—PALEONTOLOGICAL PAPERS NO. 1.—DESCRIPTIONS
OF UNIONIDÆ AND PHYSIDÆ COLLECTED BY PROFESSOR E.
D. COPE FROM THE JUDITH RIVER GROUP OF MONTANA
TERRITORY DURING THE SUMMER OF 1876.

BY C. A. WHITE, M. D.

UNIONIDÆ.

UNIO PRIMÆVUS (sp. nov.).—Shell of medium size, broadly subovate in marginal outline when adult, but proportionally narrower when young; valves moderately convex, each having an umbonal sinus or radiating flattened space which ends at the ventral margin a little behind the mid-length of the shell; the sinus or flattened space is bordered posteriorly by a broad, undefined, umbonal ridge, or slight radiating prominence; beaks situated nearly equidistant from the anterior and posterior ends, prominent by reason of the abruptly sloping away from it of both the antero- and postero-dorsal borders as well as the sides; from the beaks to the postero-ventral portion of the shell the margin is broadly convex; postero-ventral margin abruptly rounded to the ventral margin, and the latter broadly convex, or nearly straight along its mid-length; front regularly rounded; both cardinal and lateral teeth strong and well developed. The posterior end of the lateral portion of the hinge ends by a thickening and rounding of its substance upon the inner or under side, instead of each lateral tooth or lamellation ending thinly or sharply, as they usually do in this genus. The postero-dorsal portion of the surface is marked by somewhat distant, very irregular raised ridges, or sharp lines, giving the surface a corrugated aspect; all the surface in front of the corrugated portion is marked only by the ordinary concentric lines of growth and the common fine radiating lines observable in the substance of the shell when it has been exfoliated.

This shell is somewhat remarkable for its broadly subovate outline and the unusual character of the irregular raised lines on the postero-dorsal surface.

The peculiar character of the lateral portion of the hinge observed in this species was also observed in *Unio stewardi* White from the Jurassic strata of Northern Utah, but it seems to be characteristic of only a few species of fossil Unios, and not confined to any epoch or period.

Length of an adult specimen 65 millimeters; height of same from base to beak 49 millimeters.

Position and locality.—Ferruginous sandstones, at the summit of the

Judith River beds;—south of Cow Island, Upper Missouri River, Montana Territory.

UNIO CRYPTORHYNCHUS (sp. nov.).—Shell of medium size, ventricose, subelliptical in marginal outline; height a little greater forward of the mid-length; test moderately thick; dorsal margin nearly straight, or slightly convex; basal margin broadly convex; posterior margin regularly rounded; front margin also regularly rounded from beneath the beaks to the ventral margin; beaks rather large, distinctly defined from the body of the shell, not elevated but projected forward and turned strongly inward, placed near the anterior end of the shell, but not reaching quite so far forward as the anterior border, between which and the beak there is a distinct sulcation; cardinal teeth strong, each having behind it a moderately deep crypt or cavity of the beak; lateral teeth well developed but rather thin and sharp.

Surface marked only by the ordinary lines of growth.

Length 7 centimeters; greatest height from base to umbo $4\frac{1}{2}$ centimeters.

This species bears some resemblance to *U. proavitus* White from the Wahsatch group, at Black Buttes Station, Wyoming Territory, but it differs in being subelliptical instead of subtetrahedral in marginal outline; in wanting the umbonal and postero-dorsal ridges and oblique posterior truncation of that species; and also in having the front margin projecting a little beyond the beaks, instead of the beaks projecting beyond the front margin, as they do in *U. proavitus*.

Position and locality.—Judith River group;—Dog Creek, a tributary of the Upper Missouri River, Montana Territory.

UNIO SENECTUS (sp. nov.).—Shell elongate-subelliptical in marginal outline; convexity of the valves comparatively slight and nearly uniform over the whole surface; test thin; both basal and dorsal margins broadly convex, or the latter sometimes straightened; front regularly rounded; posterior margin also rounded, but more abruptly so than the front; beaks scarcely definable as such from the body of the shell, situated at about one-fifth the length of the shell from the front; hinge well developed; cardinal teeth prominent; lateral teeth long and well formed, but between their anterior end and the cardinal teeth there is considerable space. Above and behind a line drawn from the beak to the postero-basal margin—the place of the umbonal ridge when one is present—the surface is marked by very numerous, small, crenulated undulations, which increase in number both by implantation and bifurcation with the increasing size of the shell; their general direction being backward, but along the dorsum they are flexed upward and end along the dorsal margin. Below and in front of this line, the surface is plain, being marked only by the ordinary lines of growth, except the five radiating lines, which appear in the substance of the shell where it is exfoliated.

Length 8 centimeters; height 4 centimeters.

In its general form and surface-characters, this species somewhat

resembles the living *Margaritana rugosa* Barnes, but the undulations are much smaller, more numerous, and occupy a proportionally broader space upon the surface of the shell than they do in that species; besides which the species here described is a true *Unio* and not a *Margaritana*.

Position and locality.—Judith River group;—Dog Creek, a tributary of the Upper Missouri River, Montana Territory.

Anodonta propatoris (sp. nov.).—Shell elongate-subelliptical in marginal outline; valves moderately and somewhat uniformly convex; beaks small, slightly elevated above the cardinal border; hinge-line long and straight; ventral border broadly convex; front regularly rounded from the base up to the antero-dorsal border, which is more abruptly rounded to the hinge-line; postero-dorsal border oblique and slightly convex; postero-ventral border somewhat abruptly rounded from the postero-dorsal to the ventral border; cardinal border slightly thickened, but entirely plain, and in all respects such as characterizes the genus *Anodonta*.

Surface plain, or marked only by the usual lines of growth.

Length of the largest example collected 62 millimeters; height of the same from base to beak 36 millimeters. Length of a partly grown example 37 millimeters; height 20 millimeters.

This species is not only a true *Anodonta*, but in all its characters and aspect it very closely resembles several living species of that genus. Should perfect examples ever be obtained, it is probable that it would be very difficult to say how it differs from some one of the many and closely similar living forms. It is not to be denied that its separate specific identity is assumed from its known antiquity rather than proved by its structure and form. So far as is known to me, this is the only species of true *Anodonta* that has ever been discovered in any of either the Mesozoic or Cenozoic strata of Western North America.

Position and locality.—Judith River group;—Dog Creek, and also upon the north side of the Missouri River, near Birch Creek, Montana Territory.

PHYSIDÆ.

BULINUS ATAVUS (sp. nov.).—Shell large, much elongated; volutions about seven, increasing gradually in size, moderately convex; suture not deep; aperture comparatively small for a species of this genus, elongate-subovate in outline, its length not quite equal to one-half the full length of the shell; little or no callus upon the inner lip; surface smooth or marked only by very faint and very fine lines of growth. Some of the specimens have the appearance of having been truncated or abruptly terminated at the apex.

Length 5 centimeters; diameter of body-volution 17 millimeters; length of aperture 24 millimeters.

This species is remarkable for its great size and elongation, in which

respects it differs from all other species of the genus known to me. It perhaps approaches more nearly in general form to *B. hypnorum* Linnaeus than to any other living species in the United States; but, besides being much larger, it differs in the proportion of its volutions, especially of the body-volution, as well as in some minor details.

Position and locality.—Judith River group;—Dog Creek, a tributary of the Upper Missouri River, Montana Territory.

PHYSA COPEI (sp. nov.).—Shell large, elongate-subelliptical; volutions about four; spire short; body-volution large and moderately inflated; suture not deep; aperture elongate-subovate in marginal outline, produced in front; callus of the inner lip moderately thick. Surface marked only by the ordinary faint lines of growth.

Length 5 centimeters; diameter of body-volution $2\frac{1}{2}$ centimeters.

This fine *Physa* is the largest species known to me except *P. pleromatis* White from the Wahsatch group of Wyoming, Colorado, and Utah. It differs from that species, however, in being proportionally longer, less ventricose, and in having the border of its aperture more produced in front.

The specific name is given in honor of its discoverer, Prof. E. D. Cope, the distinguished paleontologist.

Position and locality.—Judith River group;—south side of the Missouri River, near Cow Island, Montana Territory.

ART. XXI.—PALEONTOLOGICAL PAPERS NO. 2.—DESCRIPTIONS OF NEW SPECIES OF UNIONES AND A NEW GENUS OF FRESH-WATER GASTEROPODA FROM THE TERTIARY STRATA OF WYOMING AND UTAH.

BY C. A. WHITE, M. D.

UNIONIDÆ.

UNIO PROAVITUS (sp. nov.).—Shell of medium size, moderately ventricose, irregularly oblong or subtetrahedral in marginal outline; front moderately broad and flattened below the beaks; test of ordinary thickness; basal and dorsal margins subparallel, the latter being broadly convex, and the former more nearly straight or slightly emarginate; front margin regularly rounded from beneath the beaks to the basal margin; posterior margin nearly straight or slightly convex, truncating the shell obliquely upward and backward, shortly rounded to the basal margin and more sharply rounded up to the dorsal margin; beaks moderately strong, not elevated, but incurved and projecting beyond the front margin of the shell; the antero-dorsal and umbonal portions of each valve are sufficiently elevated to hide the cardinal ligament from a side-view of the shell, but the postero-dorsal portion of each valve slopes away from the dorsal margin. Two obtuse ridges or elevations radiate from the beak of each valve to the margin. One of these, the umbonal ridge proper, ends at the junction of the posterior and basal margins, and the other at the junction of the posterior and dorsal margins. Between the latter and the dorsal margin, the space is narrow; between the two ridges, the surface is distinctly flattened, and forward of the umbonal ridge there is an umbonal flattening or very shallow umbonal sinus, which causes the slight emargination of the ventral margin as well as the flattening of the outer side of the beaks. Cardinal teeth moderately strong; lateral teeth well developed.

Surface marked by the ordinary lines and undulations of growth, and faint radiating lines are also usually observable, especially where the prismatic layer has been exfoliated.

Length from front to postero-dorsal prominence 52 millimeters; height from basal margin to dorsum 35 millimeters; greatest thickness, both valves together, 31 millimeters.

This species is related to *U. propheticus* White, but differs from that species in having an oblong instead of ovate outline; in its nearly hor-

izontal instead of oblique dorsal margin; in possessing the radiating ridges before described; and in having the umbones and dorsal portions of its valves less elevated.

Position and locality.—Wahsatch group;—Black Buttes Station, Wyoming Territory, where it is associated with the two following species.

UNIO HOLMESIANUS (sp. nov.).—Shell small, short, compact, moderately gibbous, subtrihedral in marginal outline, of ordinary length anteriorly, very short posteriorly, the postero-dorsal portion forming only a small, narrow prominence upon the broad, abruptly truncated posterior; valves in front of the umbonal sinus regularly convex; umbonal sinus well defined but somewhat narrow, its posterior side a little higher than the anterior, terminating at the base of the shell a little behind the middle; umbonal ridge prominent, forming a roughly rounded angle between the side of the valve and its posterior end; hinge-line very short; antero-dorsal margin sloping gently downward; front and antero-basal margins regularly and continuously rounded to the termination of the umbonal sinus, where the base is a little emarginate; postero-basal margin sharply rounded up to the almost perpendicular posterior margin; beaks small, somewhat prominent, incurved. The surface of a moderately narrow space along the front and basal margins as far back as the umbonal sinus is marked only by the ordinary lines of growth; all the remainder of the surface in front of the umbonal sinus is marked by somewhat close-set rhombic papillæ, arranged in more or less distinct oblique lines. All the surface behind the umbonal sinus marked by small, irregular, somewhat corrugated ridges, which are strongest upon the umbonal ridge, from the median line of which they diverge downward toward both the umbonal sinus and the posterior margin.

Length 23 millimeters; height 21 millimeters; thickness 14 millimeters.

This species presents a greater degree of differentiation from what may be regarded as the typical form of the genus than any other known fossil species, and fully as great as that of any species now living.

The specific name is given in honor of Mr. W. H. Holmes, of the United States Geological Survey of the Territories.

Position and locality.—Wahsatch group;—Black Buttes Station, Wyoming Territory, where it is associated with the foregoing species.

UNIO ENDLICHII (sp. nov.).—Shell large, obliquely elongate-ovate in marginal outline, moderately thick, very short in front of the beaks and elongated and narrowed behind them; test massive; basal margin having a slight general convexity, but it is sometimes straightened, or even a little emarginate behind the middle, regularly and continuously rounded to the front, and abruptly rounded to the postero-dorsal margin; dorsal margin broadly rounded from front to rear, forming a broadly convex slope down to the postero-basal margin; beaks much depressed, and the whole umbonal region only slightly elevated; hinge well developed; cardinal teeth strong; lateral teeth large and very long.

Surface apparently simple, or, in other words, marked only by the ordinary lines and imbrications of growth.

Length of the largest example discovered 13 centimeters; greatest width of the same 7 centimeters. These proportions, and consequently the marginal outline, vary somewhat with age, being opporportionally narrower when young; and, even in the case of adult specimens, the length is sometimes proportionally less than that given above.

This species resembles *U. couesi* White, with which it is associated, in its great size, massive test, and simple surface; but it differs in outline, being much narrower posteriorly, and in having its beak much nearer to the front of the shell than it is in that species. It bears some resemblance also to some of the varietal forms of *U. danae* Meek and Hayden, but it is constantly a more massive shell, is always proportionally wider in its widest part, and has its beaks placed farther forward, the front in this species projecting only very slightly beyond them.

The specific name is given in honor of Dr. F. M. Endlich, of the United States Geological Survey of the Territories.

Position and locality.—Wahsatch group;—Black Buttes Station, Wyoming Territory, where it is associated with the two foregoing species.

UNIO COUESI White.—A very large, broad, arcuate-smooth species, from the Wahsatch group at Black Buttes Station, Wyoming, was described by me as *Unio petrinus* on page 125 of Powell's Report on the Geology of the Uinta Mountains, 1876. I had overlooked the fact that Gould described a living species under the same name in the Proceedings of the Boston Society of Natural History in 1855. I therefore change the name of this species to *U. couesi*, in honor of Dr. Elliott Coues, the able zoölogist of the United States Geographical and Geological Survey.

UNIO MEEKI White.—The late Mr. F. B. Meek, in Dr. Hayden's Report of 1872, United States Geological Survey of the Territories, dedicated a species of *Unio*, from the Bridger group of Wyoming, to Dr. Isaac Lea, of Philadelphia. Notwithstanding Mr. Meek's habit of extraordinary carefulness, he seems to have overlooked the fact that Gray had, some twenty years before, dedicated a *Unio* from China, published in India, to Dr. Lea. It therefore becomes necessary to substitute another name for the fossil species, which I do by applying that of my late distinguished friend.

UNIO MENDAX (sp. nov.).—Shell of medium size, elongate-subelliptical in outline, moderately gibbous; beaks placed somewhat near the front end; front regularly rounded down to the base, which is only slightly convex or a little straightened; dorsal margin slightly convex or nearly straight and subparallel with the base; posterior margin sloping obliquely downward and backward from the dorsal margin, and abruptly rounded below to meet the basal margin.

Surface marked only by the usual lines of growth, except that there are usually numerous small wrinkles upon the beaks; and that two

small, sharply raised, radiating lines are usually observable upon the postero-dorsal portion of each valve.

Length 67 millimeters; height 39 millimeters.

This species was described by me in vol. iv, part i, of Lieutenant Wheeler's Explorations and Surveys West of the One Hundredth Meridian (1876) as *Unio vetustus* Meek. A careful examination of fuller collections convinces me that they are specifically distinct. So far as I am aware, *Unio vetustus* has been found only in the strata of the Laramie group and in the vicinity of Old Bear River City, Wyo.; while *U. mendax* is found in strata probably of the age of the Wahsatch group at Wales, Utah, and also in the Cañon of Desolation of Green River in the same Territory.

CERIPHASIIDÆ.

Genus CASSIOPELLA (gen. nov.)

Shell resembling *Goniobasis* in form, and in many of its other characteristics, but, unlike that genus, this is distinctly umbilicated; volutions more or less convex or angular; aperture more or less produced in front, subovate or rhomboidal in outline; outer lip sinuous; inner lip more or less callous upon the body-volution.

This genus is proposed to include the species published by myself as *Leioplax? turricula* in Powell's Report on the Geology of the Uinta Mountains, page 133 (1876). I am by no means satisfied as to its true family affinities, but place it provisionally with *Goniobasis*, in the family *Ceriphasiidae* of Gill. Being umbilicated, it bears nearly the same relation to *Goniobasis* that *Cassiope* does to *Turritella*.

Only one species referable to this genus has yet been recognized, but among the typical specimens collected from the Wahsatch strata at Black Buttes Station, Wyoming, is one the volutions of which are convex, and not angular, like those of the typical examples; but a few distinct raised revolving lines exist upon the anterior side of the last volution. This specimen is distinctly umbilicated, and may possibly represent another species of the genus here proposed, but I am at present inclined to regard it as only a variety of the typical species.

ART. XXII.—PALEONTOLOGICAL PAPERS NO. 3.—CATALOGUE
OF THE INVERTEBRATE FOSSILS HITHERTO PUBLISHED
FROM THE FRESH- AND BRACKISH-WATER DEPOSITS OF
THE WESTERN PORTION OF NORTH AMERICA.

BY C. A. WHITE, M. D.

The principal object of the following catalogue is to present a synopsis of the invertebrate fresh- and brackish-water species, including the terrestrial Mollusks, hitherto discovered in the Mesozoic and Cenozoic strata of Western North America, so that the faunæ of the different groups and those now living may be briefly compared. Only a small part of the great region indicated has yet been carefully examined, and therefore great additions to our knowledge of these fossil faunæ are yet to be made. At present, our knowledge of them is mostly confined within two quite large and distinct regions, namely, the Upper Missouri River region and the Green River region.

Limiting the scope of the catalogue by excluding the marine faunæ, it has been found difficult to draw a distinct line between the brackish-water and marine forms, because of the well-known fact that there is no precisely fixed limit of habitat in this respect among such living species as are represented generically by some of these fossil forms. In such cases of doubt, I have included only those species that seem to indicate clearly a brackish condition of the waters in which they lived; but, in all cases, all undoubted fresh-water invertebrates and land Mollusks are included. Thus, while the catalogue is intended to embrace all the invertebrate species yet discovered in the strata of the Wahsatch, Judith River, Fort Union, Green River, Bridger, Wind River, and White River groups, besides some strata not yet correlated with either of these groups, only a part of those found in the Laramie, Fox Hills, Dakota, and Jurassic strata are included. This is because the fossils of the last-named groups, except the Laramie, are usually found to be of marine origin. Much the greater part of the fossils yet collected from the Laramie group are of either brackish- or fresh-water origin. These facts indicate that a much smaller area was occupied by brackish and fresh waters in those earlier epochs than afterward prevailed upon what is now the North American continent; and that the area they occupied increased until the saline waters were finally displaced entirely by fresh waters.

Following is a serial list of the groups of strata that have hitherto been recognized and published, in the two regions respectively. As to the geological age of a part of these groups, there has been, among geologists, a difference of opinion. It seems clear that we have in those regions an almost or entirely unbroken series, both stratigraphical and paleontological, from earlier Cretaceous to at least Middle Tertiary. There is, therefore, no well-defined line of separation between the strata of these two great periods, but a certain portion of these strata form a transitional series from those of one to those of the other period. This fact is attempted to be shown in the following method of tabulating the groups:—

THE GREEN RIVER REGION.

Cenozoic, or Tertiary ..	Brown's Park Group.
	Bridger Group.
	Green River Group.
	Wahsatch Group.
Post-Cretaceous	Laramie Group.
	Fox Hills Group.
	Colorado Group.
Later Mesozoic, or Cretaceous.	Dakota Group.
	Jurassic.
Earlier Mesozoic	

THE UPPER MISSOURI RIVER REGION.

Cenozoic, or Tertiary ..	White River Group.
	Wind River Group.
	Fort Union Group.
Post-Cretaceous	Judith River Group.
	Fox Hills Group.
	Fort Pierre Group.
Later Mesozoic, or Cretaceous.	Niobrara Group.
	Fort Benton Group.
	Dakota Group.
Earlier Mesozoic	Jurassic.

The parallelism of the Cretaceous and Jurassic groups in the two regions respectively is unmistakable; but that of the higher groups has not yet been clearly made out. The list shows, however, that three of the species originally discovered in the Fort Union group have been identified in the Wahsatch group in Utah, or in strata that are now believed to be equivalent with that group.

Besides the fossils that have been collected from these defined groups of strata, the catalogue contains some others, that have been collected from Tertiary strata at different localities in the great Rocky Mountain region, which have not yet been correlated with the strata of any of those groups. This is partly due to a want of knowledge of their stratigraphical relations, and partly because those fossils are mostly of different types from any found in the recognized groups; and different also, in part, from any types, either fossil or recent, yet found on this continent. As the scope of this paper is only intended to embrace the western interior portion of the North American continent, the corresponding kinds of fossils that may have been discovered east of the Mississippi, or upon the immediate Pacific slope, are not here enumerated.

Descriptions of most of the fossils embraced in this catalogue are to be found in the following works:—The various Reports of Mr. Meek, in Dr. Hayden's Geological Survey of the Territories; White's Reports to Lieutenant Wheeler and Major Powell; Meek's reports to Mr. Clarence King and Captain Simpson; and in the Paleontology of California.

JURASSIC.

<i>Viviparus gilli</i> Meek and Hayden.	<i>Neritina nebrascensis</i> Meek and Hayden.
<i>Leioplacodes veternus</i> Meek and Hayden.	<i>Unio nucalis</i> Meek and Hayden.
<i>Valvata? scabrida</i> Meek and Hayden.	<i>Unio stewardi</i> White.
<i>Planorbis veternus</i> Meek and Hayden.	

CRETACEOUS.

DAKOTA GROUP.

<i>Cyrena dakotaensis</i> Meek and Hayden.	<i>Margaritana nebrascensis</i> Meek and Hayden.
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FOX HILLS GROUP.*

<i>Valvata nana</i> Meek.	<i>Cyrena carletoni</i> Meek.
<i>Physa carletoni</i> Meek.	<i>Unio</i> —? Meek.
<i>Melampus antiquus</i> Meek.	

LARAMIE GROUP.

<i>Campeloma macrospira</i> Meek.	<i>Planorbis (Bathyomphalus) kanabensis</i> White.
<i>Viviparus panguitchensis</i> White.	<i>Rhytophorus meeki</i> White.
<i>Goniobasis chrysalis</i> Meek.	<i>Rhytophorus priscus</i> Meek.
<i>Goniobasis chrysaloidea</i> White.	<i>Corbula pyriformis</i> Meek.
<i>Goniobasis areta</i> Meek.†	<i>Corbula englemanni</i> Meek.
<i>Goniobasis cleburni</i> White.	<i>Corbula undifera</i> Meek.
<i>Goniobasis? insculpta</i> Meek.	<i>Corbicula (Veloritina) durkeei</i> Meek.
<i>Pyrgulifera humerosa</i> Meek.	<i>Unio vetustus</i> Meek.
<i>Helix kanabensis</i> White.	<i>Unio belliplicatus</i> Meek.
<i>Physa kanabensis</i> White.	<i>Unio gonionotus</i> White.
<i>Limnæa nitidula</i> Meek.†	

*These fresh- and brackish-water species were all found by Mr. Meek, near Coalville, Utah, associated together, and also with species of the genera *Neritina*, *Eulimella?*, *Turritella*, *Inoceramus*, *Anomia*, etc. The strata are certainly Cretaceous, and not of later date than the Fox Hills group.

†These two species were originally reported from the Tertiary strata on Ham's Fork, Wyoming, but they probably belong in the brackish-water beds of Sulphur Creek near Bear River, Southwestern Wyoming.

TERTIARY PERIOD.

WAHSATCH GROUP.

<i>Viviparus plicapressus</i> White.	<i>Limnæa (Limnophysa?) compactilis</i> Meek.
<i>Viviparus ionicus</i> White.	<i>Planorbis utahensis</i> Meek.†
<i>Viviparus trochiformis</i> Meek and Hayden.*	<i>Corbula subundifera</i> White.
<i>Viviparus paludinaeformis</i> Hall.†	<i>Corbula crassitilliformis</i> Meek.
<i>Tulotoma thompsoni</i> White.	<i>Corbicula bannisteri</i> Meek.
<i>Bythinella utahensis</i> White.	<i>Corbicula (Leptesthes) fracta</i> Meek.
<i>Bythinella recta</i> White.	<i>Pisidium saginatum</i> White.
<i>Goniobasis tenera</i> Hall.‡	<i>Unio couesi</i> White.
<i>Goniobasis? wyomingensis</i> Meek.	<i>Unio propheticus</i> White.
<i>Goniobasis nebrascensis</i> Meek and Hayden.*	<i>Unio proavitus</i> White.
<i>Goniobasis tenuicarinatus</i> Meek and Hayden.*	<i>Unio brachyopisthus</i> White.
<i>Cassiopella turricula</i> White.	<i>Unio holmesianus</i> White.
<i>Neritina volvilineata</i> White.	<i>Unio endlichi</i> White.
<i>Helix peripheria</i> White.	<i>Unio mendax</i> White.
<i>Physa pleromatis</i> White.	<i>Ostrea wyomingensis</i> Meek.
	<i>Ostrea arcuatilis</i> Meek.

GREEN RIVER GROUP.

<i>Viviparus paludinaeformis</i> Hall.§	<i>Succinea papillispira</i> White.
<i>Goniobasis tenera</i> Hall.§	<i>Limnæa vetusta</i> Meek.
<i>Bythinella gregaria</i> Meek.	<i>Limnæa similis</i> Meek.
<i>Pupa incolata</i> White.	<i>Planorbis utahensis</i> Meek.§
<i>Pupa arenula</i> White.	<i>Unio washakiensis</i> Meek.
<i>Helix riparia</i> White.	<i>Unio shoshonensis</i> White.
<i>Helix peripheria</i> White.	

BRIDGER GROUP.

<i>Viviparus paludinaeformis</i> Hall.§	<i>Physa bridgerensis</i> Meek.
<i>Viviparus wyomingensis</i> Meek.	<i>Planorbis utahensis</i> Meek.§
<i>Goniobasis tenera</i> Hall.§	<i>Unio haydeni</i> Meek.
<i>Pupa? leidyi</i> Meek.	<i>Unio meeki</i> White.

* Originally discovered in the Fort Union group, but identified in strata probably equivalent with the Wahsatch group of Eastern and Central Utah.

† This species ranges, with slight variations, through all the fresh-water deposits of the Wahsatch, Green River, and Bridger groups, and is regarded specifically identical with *U. spectabilis* Meek.

‡ This species ranges from the beginning of purely fresh-water deposits in the Wahsatch group and up through the Green River and Bridger groups inclusive. *G. nodulifer* Meek, *G. carteri* Conrad, and *G. simpsoni* Meek are all believed to be identical with *G. tenera* Hall.

§ See foot-notes on page 610.

JUDITH RIVER GROUP.

- Valvata? montanaensis* Meek.
Viviparus conradi Meek and Hayden.
Campeloma vetula Meek and Hayden.
Hydrobia subconica Meek.
Goniobasis convexa Meek and Hayden.
Goniobasis invenusta Meek and Hayden.
Goniobasis sublavis Meek and Hayden.
Goniobasis omitta Meek and Hayden.
Goniobasis? gracilenta Meek and Hayden.
Goniobasis? subtortuosa Meek and Hayden.*
Hélix vetusta Meek and Hayden.
Hyalina? occidentalis Meek and Hayden.
Hyalina? evansi Meek and Hayden.
Vitrina obliqua Meek and Hayden.
Physa copei White.
Bulinus atavus White.
Bulinus subelongatus Meek and Hayden.
Planorbis convolutus Meek.
Planorbis (Bathyomphalus) amplexus Meek.
Corbula perundata Meek.
Corbula mactriiformis Meek and Hayden.
- Corbicula subelliptica* Meek and Hayden.
Corbicula moreauensis Meek and Hayden.
Corbicula nebrascensis Meek and Hayden.
Corbicula cytheriformis Meek and Hayden.
Corbicula subtrigonalis Meek and Hayden.
Corbicula occidentalis Meek and Hayden.
Sphaerium planum Meek and Hayden.
Sphaerium formosum Meek and Hayden.
Sphaerium subellipticum Meek and Hayden.
Sphaerium recticardinale Meek and Hayden.
Unio cryptorhynchus White.
Unio primævus White.
Unio danae Meek and Hayden.
Unio deweyanus Meek and Hayden.
Unio subspatulatus Meek and Hayden.
Unio priscus Meek and Hayden.
Unio senectus White.
Anodonta propatoris White.
Ostrea subtrigonalis Evans and Shumard.
Ostrea glabra Meek and Hayden.

* Probably belongs to the genus *Cassiopella* of White.

FORT UNION GROUP.

<i>Valvata subumbilicata</i> Meek and Hayden.	<i>Goniobasis nebrascensis</i> Meek and Hayden.*
<i>Valvata parvula</i> Meek and Hayden.	<i>Goniobasis tenuicarinata</i> Meek and Hayden.*
<i>Viviparus raynoldsianus</i> Meek and Hayden.	<i>Cerithidea (Pirenella) nebrascensis</i> Meek and Hayden.
<i>Viviparus leidy</i> Meek and Hayden.	<i>Thaumastus limnæformis</i> Meek and Hayden.
<i>Viviparus trochiformis</i> Meek and Hayden.*	<i>Columna teres</i> Meek and Hayden.
<i>Viviparus peculiaris</i> Meek and Hayden.	<i>Columna vermicula</i> Meek and Hayden.
<i>Viviparus retusus</i> Meek and Hayden.	<i>Bulinus? rhomboideus</i> Meek and Hayden.
<i>Viviparus leai</i> Meek and Hayden.	<i>Bulinus longiusculus</i> Meek and Hayden.
<i>Campeloma multistriata</i> Meek and Hayden.	<i>Limnæa (Pleurolimnæa) tenuicostata</i> Meek and Hayden.
<i>Hydrobia anthonyi</i> Meek and Hayden.	<i>Planorbis (Bathyomphalus) planoconvexus</i> Meek and Hayden.
<i>Hydrobia warrenana</i> Meek and Hayden.	<i>Acroloxus minutus</i> Meek and Hayden.
<i>Hydrobia? eulimoides</i> Meek.	
<i>Mycropyrgus minutulus</i> Meek and Hayden.	

WIND RIVER GROUP.

<i>Helix? veterna</i> Meek and Hayden.	<i>Macrocyclus spatiosa</i> Meek and Hayden.
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WHITE RIVER GROUP.

<i>Cypris leidy</i> Evans and Shumard.	<i>Limnæa diaphana</i> Evans and Shumard.
<i>Helix leidy</i> Hall and Meek.	<i>Planorbis vetustus</i> Meek and Hayden.
<i>Physa secalina</i> Evans and Shumard.	<i>Planorbis leidy</i> Meek and Hayden.
<i>Limnæa nebrascensis</i> Evans and Shumard.	<i>Planorbis nebrascensis</i> Evans and Shumard.
<i>Limnæa meekiana</i> Evans and Shumard.	
<i>Limnæa shumardi</i> Meek.	

The following species are from Tertiary strata, at different localities, in the great Rocky Mountain region, which have not yet been correlated with any of the groups of the foregoing catalogue. These fossils are of unusual interest, because of the fact that they comprise types which

* See foot-note on page 110.

differ materially from those of any of the formations that have hitherto been studied:—

FROM SNAKE RIVER VALLEY, SOUTHWESTERN IDAHO.

Melania taylori Gabb.

| *Lithasia antiqua* Gabb.

FROM CACHE VALLEY, UTAH.

Linnæa (Polyrhytis) kingi Meek.

FROM FOSSIL HILL, KAHSOW MOUNTAINS, NEVADA.

Melania? sculptilis Meek.

| *Ancylus undulatus* Meek.

Melania? subsculptilis Meek.

| *Sphærium? rugosum* Meek.

Carinifex (Vorticifex) tryoni Meek.

| *Sphærium? idahoense* Meek.

Carinifex (Vorticifex) binneyi Meek.

FROM CROW CREEK, NORTHERN COLORADO.

Melania larunda White.

ART. XXIII.—PALEONTOLOGICAL PAPERS NO. 4.—COMPARISON OF THE NORTH AMERICAN MESOZOIC AND CENOZOIC UNIONIDÆ AND ASSOCIATED MOLLUSKS WITH LIVING SPECIES.

BY C. A. WHITE, M. D.

The remarks embraced in this paper are intended to apply only to those fossils which are enumerated in the catalogue that constitutes the principal part of the paper immediately preceding this (Paleontological Papers No. 3), and also to that portion of North America to which the catalogue is restricted.

The scope of this paper is still further restricted by treating only of those Molluscan forms that are universally regarded as indicating either a purely fresh-water or a land habitat. Furthermore, an extended discussion of the relations and characteristics of the *Gasteropoda* of that catalogue is deferred until another occasion shall offer, the present one being devoted mainly to remarks upon the fossil *Unionidæ*, and their relation to living forms of the same family.

As a rule, the types of fresh-water and land Mollusks that have hitherto been discovered in the Mesozoic and Cenozoic strata of the western part of North America are such as now exist in different parts of the continent, especially its *eastern* half. This similarity of type, although it is somewhat more apparent in the later than in the earlier formations, extends as far back as the earlier Mesozoic epochs, and is so plainly apparent that the principal indication of antiquity which the specimens exhibit is their fossilized condition. Even in the case of a majority of exceptions to this rule, the relationship to existing forms is readily recognized.

In short, the almost exact identity of types of the fossil and living fresh-water and land *Mollusca* of North America is such as to leave no doubt that the former represent the latter ancestrally. The fact also that the types of these fresh-water and land Mollusks had become so variously differentiated before the close of Mesozoic time, and that they have changed so little since, points back to a previous evolutionary history which doubtless began in Paleozoic time, but concerning which we have yet collected little or no material. So large a proportion of the existing genera and subgenera of North American fresh-water and land Mollusks have been found to be represented by fossil extinct species, that it is probable

representatives of all of them may yet be discovered in the great lacustrine deposits of the West. It is possible also that some of the very few groups that are now known to be represented only by fossil forms may yet be found to be represented by living species in some part of the continent. But this is less probable, and we may doubtless safely assume that most, if not all of them, have become extinct with the extinction of the few species that composed them.

The catalogue comprised in Paleontological Papers No. 3 shows how numerous are the species already discovered in those western North American strata, none of which, not even the most recent, have yet been referred to living species. But when this whole subject shall be taken up for judicious *synthetical* study, it will probably appear that sufficient cause for separating many of them from existing species, as well as from each other, will be difficult to find.

Although, as before stated, the present discussion is intentionally limited to the true fresh-water and land Mollusks, it is proper to state that some of these fossils have been found in such association with others that are regarded as brackish-water species as to indicate that they were probably capable of living in water that was impregnated with at least a small proportion of salt, which their living representatives seem incapable of enduring. For example, at a locality in Southwestern Wyoming, in strata that are designated in the catalogue as Post-Cretaceous, two species of *Unio* are abundantly represented in association with occasional specimens of an Oyster and other Mollusks that also indicate a brackish-water habitat. None of these specimens present the appearance of having been drifted or transported to their present position and association, but all seem to have lived and flourished together. Also, in strata at Black Buttes Station, Wyoming, that are a little more recent than those just referred to, several species of the genera *Unio* and *Viviparus* are found associated in the same layers with *Corbula*, *Corbicula*, *Neritina*, etc., which layers alternate with others that contain *Ostrea* and *Anomia*. These facts, while they do not affect the validity of those which I propose to discuss, suggest an important bearing upon the subject of the early differentiation of fresh- and brackish-water Molluscan types, which will be further considered on a subsequent page.

The species embraced in the catalogue which present the greatest differences from their related existing forms are regarded as true brackish-water species, and therefore do not fall within the especial scope of this paper. The few fresh-water species that are likewise not congeneric with living forms are confined to strata that have hitherto been but little studied, and are not yet correlated with those of any of the groups of strata named in the tables preceding the catalogue. They are those which in the catalogue are referred to the following localities:—Valley of Snake River, Southwestern Idaho; Kawsow Mountains, Nevada; and Crow Creek, Northern Colorado. Those among these few species that are referred to the genus *Melania* differ considerably from all other fossil

and living North American forms that have been referred to that genus ; and they have much the general aspect and characteristics of the Old World Melanians. They seem to constitute almost the only known foreign element among our fresh-water types, either fossil or living. The two species of *Carinifex* from the Tertiary strata of Nevada represent the only genus that is known to exist in the waters of the Pacific drainage, and not in any of those which flow into either the Atlantic Ocean or the Gulf of Mexico. This fact possesses peculiar interest, because closely related representatives of nearly all the fossil land and fresh-water Mollusks of Western North America are found now living upon the drainage-slopes of the Atlantic and Gulf of Mexico, while comparatively few of them are represented among the living forms of the land and fresh waters of the Pacific drainage-slope.

Although the peculiar "North American" characteristics before referred to are so plainly observable in nearly all the fresh-water and land Mollusks of Western North America, it is the *Unionida* that are found to possess those characteristics most completely and invariably. Before proceeding to a comparison of the fossil with the living forms of this family, however, a brief comparison of the living *Unionida* of the different parts of the world will be necessary and proper.

This family has been so variously divided and subdivided into genera and subgenera by different authors that it is somewhat difficult to adopt a classification that is free from more or less serious objections. The classification here used is, therefore, only provisionally adopted, and, in its use, reference is had to the characteristics of the shell alone, for the very obvious reason that these features only can be considered in the case of fossil forms, for the discussion of which the classification here presented is employed. It cannot, of course, be understood that these generic names represent generic distinctions of equal value, for the fact is far otherwise ; but they are presented and tabulated here to show more clearly by contrast the generic differentiation that obtains in this family in the different great divisions of the earth. Notwithstanding the fact that there is a much greater profusion of *Unione* life in the fluviatile and lacustrine waters of North America than in those of any other part of the world, the existence of only three generic forms is recognized in this discussion. This does not, however, imply a lack of diversity, for these genera (especially the genus *Unio*) embrace a greater number of species than are believed to exist on any other continent, not excepting that of South America, where the generic forms are more than three times as numerous as they are on our own continent.

The following is a tabular view of the genera of this family as it is represented upon the different continents respectively.

Genera of the family Unionidæ.

North America.	South and Central America.	Europe.	Asia.	Africa.	Australia.
Unio. Margaritana.	Triquetra. Prisodon. Unio. Margaritana. Plagiodon. Monocondylea.	Unio. Margaritana. Monocondylea.	Triquetra. Unio. Monocondylea. Dipsas. Anodonta.	Unio. Margaritana. Anodonta. Iridinia. Spatha. Ætheria.	Unio. Anodonta. Mycetopus
Anodonta.	Anodonta. Columba. Byssanodonta. Mycetopus. Mulleria.	Anodonta.			Anodonta.

A glance at the foregoing table will show that of the three genera represented in North America two of them, *Unio* and *Anodonta*, are also represented in every other part of the world, while the other, *Margaritana*, is more widely distributed than any of the remaining genera. These three genera may therefore be properly regarded as the standard or general types of the family; and as such they show its integrity in this part of the world in a very conspicuous manner. This integrity is still further conspicuously shown by the fact that in all parts of the world the species of all the other genera except *Monocondylea* (which has twenty-six species) are very few, ranging only from one to nine species to a genus, and still further shown by the fact that the genus *Unio* embraces fully four-fifths of all the species that belong to the family.

Dr. Isaac Lea assigns only a subgeneric place to *Unio*; but other authors have given it a higher than generic rank by dividing it into several sections which they raise to the rank of genera. Most of these subdivisions of *Unio* are based upon the structure of the soft parts alone, while the shell in all cases possesses the distinguishing characteristics of *Unio*. Such a basis for the subdivision of this great genus is therefore beyond the cognizance of the paleontologist; but, nevertheless, very definite lines of differentiation within its broad limits are indicated by the form, particularly the marginal outline and the surface-features or ornamentation of the shell, and which characterize more or less clearly defined sections of the genus. While a large proportion of such types, or sections, of the genus *Unio* as are thus indicated are found to be common to all parts of the world, there are certain other types that are either peculiar to, or are more than usually prevalent in, some one continent or region. Thus, certain sections of the genus as above indicated are found to be peculiar to our continent, and have therefore come to be known as "North American types" of *Unio*. So characteristic of North American waters are some of these subordinate divisions or types that the exclusively African genera *Spatha*, *Iridinia*, and *Ætheria*, and the likewise exclusively South American genera *Plagiodon*, *Columba*, *Mulleria*, etc., are scarcely more indicative of their respective continental generation.

The genus *Anodonta* is notably free from any marked differentiation into subgenera or sections, similar to those of *Unio*, although the species are somewhat numerous and common to all parts of the world. The genus *Margaritana* is much more differentiated than *Anodonta*, but very much less so than *Unio*. I shall therefore consider only the sections or subordinate types of *Unio* in the remainder of this paper.

Dr. Lea has so tabulated the species in his Synopsis of the Family Unionidæ as to indicate the marginal outline and surface-features of each. As it is very largely by these characters that the types before referred to are expressed, I give a list of the terms he has used to indicate the outline-form and character of surface, for the purpose of using them in making comparisons of our own forms with those of other parts of the world:—

<i>Form.</i>	<i>Surface.</i>
Quadrate.	Smooth.
Triangular.	Plicate.
Oblique.	Nodulous.
Oval.	Sulcate.
Oblong.	Spinous.
Subrotund.	
Wide.	
Obovate.	
Arcuate.	

It is the oval form and the smooth or plain surface that are found to be more common than all other features, and to prevail in all parts of the world; while the oblique, quadrate, and subrotund forms, and nodulous and spinous surfaces are more restricted than any of the others. It is these restricted features that are among the leading characteristics of our North American types of *Unio*.

The following partial statements, mostly collated from Dr. Lea's Synopsis, illustrate in part the continental restrictions just referred to, the figures indicating the number of species in each case:—

	North America.	South and Central America.	Europe.	Asia.	Africa.	Australia.
FORM.						
Oblique.....	45	1	0	7	0	0
Subrotund.....	43	11	0	2	0	1
Quadrate.....	29	1	0	0	0	1
SURFACE.						
Smooth.....	500	48	All	78	10	9
Plicate.....	29	7	0	28	6	2
Nodulous.....	43	1	0	1	0	1
Sulcate.....	12	7	0	5	1	0
Spinous.....	2	0	0	0	0	0

It is not claimed that the marginal outline as given by Dr. Lea invariably indicates a definite type or section of the genus, for it does so only approximately; but this method of presenting the subject seems to be the best that is at present available. For example, the "wide"

form is only a more than usually elongate oval, and the real affinities of some of the quadrate forms are more nearly with the triangular than with some others of a quadrate outline. Indeed, the massive triangular, plicate, and nodulous shells are almost as distinctly North American in type as are any of those which are indicated in the foregoing table. However, the tabular groupings given in this paper exhibit somewhat clearly the characteristics of the North American *Unionida*, and especially the subordinate types of the genus *Unio*.

By observing the characteristics which this great family presents in different continents and in different parts of the same continent, one becomes strongly impressed with the idea that local or circumscribed influences, either near or remote, have variously modified its evolution. For example, omitting present consideration of many of the genera of the family, the living *Unionida* of Europe comprises very few species, all of which have a smooth or plain surface, and none have so massive a test as many of the American species have, nor are any excessively shortened, like the subrotund, quadrate, and other forms that are found in other parts of the world. The *Unionida* of the New England States are, as a whole, almost a counterpart of those of Europe, while the streams south of that region, which empty into the Atlantic and Gulf of Mexico, contain quite a different set of species and types. Again, the great Saint Lawrence River system, including the great lakes, has, compared with other North American rivers, a meager *Unione* fauna, so far as specific representation is concerned, and the rivers which empty into the Pacific Ocean have still fewer specific representatives of this great family. The waters of the great Mississippi River system not only contain the richest *Unione* fauna in the world, but even a casual examination will show that the fauna of this river system comprises nearly all the forms that have been so generally designated as North American types. The smaller rivers of the Gulf drainage not tributary to the Mississippi contain among their numerous species some of those peculiar types also; but few or none, other than the simpler forms, are found in those waters of North America that lie to the west, north, and northeast of the great Mississippi River system.*

The discovery in different parts of the world of so many fossil species of the *Unionida* in strata of different geological periods, extending back at least as far as the earlier Mesozoic epochs, and which ancient species differ so little in type from forms now living, suggests as legitimate and natural the inference that the living species are lineally descended from the fossil ones, and that they were not evolved in recent times in the waters that now form their habitat. We feel warranted in assuming that the conditions of *Unione* life have been preserved unbroken, in some cases at least, if not in others, notwithstanding the physical changes that have taken place during the Mesozoic and Tertiary periods.

* It is a significant fact that those North American rivers which contain the richest *Unione* fauna drain Mesozoic and Tertiary regions, while those that drain only Paleozoic and Azoic regions have a comparatively meager *Unione* fauna.

It has already been shown that the living *Unionida* of all Europe depart comparatively little from the primary typical oval form and smooth or plain surface. These are also the characteristics, so far as I am aware, of all the fossil species, except one, that are found in the strata of Western Europe, including those from the Wealden and Cretaceous rocks. The exception referred to is *Unio toulouzanii* Matheron, from the Lignitic strata of the department of the Mouths of the Rhone, which, while differing but little in form from the other fossil and living *Unionida* of Western Europe, is marked by small plications upon its postero-dorsal surface. In Slavonia, Croatia, Dalmatia, and other parts of Southeastern Europe, however, the fossil Tertiary species of *Unio* are much more numerous than the fossil species are in Western Europe, and also more numerous than the living species of the family are in the whole continent. Furthermore, a large proportion of the types of those fossil species of Southeastern Europe are as distinctively "North American" in character as those are which now live in the Mississippi River and its tributaries.

From these facts, the inference seems to be a natural one that the living *Unionida* of all Europe are descended from those which are represented by the Mesozoic and Cenozoic fossil species of the western part of that continent; while the line of descent of the fossil species of Southeastern Europe has evidently been cut off by disastrous changes of the physical conditions necessary to its perpetuity. The fact that these last-mentioned fossil species are identical in type with those of North America, presumably indicates, although it does not necessarily prove, a community of origin; in which case they must have reached their present separated regions by some ancient continental connection now destroyed. If this was not the case, it seems necessary to conclude that these geographical groups of identical types were produced in separate lines of descent, the whole evolutionary history of each having been confined to its own hemisphere; the European line ending before the close of the Tertiary period, and the American line continuing in full force, reaching its culmination in the fluvial waters of the present period.

Up to the present time, there have been twenty-four species of the *Unionida* discovered in the strata of Western North America, ranging from the Jurassic period to the earlier Tertiary, and without doubt many more species remain to be discovered there.

All except two of these species have the well-defined characteristics of true *Unio*, as that genus is defined and understood by the writer. One of these species is *Anodonta propatoris* White, from the Judith River group (Post-Cretaceous), and the other is *Margaritana nebrascensis* Meek, from the Dakota group (earlier Cretaceous). Less than one-half of these species of *Unio* have either the oval, elongate-oval, or arcuate outline and plain surface, while the others are of various types, a large proportion of them being peculiarly North American, with a tendency to excessive shortening of the shell in front of the beaks, in some cases

having the beaks projecting beyond the front. These last-named types are not confined to the strata of any particular epoch, but are found in those of Jurassic, Cretaceous, Post-Cretaceous, and Tertiary age.

It is these species of the *Unionidae*, among other fossil species of fresh-water and land Mollusks, that were referred to in the early part of this paper as the ancestral representatives of similar Mollusks now living in North America. Admitting this relationship by descent, one naturally inquires how the necessary conditions for a continuous progenital line could have been preserved from Jurassic, and doubtless much earlier, time to the present. As before remarked, this history, from the very nature of the case, can never be accurately known; but the following suggestions are offered concerning the assumed relationship of the fossil with the living *Unionidae* of North America.

All the fossil *Unionidae* of Western North America, so far as is now known, have been obtained from lacustrine strata, with one or two possible exceptions of what may have been estuary deposits, no evidence having been observed that any of those deposits are of fluvial origin. These lacustrine formations are of very great extent in Western North America, and, without doubt, the lakes in which they were deposited were caused by encircling bands of rising land during the elevation of the continent. These great land-locked waters were at first brackish, but finally became, and for a long time remained, fresh, continuing so until their final desiccation.

That many species of the *Unionidae* of the West not only originated, but became greatly differentiated, at earlier periods than those in the strata of which the oldest known species have been discovered seems quite certain, because those earliest species are found to be so greatly differentiated as to indicate the lapse of much time in the process, and it is interesting to note that among the results of this early differentiation was the production of some of the characteristics which we now recognize as peculiar to North American types. These earliest known American species may have been developed in either lacustrine or fluvial waters, or both, but it seems at least very probable that a large proportion of the fossil species that are related to living ones, especially the more differentiated forms, originated in the great lakes, in which the extensive Post-Cretaceous and Tertiary deposits were made, *and in waters that were at least a little salt*. That they did not originate by immediate evolution from marine species, which must necessarily have become land-locked when the great lakes were first formed, is suggested by the fact that other invertebrate species, such as would doubtless have survived with the *Uniones* by evolution into other species and genera, have not been discovered.

No trace, for example, of the genus *Dreissena*, various species of which are so common, both fossil and living, in the Old World, has yet been found in American strata, although its near relatives, *Mytilus* and *Modiola*, are not uncommon in the immediately underlying marine Cretaceous strata. The purely fresh-water fauna of those western deposits seems

to be without any more evidence of *immediate* relationship to marine species than that which the fauna of the present North American rivers possesses, although it may be assumed that primarily all Molluscan life must have originated in marine waters.

Every person familiar with the numerous species of *Unio* now living in the streams of the great Mississippi River system knows that different portions of the same stream are found to afford habitats for certain species that are more congenial to them than they are to other species. Thus the experienced collector expects to find certain species, among which are those of the more differentiated forms and thicker test, in the swifter waters and upon gravelly or rocky bottom, while other species will be found on sandy or muddy bottom and in stiller waters; and these latter species have usually the smooth or plain surface, thinner test, and oval or approximately oval form. As a rule, also, the *Unione*, as well as the other Molluscan, fauna of the lakes and ponds of North America is remarkably meager compared with that of the running streams. This may be in part due to the fact that the great lakes, and many of the smaller ones also, belong to the great Saint Lawrence River system, which, as before stated, possesses a comparatively meager *Unione* fauna.

But that this result is not wholly due to that cause is shown by the fact that the lakes and ponds which empty into streams that are rich in *Unionida* themselves contain comparatively few species, and these species almost always possess the same characteristics that those do which are found in the stiller portions of the streams into which the lakes overflow.

With these facts in mind, we should naturally expect to find the remains of a meager *Unione*, as well as other Molluscan, fauna in those great lacustrine Tertiary deposits of Western North America; and to find also the *Unionida* represented there by species having a smooth surface and oval or approximately oval form. This is exactly what is found to be the case in all those strata which bear evidence of having been deposited in purely fresh waters; but in those strata that bear evidence of having been deposited in waters that were a little salt, the *Unionida* are much more differentiated. Indeed, it is in the last-mentioned strata alone that those species of *Unio* have been found that possess the peculiar North American characteristics.

It is well known that the maximum of differentiation of Molluscan types takes place in marine waters; that it is much less in brackish waters; and that the minimum in this respect is reached in purely fresh waters. Judging from facts before stated, it would seem that those ancient *Unionida* were not only capable of living in waters that were a little salt, but that the influence of the salt upon them was such as is in a general way exerted by it upon all Molluscan life, producing a greater differentiation than would have been produced in fresh lacustrine waters, and such as has generally supposed to have been exerted upon the family in existing fluviatile waters. While it is not unreason-

able to assume that much of the differentiation that now prevails among the living North American *Unionidae* took place in purely fresh, and especially in fluviatile waters, the facts brought out by the study of the fossil forms seem to indicate plainly that the characteristics which we call "North American" have been directly inherited from those fossil species, and the probability also that the latter species received in Mesozoic and Tertiary times their differentiation under the influence of other conditions, among which was the diffusion of a small proportion of salt in the waters in which they lived. Before this proposition can be received without question, however, much careful investigation must be made; and it is especially desirable that numerous observations be made upon the *Unionidae* of various rivers at the meeting of fresh with salt waters.

If the progenital line of the North American *Unionidae* has remained unbroken from the earlier Tertiary epoch to the present time, as is believed to have been the case, it was doubtless accomplished through some streams that are now western tributaries of the great Mississippi River system, and which were then outlets of those great lakes in the deposits of which the fossil *Unionidae* are now found. It is comparatively easy to understand how this might have been the case with the lakes that formerly existed in what is now the Upper Missouri River region, because that river now runs through the region and has doubtless done so ever since the final desiccation of the great lakes there. The Green River region, however, which was the site of probably the largest fresh-water lake that ever existed on the North American continent, is now drained into the Gulf of California; but it is not at all improbable that, during its existence, this great lake had its drainage of overflow into the Atlantic by some stream that is now either a direct or indirect tributary of the Mississippi River, and that this was the channel through which the Molluscan fauna of that ancient lake was transmitted by lineal descent to the waters of the great existing river-system last named. It is not difficult to understand how the ordinary drainage of the region, after the desiccation of the lakes which had occupied so large a part of it, might have become turned toward the Pacific instead of the Atlantic Ocean, by the continuation of those varying changes of elevation of different portions of the continent which caused the desiccation of the lakes, and produced or modified other great features of the gradually growing continent. Indeed, the fact that the Molluscan fauna of the great Colorado River system is very meager, and unlike that of the great fresh-water deposits of the region which it drains, and that it contains none of those types so often referred to as distinctively North American, while the great Mississippi River system constitutes the great habitat of those types now living, seems to afford presumptive proof that the drainage of overflow from the great lakes of what is now the Green River region was into streams that have since become tributaries of the Mississippi.

ART. XXIV.—PALEONTOLOGICAL PAPERS NO. 5.—REMARKS ON
THE PALEONTOLOGICAL CHARACTERISTICS OF THE CENO-
ZOIC AND MESOZOIC GROUPS AS DEVELOPED IN THE GREEN
RIVER REGION.

BY C. A. WHITE, M. D.

No strata of Carboniferous age in Western North America have yet been found to contain any fossils that are referable to a fresh-water habitat. In the Jurassic strata of different portions of that region, however, some fresh-water Mollusks have been discovered, and a still greater number have been obtained from the strata of different Cretaceous, Post-Cretaceous, and Tertiary groups, becoming more and more abundant in the order of time. There is sufficient evidence to show that over what is now the western part of the continent, the marine condition which prevailed through Palæozoic time began in Mesozoic time gradually to give place to partially land-locked seas, and finally to great lakes of fresh waters, which changes were caused by the gradual elevation of the continent. In these waters, both marine and fresh, the deposits went on continuously, notwithstanding the important physical changes that were simultaneously in progress, so that we now find an essentially unbroken series of strata ranging from Paleozoic time far into the Tertiary period. Although there existed during the last-named period such immense fresh-water lakes upon that portion of the continent, the areas occupied by fresh water were probably not very extensive until after the epoch of the Wahsatch group had well progressed. This inference is drawn from the fact that all the fresh-water deposits that have been discovered among the strata of earlier groups are very limited, and the brackish condition of the waters is known to have prevailed for a considerable time after the beginning of the Wahsatch epoch.

As a partial but not essential modification of the statements just made, it should be mentioned that the character of the invertebrate fossils hitherto found in the Laramie group indicate that few, if any, of its strata were deposited in open sea waters, but rather in wholly or partially land-locked brackish waters, with here and there localities where they were nearly or quite fresh. It is a continuation of these conditions that have just been referred to as prevailing in the early part of the Wahsatch epoch, when they finally gave place to a wholly fresh-water condition that continued through all the succeeding epochs.

During the time of the Laramie epoch and the early part of the Wahsatch, there were, in the vicinity of the Uinta Mountains, the uplift

of which was then in progress, certain oscillatory movements, one of which produced some unconformity of the Wahsatch upon the Laramie group. At a distance from the mountains, this unconformity is very slight, or perhaps wanting; and it is not improbable that we may yet discover localities where the strata of the Laramie group pass so insensibly into those of the base of the Wahsatch group that the latter strata must necessarily be included in the first-named group. The final change from brackish to fresh waters took place during what is now understood to be the early part of the Wahsatch epoch, and unaccompanied by any disturbance of the already deposited strata, at least in the region where these groups have been studied, and also with no perceptible change in the character of the sedimentary material that continued to be deposited in the freshened waters. The exact nature of the change in the physical conditions of the region which caused the final banishment of salt from the waters in which it had lingered so long after the cessation of true marine conditions, without materially changing the character of the sedimentation over so large an area, has not been investigated; but the final freshening of the waters was doubtless accomplished through the complete inclosure, by elevated land, of the large aqueous areas, save some free outlets for the drainage of overflow.

With the final freshening of the waters in the Wahsatch epoch ceased all considerable saline-water deposits, at least in the region embracing Southern Wyoming and the adjacent parts of Colorado and Utah. The affinities of all the fossils found in those subsequently deposited strata of the Wahsatch, Green River, and Bridger groups, aggregating a mile in thickness, are with such forms as are now found living only in fresh waters.

It is true that Professors Cope and Leidy have described two or three species of Herring from the shales of the Green River group; and Professor Cope speaks of those strata in connection with the Fish remains as a brackish-water deposit. But it is not thought necessary to infer the presence of salt in those waters in any proportion from the presence of the Clupeid remains, because there appears to be no reason to suppose that they were not land-locked species, permanently inhabiting the Green River Tertiary lake. Even if they were migratory species, they doubtless went to that lake to spawn, as some species of Herrings now go from marine to fresh waters for the same purpose. The known limits of the deposits of that ancient lake, as well as those of the marine deposits of similar age, show that the shortest route from marine waters to the lake by any outlet it may have had was too long to allow Fishes so small as they were to reach the lake during the time the reproductive impulse was upon them. These fossil Clupeids were therefore not probably migratory, but they doubtless permanently inhabited the fresh waters of the Green River lake.

An examination of the fossils obtained from the Dakota, Colorado, and Fox Hills groups, as they are developed in Southern Wyoming and

the adjacent parts of Utah and Colorado, whether vertebrate or invertebrate, will leave no question in the mind of a paleontologist as to their Cretaceous age. A similar examination of the fossils of the Green River and Bridger groups will disclose equally conclusive evidence of their Tertiary age. There are two other groups that come in the series between the Fox Hills group below and the Green River group above that contain fossil remains concerning which paleontologists are divided in opinion. These are the Laramie and Wahsatch groups, the relations of which to the other groups here mentioned are shown in a table embraced in Paleontological Paper No. 4. It is therefore certain that the plane of demarkation between the Cretaceous and Tertiary, if such really exists in nature, must be sought for within the vertical limits of these two groups. It should be remarked, however, that all geologists and paleontologists, so far as I know, agree in referring to the Tertiary period all of the Wahsatch group as I have defined it, except some 500 to 800 feet of strata that form its base.

These lower strata contain a greater or less proportion of brackish-water species of Mollusks, which are very closely allied with those of the Laramie group, while the upper portion of the former group contains only fresh-water species, all of which are closely related to those of the Green River group above it. Therefore the debatable ground is reduced to the Laramie group, together with the lower portion of the Wahsatch group. Some hold the opinion that all the strata thus included should be referred to the Cretaceous period; others have been inclined to refer the whole to the Tertiary; and still others select the upper limit of the Laramie group as the proper plane of separation between the strata of the Cretaceous and Tertiary periods. These differences of opinion would alone suggest that no well-marked plane of separation, either stratigraphical or paleontological, really exists in that region between the strata of the Cretaceous and Tertiary periods, even if more direct evidence were wanting. Dr. Hayden first,* and very plainly, pointed out the fact that no definite plane of demarkation between the Cretaceous and Tertiary strata could be designated. This is indeed just what we ought naturally to expect where the geological series is complete, and the deposition of sediment was continuous or nearly so. In such a case, there is no reason in nature to expect either the stratigraphical or paleontological transition from the uppermost Cretaceous to the lowest Tertiary group to be any more abrupt than it is between any other groups of those periods respectively.

The differences of opinion before referred to are understood to be largely due to the special character of the subjects of investigation respectively pursued by each observer; for it is evident that the various evolutionary currents of faunal and floral life were not synchronous in the rate of their progression through geological time. For example, it is a well-known fact that the evolutionary advance of the vegetable king-

* See his Annual Report for 1870, pp. 165-166.

dom has been greater on this continent than it has been in Europe. Hence, a student of the flora of these American strata, using a series of European standards, would naturally refer those which he found to contain certain vegetable forms to the Tertiary period, while the associated or superimposed remains of animal life might all show them to be of Cretaceous age, according to the same series of European standards.

The fact that the physical changes which took place in Western North America during the Mesozoic and Cenozoic periods were very gradual, and without any important break, is of itself sufficient to lead us to expect to find those animals whose existence was not necessarily affected by a change from a saline to a fresh condition of the waters, would be found to have propagated their respective types beyond the period which those types in their culmination distinctively characterized. Thus the discovery of these perpetuated types that in their culmination distinctively characterized the Cretaceous period does not necessarily prove the Cretaceous age of those strata, because they are evidently the last of their kind, and because all the other known fossil remains of the group are indicative of a later period.

Again, the plants that have been found in the Dakota group when first discovered were, by European standards, referred to the Tertiary period, until it was found that all the other Cretaceous groups of the Western North American series belong above the one that contained them. These may serve as extreme examples of acceleration on the one hand, and of retardation or prolongation on the other, of the evolutionary life-currents before referred to; and as such they are exceedingly significant.

These currents have been very variable also among invertebrate animals, the *Mollusca* of marine, brackish, and fresh waters affording striking examples. In marine waters, these animals have, from early geological times, attained a maximum of wide and various differentiation, in brackish waters much less, and in fresh waters a minimum. The value of their remains as indices of the geological age of the strata containing them is therefore in a similar ratio, those of marine origin being of much the greatest value, and those of fresh-water origin the least. Indeed, the evolutionary life-current among the latter, as well as among the land Mollusks, has been so sluggish that alone they are of comparatively little value to the geologist in determining the geological age of the strata in which he finds their remains. For example, if it were not for the known stratigraphical relations of the brackish- and fresh-water Wealden deposits of Europe, no paleontologist would be justified in referring them to Mesozoic rather than Cenozoic age. Many other, but less widely known, examples might also be cited from our Western North American strata.

With a few doubtful exceptions, none of the strata of the Laramie group were deposited in open-sea waters; and, with equally few exceptions, none have yet furnished invertebrate fossils that indicate the

Cretaceous rather than the Tertiary age of the group. These latter exceptions are some *Inocerami* that have been obtained upon the lower confines of the group, and doubtfully referred to it rather than to the Fox Hills group below; and also a species of *Odontobasis* from strata near the top of the group, two miles west of Point of Rocks Station, Wyoming. The latter genus, established by Mr. Meek, is comparatively little known, but it was regarded by him as characteristic of the Cretaceous period. This constitutes the slender evidence of the Cretaceous age of the Laramie group that invertebrate paleontology has yet afforded.

Again, the brackish- and fresh-water types of *Mollusca* that are afforded by the Laramie and the lower portion of the Wahsatch group are in most cases remarkably similar, and some of the species of each group respectively approach each other so nearly in their characteristics that it is often difficult to say in what respect they materially differ. Moreover, they give the same uncertain indication as to their geological age that all fossils of fresh- and brackish-water origin are known to do.

It is in view of the facts here stated, and also because I believe that a proper interpretation of them shows the strata of the Laramie group and the base of the Wahsatch to be of later date than any others that have hitherto been referred to the Cretaceous period, and also earlier than the Eocene epoch, that I have decided to designate those strata as Post-Cretaceous, at least provisionally.

ART. XXV.—PRECURSORY NOTES ON AMERICAN INSECTIVOROUS MAMMALS, WITH DESCRIPTIONS OF NEW SPECIES.

BY ELLIOTT COUES,

Captain and Assistant Surgeon U. S. A., Secretary and Naturalist of the Survey.

Although the material before me for a monographic revision of the American *Insectivora* is much greater than has been at the command of any previous investigator, I am not yet prepared to announce the final results of my study, there being several points still awaiting determination. Meanwhile, however, I think it advisable to publish without delay descriptions of such species as appear to be unquestionably new and valid, together with a number of other points which I consider established. These relate largely to the recognition of the excellent subgeneric distinctions which subsist among the *Soricidae*. These notes may be considered preliminary to a monograph of the American *Insectivora*, now in preparation, the publication of which, however, may be long delayed.

Very little has been done with these Mammals since 1857, when Professor Baird* so greatly increased our knowledge of the subject. Though the species admitted by him at that date, upon consideration of the very limited material then at his command, require to be largely reduced, all the generic and subgeneric distinctions indicated by him are confirmed. The species additional to those given by him rest without exception upon specimens not at that time available. In 1861, the same naturalist reviewed the subject, making many new and important determinations, which, however, have never been published. Most of the new subgenera and species to be described in this paper are derived from his MSS., which he very generously placed at my disposal, when all the material contained in the National Museum, Smithsonian Institution, was given into my hands for elaboration.

The principal contributions to the knowledge of the subject since 1857 have been made by J. A. Allen and T. Gill. The former reviewed the genus *Blarina*,† coming to the conclusion, not supported by larger experience, that all the species of this genus were reducible to one, considering that Baird's section of *Blarina* with 30 teeth was based upon

* Mammals of North America, 1857, pp. 4-77.

† Catalogue of the Mammals of Massachusetts: with a Critical Revision of the Species. < Bull. Mus. Comp. Zoöl., Cambridge, i, No. 8, pp. 143-252. 1863. (*Blarina*, treated at pp. 213-221.)

the immature dentition, and suggesting that such was probably also the case with the corresponding section of *Sorex* with 30 teeth. But these sections are perfectly valid, and to them I add a third, in *Sorex*, of 28 teeth. In 1875, Dr. Gill* elaborately reviewed the Insectivorous Mammals at large, and proposed, mainly upon the basis of St. George Mivart's † investigations, verified by original examination of much material, a classification of the order believed to be the best yet presented. This valuable article is especially full in its treatment of the two North American families, *Talpidae* and *Soricidae*, and gives an extensive bibliography, but scarcely touches upon the characters of the genera and species.

Among other points may be mentioned the determination, by Professor Verrill, ‡ of the *Sorex palustris* of Richardson as a valid species of *Neosorex*; and the identification by Hr. Peters § of the *Scalops latimanus* of Bachman with *S. townsendi* of same author.

The most noteworthy laborer in this field before 1857 was Dr. Bachman, whose results, however, required much remodeling. The determination of his *Sorex fimbripes* was made by Professor Baird in 1861 from examination of the type, but is now first published in this paper.

§ 1.—THE AMERICAN GENERA OF *TALPIDÆ*.

America furnishes four good genera of Moles, namely, *Scalops*, *Scapanus*, *Condylura*, and *Urotrichus*. The last-named belongs to a special subfamily, *Myogalinae*, primarily distinguished from the *Talpinae* by the characters of the scapular arch and fore limb. It is related to the *Desmans* of the Old World, and is the only known insectivorous genus common to both hemispheres, furnishing one of the many evidences of a relation between the faunas of Western North America and Asia closer than that subsisting between Eastern North America and Europe. *Scalops* and *Condylura*, remarkable genera peculiar to America, have been recognized almost from the first; but the very strong claims of *Scapanus* to full generic rank have not been generally conceded. The genus differs so widely in dentition from *Scalops* that it would accord more closely with modern valuation of generic characters to give it full rank and subdivide it into two subgenera for the accommodation of its two remarkably distinct species, than to force it under *Scalops*, from which it differs more than some of the Old World genera do from each

* Synopsis of Insectivorous Mammals. < Bull. U. S. Geol. and Geogr. Surv., 2d ser., No. 2, pp. 91-120. May 14, 1875.

† Notes on the Osteology of the Insectivora. < Journ. Anat. and Phys., i, 1867, pp. 281-312; ii, pp. 117-154. (French translation: Notes sur l'Ostéologie des Insectivores. . . < Ann. Sc. Nat., 5e sér., zool. et paléont., viii, 1867, pp. 221-284; ix, 1868, pp. 311-372.)

On *Hemicentetes*, a new genus of Insectivora, with some additional remarks on the osteology of that order. < Proc. Zool. Soc. Lond., 1871, pp. 58-79, pl. v.

‡ Proc. Bost. Soc. Nat. Hist., ix, 1862, pp. 164-172, 225, 226. The same determination had been made by Baird in 1861 (MS. ined.).

§ Monatsb. Königl. Preuss. Akad. Wissensch. Berlin, 1863, p. 656.

other. In fact, it is scarcely less distinct from *Scalops* than from *Talpa* itself.

In this connection, I may notice the repeated ascription of "*Talpa*" to this country. The allegations to this effect have apparently arisen in two ways: from pure assumption and from mistaking of *Scapanus breweri* for *Talpa europæa*. The superficial resemblance of these two species is really curious; so close is it that casual examination might easily fail to detect any difference in external characters. Audubon and Bachman allude to specimens observed in the Museum of the Zoölogical Society of London marked "*Talpa europæa* from America".

Recent researches render it most probable that the current dental formulæ of our genera require to be reconsidered—not as to the total sum of the teeth nor as to their physical characters, but as to their morphological relations and their homologies. This is a subject, however, upon which I do not propose now to enter.*

§ 2.—THE AMERICAN SPECIES OF *TALPIDÆ*.

For aught that we now know to the contrary, the determination of our species offers no difficulty, if we regard the *Scalops argentatus* Aud. & Bach. as at most no more than a geographical race of *S. aquaticus*. The authors themselves were only "induced after some hesitation and doubt to designate it as a new species" (Quad. N. A., iii, p. 253), and Baird questions "whether the two can with entire propriety be separated" (Mamm. N. A., p. 63). It is certain that none of the ascribed characters are infallibly diagnostic.

No further material bearing upon the relationships of *Urotrichus gibbsii* and *U. talpoides* having come to hand, the case remains as Baird left it.

My present determination of our *Talpidae* gives the following results:—

Family TALPIDÆ.

Subfamily TALPINÆ.

Genus *Scalops*, "Cuv. 1800".

1. SCALOPS AQUATICUS (L.).

Talpa flavescens, Erxl.—*T. fusca, purpurascens*, Shaw.

Scalops canadensis, Desm. (nec Rich.).—*S. pennsylvanica*, Harl.

1 a. SCALOPS AQUATICUS ARGENTATUS (Aud. & Bach.).

S. argentatus, Aud. & Bach.

* Cf. Spence Bate "On the dentition of the common mole (*Talpa europæa*)", Ann. Mag. Nat. Hist., xix, 1867, pp. 377-381, plate; and Trans. Odontogr. Soc. Lond., v, 1867, pp. 261-294, pl. vi; also Mosely and Ray-Lankester "On . . . the dentition of the mole" . . . , Journ. Nat. and Phys., iii (2d ser. ii), 1869, pp. 73-80, pl. ii, figs. 5, 6.

Genus *Scapanus*, Pomel, 1848.

2. SCAPANUS TOWNSENDI (Bach.).

Scalops townsendii, *S. latimanus*, Bach.—*S. canadensis*, Rich. (nec auct.).—*SS.*
metallescens, *aneus*, Cass. *—*S. taniata*, Le C.†—*S. californica*, Ayres.‡

3. SCAPANUS BREWERI (Bach.).

(" *Talpa europæa ex Americâ* ", Aliq.)

Genus *Condylura*, Ill., 1811.

4. CONDYLURA CRISTATA (L.).

Sorex cristatus, L.—*Talpa longicaudata*, Erxl.—*T. radiata*, Shaw.—*T. longicauda*,
Bodd.—*C. macroura*, Harl.—*C. prasinata*, Harris. §

Genus *Urotrichus*, Temm., 1842.

5. UROTRICHUS GIBBSI Bd.

(?= *U. talpoides*, Temm.)

§ 3.—GENERAL REMARKS ON THE *SORICIDÆ*.

Study of our Shrews will not give results with requisite precision, no matter how great the accessions of material, until we know more than we have yet learned of the limits of geographical and individual variation to which the same species may be subject. I am not aware that a single one of our species has yet become fully known in these respects, and we are still obliged to rely somewhat upon analogies which the cases of better known European species may afford. In treating of *Blarina talpoides* from this point of view, Mr. J. A. Allen (*loc. suprâ cit.*) certainly overreached the mark; yet enough has been ascertained to render it certain that he was right in insisting that a much wider range of geographical and individual variation exists than is admitted, infer-

* 1853.—Cassin (J.).—[Exhibition of a new mole, *Scalops metallescens* (descr. nulla).] <Proc. Acad. Nat. Sci. Phila., vi, Feb., 1853, p. 242.

[Described, *ibid.*, p. 299, as *S. aneus*.]

1853.—Cassin (J.).—Description of a new mole of the genus *Scalops*, from Oregon; a specimen of which is in the collection of the Exploring Expedition made by the U. S. ships *Vincennes* and *Peacock*, under the command of Captain Charles Wilkes, of the United States Navy. <Proc. Acad. Nat. Sci. Phila., vi, 1853, p. 299.

[*S. aneus*—named, not described, *ibid.*, p. 242.]

Mr. Cassin, whether intentionally or inadvertently, applied these two names to the same specimen.

† 1853.—Le Conte (J.).—[Remarks on the species of *Scalops* in the Collection of the Philadelphia Academy.] <Proc. Acad. Nat. Sci. Phila., vi, June, 1853, pp. 326, 327 (name on p. 327).

‡ 1855.—Ayres (W. O.).—"On *Scalops californicus*." <Proc. Cala. Acad. Sci. i, May, 1855, p. 54.

§ 1825.—Harris (T. W.).—"Description of a nondescript species of the genus *Condylura*." <Boston Journ. Philos. and Arts, ii, 1825, pp. 530, 533. (Also, Tilloch's Philos. Mag., lxxvii, 1826, pp. 191-193.)

entially or in practice, by most authors. The only question is, how much to allow. It is also certain that the recognized species must be largely reduced in number, specific characters having been too often drawn from features which can be proven to not hold good.

The study of these diminutive quadrupeds would be difficult under the most favorable circumstances; and the kind of material that reaches us increases the difficulty. The skins are for the most part indifferently or very poorly prepared, and unaccompanied by cleaned skulls; while neither these nor the smaller number of alcoholic specimens are, as a rule, accompanied by the data requisite for their satisfactory utilization. They are generally unmarked for sex (difficult or impossible to determine from dried preparations at least) or date of capture. Measurements of dried skins are never more than approximately correct, frequently give very fallacious results, and must always be taken with allowance for probable error. This, in the case of such small objects, gives rise to much uncertainty. The date of capture is a very important item; for the seasonal changes of the pelage are evidently as decided as they are in the cases of animals better known in this respect, though terms expressive of length, fullness, softness, etc., of the fur continually recur in descriptive writing, without a hint as to what seasonal condition may be in point. To render such terms available in diagnosis, the date of capture must be known.

Similar remarks apply to the coloration. Color is unquestionably a good specific character in many or most cases, perfectly reliable within certain limits, or rather within limits still uncertain. Color-variation in this family is presented under three conditions (aside from purely individual variation in this respect), namely, with age or sex, with season, and with geographical distribution—none of which have hitherto received sufficient attention on the part of American writers. I am not aware that the first-mentioned variations have entered to any appreciable extent into the establishment and description of species; and I must confess my own very slight knowledge of the subject. Seasonal color-variation I know to be much greater than has ever been practically recognized by our writers, most of whom seem to have never even suspected its extent. In the Arctic material before me are some very striking illustrations of this variability in color. Under certain conditions of the change of pelage, specimens normally concolor or imperfectly bicolor show a narrow dark stripe along the back, sharply defined against rich-colored sides, the resulting pattern of coloration being comparable as to sharpness of effect with the pelage of a Weasel during the change from the summer to winter coat. I hope to enlarge hereafter upon this subject, which is one that no author, so far as I know, has adequately presented. The geographical variation in color is a third point which demands careful consideration. My studies up to the present go to show a very interesting parallelism with the state of the case I have determined for other small Mammals, notably the Mice

and Gophers, and which my friend Mr. Allen has admirably brought out in his studies of the Squirrels. In some cases, I find almost identical effects of climatic or other conditions upon the Shrews and the Mice of particular localities, by which they both acquire the same *facies loci*.

Present indications are that the normal variability of the Shrews in size, shape, and color is not less than has been determined to hold good in various other families of Mammals. But our species have yet to be handled with full appreciation of this fact, and revised accordingly.

Besides these general conditions of variability, there are some peculiar to *Insectivora*. The tail and lips, if not also the feet, are known to undergo extraordinary changes in connection with the rutting season. The remarkable swelling of the tail of the shrew-like Mole, *Condylura cristata*, finds its representation, if in less degree, among the Shrews, associated with tumidity of other parts. These facts are known at large, yet their practical application in the discrimination of species has been too limited. The implication of all such terms as "pachyurus", "longirostris", "platyrhinus", must be cautiously accepted.

The skull and teeth offer a ready means of throwing our species into genera and lesser groups, and no step in the study of the Shrews can be safely taken without examination of the cranial and dental characters. The skulls which come into our hands are very commonly mutilated or defective as to the back part, such is the fragility of the cerebral portions; but fortunately the rostral portion, including the jaw, is unusually strong for its size, and, with the teeth, is generally available for study. The dental armature of the Shrews is singularly powerful, far surpassing, in relative strength, that of the large Carnivores.

Notwithstanding assertions of authors to the contrary, the number of the teeth of the Shrews is constant in the same species. Replacement of the temporary teeth is said to occur in the foetus; at any rate, specimens occur so young that the teeth are still encapsuled in membrane, which, nevertheless, show the normal adult number and permanent relative position when this envelope is torn off. All the American Shrews hitherto known have either 32, 30, or 28 teeth. The number in the lower jaw is the same for all, namely, 12. The difference in the upper jaw occurs in the "lateral" teeth intermediate between the large anterior incisor and the first molariform tooth. It has been wrongly supposed by at least one author that the *Blarina* and *Sorex* of 30 teeth were respectively the young of those of 32 teeth. In the case of the 30-toothed *Sorex*, the validity of the numerical distinction is curiously proven by the fact that it is not the minute tooth immediately preceding the large molariform premolar which is wanting, but one of the preceding premolars. The minute tooth is there still, but it is preceded by only 3 instead of 4 lateral teeth. In the new subgenus proposed beyond, in which there are but 28 teeth, it is the same premolar which is wanting.

We have no known white-toothed Shrews in America, like *Crocidura aranea*, though in our 28-toothed species the points of only a few anterior

teeth are colored, and these but slightly. In all the rest, the teeth are heavily pointed with color, as in *Sorex vulgaris* of Europe, with which our *Sorices* of 32 teeth are strictly congeneric. This color is usually described as "chestnut"; it varies much in intensity, from piceous reddish-black, through rich burnt sienna, to quite light and bright red. The younger teeth appear to be the more heavily colored; they take color with their early development. Since, too, it is their points that are most heavily colored, wearing of the dentition gradually lightens the tint at the same time that it decreases its extent.

The Shrews are remarkably voracious animals, like the Moles, requiring a large supply of food, and the ceaseless working of their jaws results in attrition of the teeth to such degree that the appearance is greatly altered with age. In extreme cases, the cusps of the molars, ordinarily so conspicuous, are entirely ground away, the premolars are reduced to mere stumps, while the fangs of the upper incisors and the curious denticulations of the lower incisors suffer quite as much. Teeth of the same or very closely allied species vary remarkably in their appearance as a whole, probably according to age; the variation being (besides the actual shortening of the teeth) in the apparent set or "dip" of the anterior teeth, the degree to which they are "tiled" or imbricated at base, and in the obliquity with which the anterior incisors connive. The precise nature and purport of these observed differences in the same or closely allied species, and the reliability of certain assumed specific characters thereby afforded, remain matters for further investigation.

I may here allude, however, to the curious fact first pointed out by Professor Baird, and which I have verified, of the modification of the premolar dentition which the Western species collectively, as compared with the Eastern, have undergone. A striking peculiarity of all the Western species, no matter how diverse in other respects, is to have the "third premolar" decidedly smaller than the "fourth"; while, in all the species east of the Rocky Mountains (with one possible exception), the same tooth is as large as or larger than the other. Of the fact there is no question; it may be observed in an instant, and is unmistakable. Its significance is another thing. Some of the Western species are scarcely distinguishable, if at all, from their respective Eastern analogues, except by this character, and they all show it. It is even repeated in *Neosorex navigator*, as compared with *N. palustris*. What relation this condition bears to the Pacific fauna it is difficult to understand. We may practically recognize it in two ways: by giving it prominence as a leading feature, by which two groups of *Sorex* proper may be discriminated, or by reducing it to merely a secondary character of certain species, irrespective of geographical distribution. To pursue the former course would be to rather widely separate certain species hardly or not distinguishable except by this technical character; to adopt the latter alternative would be to ignore a generalization equally legitimate and curious, that may have important if unsuspected rela-

tions with the determination of faunal areas. At present, I am inclined to follow Professor Baird in the appreciation of this character.

Certain other relative proportions of the anterior lateral teeth of the Shrews, which Professor Baird used as means of pushing the analysis of the species still further, seem to be of decidedly less applicability, even if they do not fall wholly within the limits of individual variation of particular specimens examined. These, therefore, I shall not bring into consideration of the question.

I may add here that no American Shrew is known to possess fewer than 28 or more than 32 teeth, though various authors have miscounted from 26 to 36, in the one case overlooking a minute premolar, in the other counting the posterior cusp of the upper anterior incisor as a distinct tooth. *Genera* have been founded on each of these blunders.

§ 4.—GEOGRAPHICAL DISTRIBUTION OF THE AMERICAN SPECIES OF *SORICIDÆ*.

Shrews have been commonly supposed, or tacitly represented, to be wanting in the warmer parts of America. Many years ago, however, J. E. Gray named two species of "Corsira" from Central America, and I have specimens from different localities in Mexico and from Costa Rica, whence only one* species has hitherto been described. No repre-

* *BLARINA* (*SORICISCUS*) *MICRURA*, Coues.

Corsira tropicalis, GRAY, P. Z. S., 1844, . . . , descr. nullâ (fide E. R. Alston in epist.).

Sorex micrurus, TOMES, P. Z. S., 1861, 279 (Guatemala, coll. Osbert Salvin).

HAB.—Guatemala (Salvin). Costa Rica (Carmiol).

This is a 30-toothed *Blarina* (subg. *Soriciscus*), very closely related to United States species like *B. cinerea*, *B. exilipes*, and *B. berlandieri*, if really distinct. As I have not finished my examination of the specific differentiation of this group, I should not here notice the supposed species were it not already described and did I not wish to indicate its proper generic and subgeneric position.

A short time ago I sent a number of Shrews to my valued correspondent Mr. E. R. Alston, of London, begging him to compare them with the types of certain species preserved in the British Museum. I receive his answer just in the nick of time, as these sheets are passing the press. He identifies my British American specimens with types of Sir John Richardson's species described in the F. B.-A., so that this matter will be placed beyond dispute as soon as I get ready to use the important information thus kindly communicated by Mr. Alston.

Among the Shrews sent to him was a specimen from Costa Rica (coll. J. Carmiol), of which he states:—"I have little or no doubt that it is the same as *Sorex micrurus* Tomes . . . I have not access to Mr. Tomes's types, but I have examined another of Mr. Salvin's specimens, in spirits, and have no doubt your animal is the same. I also believe that Gray's *Corsira tropicalis* is the same, though the types look darker from dirt."

Mr. Alston writes further:—"Gray's *C. temlyas*, afterward renamed in MS. *C. teculyas* is a large species, apparently a true *Sorex* . . ." Not to anticipate the description of the species, which I trust we shall have from Mr. Alston in due time, I thus merely allude to the apparent presence of *Sorex* proper in Central America, as the *Soricidæ* have not hitherto been ascertained to be represented there excepting by the genus *Blarina*, nor indeed south of the United States excepting by *Blarina* and by the beyond-described new subgenus and species of *Sorex*.

sentatives of the *Soricida*, or, indeed, of the order *Insectivora*, are known in South America.

In North America, the differentiation of the *Soricida* into genera and species has progressed farthest in the temperate and cold-temperate portions of the continent. Shrews occur throughout British America and the United States, from Atlantic to Pacific, and north to the very shores of the Arctic Ocean. These diminutive quadrupeds are endowed with wonderful powers of resisting cold, generating heat enough in their small bodies to endure the rigors of hyperborean winters. Their rapacity, voracity, and salacity are of the highest order, and they are incessantly active, never hibernating, but running freely about on the snow during the long Arctic winters. In the high north, the species are few, but individuals abound, comparable in numbers with the Arvicolas and Lemmings which swarm in the sphagnous regions of the Arctic zone. The genus *Sorex* alone is known to occur in the higher latitudes, where it is represented by the subgenera *Sorex* proper (one species being very near *S. vulgaris* itself) and *Microsorex*, the latter only just now ascertained to extend to the region of the Yukon River.

Somewhat farther south, in Northern United States and contiguous portions of British America, the genera and species multiply directly. Here we encounter *Neosorex*, and with it or directly after it *Blarina*, the latter being the most characteristic American genus of the family. Species of *Neosorex* are known to occur from Nova Scotia and New England across to Washington Territory and Oregon, and south along the Rocky Mountain chains to New Mexico. It is not yet time to map its distribution. I suspect that its dispersion is wider than now known. I anticipate its occurrence in Alaska and other northern regions, where the present evidence of its absence is wholly negative; but I rather presume that its southward extension may prove to be really limited much in the way just indicated. It seems to find its centre of abundance in interior cold-temperate regions, as those of the Red River of the North and the Great Lakes.

Sorex proper occurs throughout the United States; at any rate, it cannot be supposed absent from any single area, so extensively is it represented by specimens now in our hands. Three or more species are peculiar to the Pacific Province of the United States; others are generally dispersed, but most abundant in individuals in northerly portions of the United States, where also occur the majority of the species. Exclusive of the peculiar Pacific ones, all the described United States species occur in New England or along the northern tier of States, this being also the United States distribution of the single known species of the subgenus *Microsorex* (*M. hoyi*), though the entire distribution of the latter must not be presumed to be known as yet.

The remarkable new subgenus *Notiosorex*, to be described on a succeeding page, is found in New Mexico and at Mazatlan, Mexico; it is, with one exception, the only representative of the genus *Sorex* known to occur

south of the United States, the subtropical extension of the family further being represented, as far as is now known, only by one or two species of *Blarina*, and by the still undescribed species of *Sorex* (?) named *Corsira temlyas* by Gray.

Blarina, the genus of *Soricidæ* which contains the most species among those peculiar to this continent, is on the whole rather southerly in distribution. It is not known to occur much beyond the northern border of the United States, nor has it been detected on the Pacific side. A species of *Blarina* proper (*i. e.*, of *Blarina* with 32 teeth) is the commonest representative of the family in New England and adjacent portions, and with another species (or variety) extends more sparingly into a part at least of the Southern States. Westward, I have no specimen of this subgenus beyond the plateau-region whence Say described the original "*Sorex*" *brevicauda*; but it probably reaches the Rocky Mountains at least. *Blarina* of 30 teeth is still more decidedly southerly. I am not aware that it is known north of the Middle States, and it appears to be the most abundant and characteristic representative of *Soricidæ* in various South Atlantic States, as the Carolinas and Georgia. One species (if not also a second) occurs throughout the Southern States, and extends through the Western States to Kansas and Nebraska, if not farther, and at least as far north as Council Bluffs. This same subgenus, to be characterized beyond as *Soriciscus*, extends through Mexico to Costa Rica, being represented south of the United States by at least two species. With the exception of one Mexican species of *Sorex* (*Notiosorex*), and one Central American species, perhaps a true *Sorex*, it is the only known subtropical representative of the *Soricidæ*.

§ 5.—DETERMINATION OF THE AMERICAN GENERA AND SUBGENERA OF *SORICIDÆ*.

According to reliable authority, the Old World Shrews occur under three principal modifications, represented by as many leading genera and their respective intimate associates. These three are *Sorex*, *Crocidura*, and *Crossopus*.

Sorex, the most generalized type, is the only one which is known to occur in America. With its Old World subdivisions I am not familiar. *Paradoxodon* and *Soriculus* appear to be the most prominent. The American species of *Sorex* are nearly all strictly congeneric with *Sorex vulgaris*,* having 32 colored teeth. I am uncertain to which one, if to any one, of the subdivisions the type *Microsorex* of 30 colored teeth may belong. We have nothing in America exactly like *Crocidura* (type *C. aranea*) of 28 uncolored teeth; but the new subgenus *Notiosorex*, of 28 nearly colorless teeth, large naked ears, etc., seems to answer for this type. *Crossopus*, embracing the Old World Water-shrews of 30 colored

* Which I here consider the type of *Sorex*, though some authors restrict the name to a species with white teeth (*Hydrosorex* Duv., 1834).

teeth, large fringed feet, and long keeled tail, finds its strict representative in the American genus *Neosorex*, which includes equally aquatic species, with large fimbriate feet, though the tail is scarcely carinate with hairs, and the teeth are 32 in number.*

Blarina with its several species is the most characteristic American genus, and the most prominent of those peculiar to this continent, having no exact Old World analogue. It is well marked by the structure of the small external ears, invisible on ordinary inspection, very short tail, and a special condition of the dentition, although the number of the teeth, 32 or 30, is the same as in *Sorex*. Like the latter, it is divisible into subgenera, according to the number of the teeth; *Blarina* proper (type *brevicauda*) having 32 teeth, while there are but 30 in the section *Soriciscus*, defined beyond.

Following are the diagnostic characters of the American genera and subgenera of *Soricidae*, with their respective synonyms:—

I. Genus NEOSOREX, Baird, 1857.

Sorex, sp., RICH., F. B.-A., i, 1829, 5. (*S. palustris*, orig. descr. in Zoöl. Journ., iii, No. xii, April, 1828, 517. Teeth miscounted 30 instead of 32, the true number.)

Neosorex, BAIRD, M. N. A., 1857, 11. (Type *N. navigator* Cooper, sp. n.)

Hydrogale, GILL, Bull. U. S. Geol. and Geogr. Surv., 2d ser., No. 2, 1875, 111. (Not of Pomel, 1848, which is a figment, based on a blunder.)

CHARS. GEN.—Teeth 32 ($\frac{20}{12}$), as in *Sorex* proper. Upper unicuspid† 5, the fifth minute, the fourth and third smaller than the second and first, which are equal to each other; third equal to or smaller than fourth. Upper incisors with a posterior hook as large as the succeeding tooth, and like it in shape, and with a notched lobe on the inner side, connivent with its fellow. Lower incisors with several (normally three) denticulations on the cutting edge, and reaching back beyond the next tooth, which is thus entirely above them. Teeth all colored.

* Dr. Gill having recently proposed to supplant the term *Neosorex* Baird, 1857, by *Hydrogale* Pomel, 1848, it becomes expedient to inquire into the case. *Hydrogale* was based upon *Sorex fimbripes* of Bachman—a species which has occasioned much uncertainty and confusion. The name suggests an aquatic species; but this is altogether erroneous. In 1861, Baird examined Bachman's type preserved in the Philadelphia Academy, and found it to be a species of ordinary 32-toothed *Sorex*, scarcely or not distinguishable from "cooperi". Bachman miscounted 34 teeth (which number no known American species possesses), and wrongly laid stress on certain characters of the feet, which had no basis except in the accidental condition of the specimen as preserved. *Hydrogale* is therefore based on a misapprehension, the characters assigned having no existence in nature, and the type of the "genus" being scarcely or not specifically separable from a previously known form; it therefore becomes of course a synonym of *Sorex* proper, as a pure figment—so far is it from being "undoubtedly congeneric with *Neosorex*", as assumed by Dr. Gill without that degree of caution which distinguishes that trained naturalist.

† By the descriptive term "unicuspid", I intend to cover in these descriptions the anterior series of lateral teeth between the bienspid front incisor and the plurienspid molariform teeth, purposely avoiding committal to the homologies which would be im-

Rostral part of skull very slender and attenuate, with nearly straight and horizontal upper profile far out of line with the profile of the swollen cerebral part. Interorbital constriction at the maximum. Bridge over the anteorbital foramen comparatively narrow. Coronoid process of jaw slender, tilted forward; angular process comparatively short, extremely slender, and nearly horizontal. Tail scarcely or not shorter or much longer than the head and body, without a decided keel of hairs along the under side. Ear distinct, the auricle directed backward (as usual). Feet large, fringed with long, straight, stiffish hairs in regular series; the hinder feet especially well developed and natatorial, about one-fourth as long as the head and body. Pelage long, soft, and thick, to resist water. Of large size and highly aquatic habits.

TYPE.—*Neosorex navigator* Cooper. Peculiar to North America, where it replaces *Crossopus* of the Old World. Includes the Water-shrews of the Western Hemisphere. Although the strict representative of *Crossopus*, it differs decidedly from the latter in cranial, dental, and external characters. In *Crossopus* there are but 30 teeth, the unicuspid being only 4, the three anterior ones regularly graduated in size, the fourth minute; the upper incisors appear to lack the lobe on the inner edge, the posterior hook is smaller, and the under incisors have but one denticulation (in the only specimen before me). The skull is much broader, as shown especially between the orbits and at the interpterygoid space. The contour of the palate is more broadly pyriform; the rostral part of the skull is much less attenuate, with wider bridge over the anteorbital foramen. The mandible as a whole is stronger, with stouter, more nearly perpendicular, coronoid process, and more oblique angular process. The tail has a prominent keel of stiffish hairs along the under side, not developed in *Neosorex*. I am unable to compare the ears. The feet are very similar, though the fimbriation is less conspicuous. In general appearance, *Neosorex navigator* and *N. palustris* are quite like *Crossopus fodiens*, all these Water-shrews being large, long-tailed, large-footed species, sharply bicolor, blackish above and whitish beneath.

plied in the use of the term "premolars", applied by Baird to these teeth. The Shrew's teeth are conveniently separable, for purposes of ordinary description, into three sets, namely:—(1) The enlarged and peculiarly modified single incisor, on each side, above and below; (2) A series of varying number of small unicuspid teeth, intervening between the incisors and the molariform teeth; (3) The molariform teeth, always four above on each side and three below on each side. The anterior one of these last on each side above is homologically a premolar, though it is like the true premolars in appearance; the homologies of some of the unicuspid teeth are in question. All the American *Soricidae* (like all the Shrews as far as known) have the same number of under teeth, namely, 12. The differences in the number of the teeth arise from the presence of 3, 4, or 5 "unicuspids". The following formula covers the numerical composition of the teeth of all American shrews, without being committed to their homologies:—

$$\underbrace{\frac{1-1}{1-1}}_{\text{Incisiform.}} + \underbrace{\frac{3-3 \text{ or } 4-4 \text{ or } 5-5}{2-2}}_{\text{Laniariform.}} + \underbrace{\frac{4-4}{3-3}}_{\text{Molariform.}} = \frac{16 \text{ or } 18 \text{ or } 20}{12} = 23 \text{ or } 30 \text{ or } 32.$$

All are highly aquatic, comparing with the species of *Sorex* and *Blarina* as a Mink or Otter does with most *Mustelidæ*, or as a Muskrat with ordinary *Arvicolæ*.

To the type-species is to be added the *Sorex palustris* of Richardson, and possibly another species.

II. Genus SOREX, Linn.

(a)

Sorex, LINN. (Type *S. vulgaris*, fide Nathusius, Arch. f. Naturg., 1838, 45.)

Sorex of AUTHORS referring to *S. vulgaris* (not of those applying the name to *Crocidura aranea*).

Corsira, GRAY, Proc. Zool. Soc., 1837, . . . (Type . . .)

Otisorex, DE KAY, Zool. N. Y., 1842, . . . (Type *O. platyrhinus*.)

Hydrosorex, DUVERNOY, 1836, nec 1834.

Amphisorex, DUVERNOY, 1834, nec 1836.

Hydrogale, POMEL, . . . 1848. (Type *S. fimbripes* Bach. Genus based in error.)

(b)

Paradoxodon, WAGNER, . . . 1855. (Separate subgenus.)

(c)

Soriculus, WAGNER, . . . 1855. (Separate subgenus.)

(d)

Microsorex, BAIRD, MSS., 1861. (Separate subgenus. Type *S. hoyi* Bd.)

(e)

Notiosorex, BAIRD, MSS., 1861. (Separate subgenus. Type *S. crawfordi* Bd. n. sp. infrà.)

In the present uncertainty which obtains respecting the limitation of the original Linnæan genus, I do not attempt to give a diagnosis covering all its modifications. Its value is very differently rated by authors, some confining the term to *S. vulgaris* and its strict congeners, while others, even among the latest systematists, make the genus coextensive with the family, as Peters and Mivart* have done. I think that the genus may be most naturally defined to exclude *Crossopus* and *Crocidura* with their respective allies, and *Blarina*, making subgeneric sections according to the numerical composition of the teeth, though some of the forms included in the foregoing synonymy may be worthy of full generic rank. It will tend to prevent confusion to hold *S. vulgaris* as the type.

To the genus *Sorex*, as thus rigidly restricted, belong nearly all the

* According to the latter author, the constants of the teeth of *Soricidæ* are as follows:—

$$i. \frac{_}{1-1}, c. \frac{1-1}{1-1}, pm. \frac{_}{1-1}, m. \frac{3-3}{3-3};$$

the variables being confined to the upper incisors and upper premolars, which may be either

$$i. \frac{4-4}{_} pm. \frac{2-2}{_}; \text{ or } i. \frac{3-3}{_}, pm. \frac{2-2}{_}; \text{ or } i. \frac{3-3}{_}, pm. \frac{1-1}{_}; \text{ or } i. \frac{2-2}{_}, pm. \frac{1-1}{_}.$$

American species, and it is the only Old World type found in this country, *Crossopus* being replaced by *Neosorex*, and *Crocidura* having no exact analogue, though the new subgenus *Notiosorex* may be considered to answer to it.

Among our numerous species of *Sorex*, however, is found considerable diversity of external characters, coupled with difference in the numerical composition of the teeth, enabling us to mark off three sections with ease. The teeth are either 28, or 30, or 32, according to the number of upper unicuspid, whether 3, or 4, or 5. Other distinctions may be drawn from the relative proportions of the unicuspid and from certain conditions of the tail, feet, and ears.

The species of American *Sorex* at large offer the following characters:—

Body slender, head elongate, and muzzle attenuate; breadth of the head nearly or about half its length; muzzle naked, with a terminal vertical furrow continuous with the horizontal one formed below by meeting of the lips, *i. e.*, end of the snout bilobate; nostrils lateral; whiskers long, some of them reaching beyond the head; ears large (comparatively), with auricle directed backward (as usual); the antitragus elliptical or semicircular, fitting and closely applied to the meatus, its upper root passing beneath a second transverse nearly horizontal flap, which projects forward and forms a second valve, closing the remaining portion of the naked auditory region. Both faces of these flaps are generally naked, the anterior always so; both surfaces of the auricle are thinly haired, while its edge and the edges of both the flaps are fringed with long hairs. The fore feet are from one-half to two-thirds as long as the hinder ones; both are naked below; the sides of the heels, however, are hairy, leaving only a narrow strip bare. The soles are paved with small granulations, among which are six large tubercles, one at the base of respectively the first, second, and fifth digits, one common to the bases of the third and fourth, and another on each side of the sole midway between the heel and the bases of the digits. The feet are not fimbriate in the sense that those of *Crossopus* and *Neosorex* are. The tail is generally subequal to the trunk alone, sometimes, however, about as long as the head and body; in only one instance known to be less than half this latter dimension. It is more or less thickly, but uniformly, covered with hairs, which usually form a slight pencil at the tip; but under some conditions, probably seasonal or otherwise fortuitous, the tail is nearly naked.

The skull is slender, constricted behind the molars. The upper unicuspid are 3, 4, or 5. When 3, they are regularly graduated in size, none being very small. When 4, the first three are graduated in size, the fourth being abruptly smaller and very minute, scarcely visible from the outside, and liable to be overlooked, so crowded is it between the closely approximated or even touching teeth which precede and follow it. When 5, the first four are abruptly larger

than the minute fifth, which occurs under the same conditions as last described; among the larger unicuspid there is either regular gradation in size, or oftener the two first are coequal and larger than the third and fourth, or again the third is decidedly smaller than the fourth or second. In the species with 30 or 32 teeth, these conditions are contrasted with those occurring in *Blarina* of the same numbers of teeth; for in the latter the last two or three unicuspid are always smaller than the first two, and much crowded. The large upper incisor has a notched lobe or snag on its inner face, besides the strongly developed posterior hook, which looks like a separate tooth, and closely resembles the succeeding tooth. The under incisor has one, two, or three denticulations on its cutting-edge, and reaches so far back that the next tooth is entirely above it, while more or less of the succeeding tooth is likewise similarly placed with reference to the incisor. The teeth are always colored (as they are also in *Neosorex* and *Blarina*), but in one subgenus the coloration is very slight.

Such sum of characters is offered under three modifications (of the teeth more particularly), which must be made the basis of subgeneric distinction, if not to be more highly appreciated. These are as follows:—

a. Subgenus *SOREX*, L. (emend).

CHARS. SUBG.—Teeth 32 ($\frac{20}{12}$). Upper unicuspid 5; the fifth minute, but generally visible from the outside, though crowded between the preceding unicuspid and the first molariform tooth, which are not in contact; the first and second appreciably larger than the third and fourth, which latter vary in size relatively to each other. Interior snag and posterior hook of upper incisor well developed; lower incisor with (normally) three denticulations; whole of next tooth and half of the next placed above incisor. Teeth all well colored. Coronoid of jaw long and comparatively slender, nearly vertical. Skull moderately high behind, the profile of the cerebral portion rising out of line with that of the rostrum; depth of rostrum (including closed jaw) less than that of cerebral portion of the skull. Molar dentition moderate in development; distance across outer edges of molars not over half the width of the cranium; length of series of molariform teeth not more than half the length of the whole line of teeth. Tail not less than half the length of the head and body, usually longer than the trunk alone. Central line of heel naked. Ears moderately large.

TYPE:—*Sorex vulgaris*, with which most of the American *Sorices* are strictly con-subgeneric.

Group A.—Species with the third and fourth unicuspid approximately equal in size (both smaller than the first and second).

Group B.—Species with the third unicuspid decidedly smaller than the fourth (which is itself less than the second and first). (Confined to the Pacific Province.)

d. Subgenus *MICROSOREX*, Baird, MS., 1861.

CHARS SUBG.—Teeth 30 ($\frac{18}{12}$). Upper unicuspid 4; the fourth minute, concealed from view externally by the contact of the third unicuspid and first molariform tooth; the third appreciably smaller than the second and first, which are equal to each other and to the hook of the incisor. Interior snag and posterior hook of upper incisor well developed; lower incisor with (normally) two denticulations, and extending so far back that the two succeeding teeth are placed entirely above it. Teeth all well colored. Coronoid process of jaw long and comparatively slender. Molariform teeth large; distance between their outer edges more than half the width of the skull. Depth of rostrum (including jaw) greater than that of the cerebral portion of the cranium. Series of molariform teeth longer than half the length of the whole series of teeth. External characters not obviously different from those of *Sorex* proper. Tail about as long as trunk.

TYPE.—*Sorex hoyi* Baird, from which *S. thompsoni* does not appear to be specifically distinguishable.

This perfectly valid section of *Sorex* has been suspected to rest upon immature dentition, the decrease in the number of teeth being supposed due to suppression or non-development of the minute last unicuspid. But it will be seen from the foregoing that this minute tooth, immediately preceding the first molariform tooth, is present in both cases, being in *Sorex* proper preceded by four larger unicuspids, while in *Microsorex* the unicuspids preceding it are only three in number.

e. Subgenus *NOTIOSOREX*, Baird, MS., 1861.

CHARS. SUBG.—Teeth 28 ($\frac{16}{12}$); upper unicuspid 3, the minute last unicuspid of *Sorex* proper and *Microsorex* here wanting; first and second unicuspids about equal to each other, larger than either the third unicuspid or the posterior hook of the incisor. No internal snag or notch on upper incisor, and the posterior hook only moderately developed, being smaller than the succeeding tooth. Lower incisor with only one denticulation, or merely a slight sinuation; its tip hooked upward, its base reaching below the two succeeding teeth. Teeth scarcely colored, and only on the tips of the incisors and a few succeeding teeth, the molariform ones left white. Coronoid process of jaw comparatively short, obtuse, and widely diverging outward. Proportion of molariform teeth to the rest of the series and width across them relative to the cranial width as in *Microsorex*. Skull very low behind, broad across the orbits, and comparatively little attenuate in front. Ears remarkably large, thinly haired, and conspicuous. Tail short, somewhat as in *Blarina*, scarcely or not half as long as the head and body. General external appearance of *Crocidura*.

TYPE.—*Sorex (Notiosorex) crawfordi* Baird, MS., 1861, sp. n., described at length beyond.

This remarkable new subgenus, the only one of America possessing 28 teeth, is related to *Crocidura*, having the same number of teeth as *C. aranea*, and sharing other dental characters, such as absence of internal snag and small size of posterior hook of the upper incisor, single or obsolete denticulation of the under incisor, massiveness of the teeth, and particularly of the molars, relative length of the molariform series to the whole line of teeth, etc. The teeth of *Crocidura* are entirely white, of *Notiosorex* scarcely colored. In both, the skull is lower behind than in *Sorex* proper, much less constricted across the orbits, and much less attenuate anteriorly, while the coronoid process of the jaw is shorter, stouter, and more divergent from its fellow.

The type of *Notiosorex* is in very bad order, not permitting satisfactory examination of external characters. A dried specimen of *Notiosorex* from Mazatlan, apparently a second species of the group, is in excellent condition. This is strikingly similar to *Crocidura* in general external appearance, even to the large scant-haired ears and short tail. The size is about the same, while in coloration it is scarcely distinguishable from some Bavarian specimens of *Crocidura* labeled "*S. leucodon* Hermann".

III. Genus BLARINA, Gray, 1837.

(a)

Sorex, spp., AUCT. AMER.

Blarina, GRAY, Proc. Zool. Soc. Lond., 1837. (Type *Sorex talpoides* Gapper.)

Brachysorex, DUVERNOY, Mag. de Zool., 1842.

Talpasorex, POMEL, . . . 1848. (Nec auct.)

Cryptotes, POMEL, . . . 1848.

Anotus, WAGNER, . . . 1855.

(b)

Soriciscus, COUES, infra, subg. n. (Type *Sorex parvus* Say or *S. cinereus* Bachm.)

CHARS. GEN.—Teeth 32 ($\frac{20}{12}$) or 30 ($\frac{18}{12}$). Upper unicuspid either 5 or 4, the two anterior of which are abruptly larger than the two or three posterior ones, which latter are small and much crowded. When there are 5 unicuspids, the third and fourth are subequal to each other; in any case, the fifth is minute, much smaller than any preceding one. The larger unicuspids have supplementary cusps. Upper incisors without internal snag or notch, and rarely connivent, with greater or less development of the posterior hook. Under incisor with several obtuse denticulations, or nearly sinuate, extending backward a variable distance, according to the subgenera. Skull variable in massiveness, etc., in the same way. Teeth all colored on the points. Coronoid process of jaw comparatively short, stout, and erect (rather inclined forward as well as outward, as in *Sorex* and its subdivisions). Styli-form angular process of jaw very short, scarcely or not reaching as far back as the condyle. Tail short, scarcely or not as long as the head, uniformly haired, with a small

terminal pencil. External ears small, invisible on ordinary inspection, and peculiarly constructed; the auricle, as well as other parts, being directed forward to close the meatus, leaving no opening or appearance of a concavity of auricle. Fore feet broad, large in comparison with the hinder ones, the palms naked, the claws enlarged and somewhat fossorial, longer than the hind claws. Hind feet very small comparatively, the soles granular and pluri-tuberculate, the heels hairy, excepting usually a very narrow central strip. Body stout; size variable, the species ranging from much the largest to the smallest of American Shrews; coloration either uniform or sharply bicolor.

The short-tailed or so-called "earless" Shrews of America constitute a strongly marked group not represented at all in the Old World. They are readily recognized by the characters of the tail and ears; while the skull and teeth furnish equally or more satisfactory means of discrimination from any other genus of *Soricidæ*. In the foregoing diagnosis I only present the more salient cranial and dental characters, serving for ready determination, omitting here, as elsewhere in this paper, many details, which, however necessary in full description, would, if here introduced, tend to obscure the characters I wish to set forth prominently.

Nevertheless, I am obliged to define the genus somewhat loosely, owing to the dissimilarity of the two types of form it covers. So far from there being only one species of *Blarina*, as Mr. Allen has sought to maintain, there are a number of them, representing two subgenera as distinct as any of those just established in the genus of *Sorex*, if not more so. Erroneous statements respecting the ears, and miscouunts of the number of the teeth, which have been rated as many as 34 and even 36, have already caused the erection of several groundless genera, such as *Anotus* and *Cryptotis*; but all these, as Baird has remarked, are strictly synonymous with *Blarina* of Gray or *Brachysorex* of Duvernoy, and belong to the section with 32 teeth represented by *B. talpoides*. The other section, of 30 teeth, properly characterized by Baird in 1857, but not hitherto named, I propose to call *Soriciscus*. It is the only known representative of the genus in Mexico and Central America.

a. Subgenus BLARINA, Gray (emend.).

CHARS. SUBG.—Teeth 32 ($\frac{20}{12}$); upper unicuspid 5; the two anterior ones largest, subequal to each other, exceeding in size the hook of the incisor; next two abruptly smaller, subequal to each other; last one smaller still, very minute, scarcely or not visible externally; three last appearing crowded together. Upper incisor with the posterior hook reduced to a mere rectangular lobe, much smaller than the succeeding tooth. Lower incisor reaching back below the first molar, so that two teeth and part of a third are above it. Skull comparatively massive with well developed lambdoidal and sagittal crests, the former defining an occipital plane. Very little interorbital constriction, and rostral part of skull moderately tapering, not nearly so attenuate as in *Sorex*.

Upper profile of skull nearly in one line from end of nasals to occiput. Size from medium to largest. Fore feet at maximum of size, with largest claws. Coloration nearly uniform.

TYPE.—*Sorex brevicauda* Say or *S. talpoides* Gapper.

b. Subgenus *SORICISCUS*, Coues, subg. n.

CHARS. SUBG.—Teeth 30 ($\frac{3}{1\frac{1}{2}}$); upper unicuspid 4; first two largest and subequal to each other; third abruptly smaller; fourth smaller still, very minute and usually crowded out of view externally. Upper incisor developing a decided posterior hook, nearly or quite as large as the succeeding tooth, and much as in *Sorex* itself. Lower incisor reaching back only below the second succeeding tooth, so that only one tooth and part of a second are placed above it. Skull in general more like *Sorex* than like *Blarina* proper; sagittal and lambdoidal crest obsolete, the occiput rounding insensibly into the parietal walls. Interorbital constriction and attenuation of rostrum much as in *Sorex*. Upper profile of skull straight in front, rounding up behind, nearly as in *Sorex*. Size small to very small. Fore feet relatively smaller than in *Blarina* proper, with less developed claws. Coloration indifferently bicolor or concolor, oftener the former.

TYPE.—*Sorex parvus* Say or *S. cinereus* Bachm.

Here belong the greater number of the species, among them the very smallest Shrews of America. In bulk of body, some species are about the same as *Microsorex hoyi*, but the shortness of the tail makes the total length much less. Thus, apparently full-grown specimens before me are under two and a half inches long, tail and all, while *M. hoyi* measures at least three inches, tail included. In general configuration, the skull is more like that of an ordinary Shrew than it is like that of the other section of the same genus.

I conclude this portion of the subject with an analysis of the genera and subgenera according to a few salient features:—

- A.—Ears ordinary. Feet fimbriate. Tail about equaling or exceeding the head and body in length.
- Teeth 32 *NEOSOREX*.
- B.—Ears ordinary. Feet ordinary. Tail shorter than head and body.
- Teeth 32 *SOREX*.
- Teeth 30 *Microsorex*.
- Teeth 28 *Notiosorex*.
- C.—Ears peculiar. Feet not fimbriate. Tail about as long as the head.
- Teeth 32 *BLARINA*.
- Teeth 30 *Soriciscus*.

§ 6.—DESCRIPTION OF FIVE NEW SPECIES OF AMERICAN
SORICIDÆ.

1. *SOREX PACIFICUS* Baird, n. sp.

Sorex pacificus, BAIRD, MSS. ined., 1861.

Teeth 32. Upper unicuspid 5, the third decidedly smaller than the fourth, the fifth smaller still, but distinctly visible externally. Upper incisor lacking an obvious internal notch, but with well developed posterior hook as large as the succeeding tooth. Under incisor with two blunt lobes and a slight sinuation, reaching back to first molar, two teeth being placed entirely above it.

Nearly unicolor, without line of demarkation, becoming insensibly a little paler below. Rusty iron-gray, or light dull reddish-brown, gradually fading to a lighter gray shade of the same on the under parts. Feet and under side of tail brownish-white; tail more decidedly bicolor than the body, colored above to correspond. Teeth colored as usual.

Large; length (of skin, approximate) 3.00 inches. Tail-vertebræ 2.25, with hairs 2.45. Hand 0.35. Foot 0.60.

Hab.—Fort Umpqua, Oregon (Dr. E. P. Vollum).

Type No. 3266, Nat. Mus. (Smiths. Inst.).

Readily distinguished by the peculiar proportions of the unicuspid teeth, which are as in all the other Shrews of the Pacific Province—these species being entirely different in other respects. One of the largest species, rather surpassing the *S. "richardsoni"* of Baird, and two or more times as bulky as any of the Shrews like "*cooperi*" or "*platyrhinus*". Nearly identical in color with the type of *S. "richardsoni"* of Baird (No. 830, Nat. Mus., Racine, Wis.), but larger; tail an inch longer, differing in the latter respect much as *Neosorex navigator* does from *N. palustris*. Requiring no comparison with any other species hitherto described.

2. *SOREX SPHAGNICOLA* Coues, n. sp.

Teeth unknown; undoubtedly 32; with third unicuspid undoubtedly not smaller than fourth.

Nearly unicolor, without line of demarkation, merely paler below; blackish-brown, changing insensibly on under parts to blackish-gray, with a slight rusty shade; tail obscurely bicolor, to correspond; feet dark brown.

Very large, fully equaling *S. "alpinus"* of Europe; length (of skin, approximate) 3.25; tail only about half as long, 1.50; foot 0.50.

Hab.—Fort Liard, H. B. T., or vicinity (W. L. Hardisty).

Type No. 6361, Nat. Mus. (Smiths. Inst.).

Belonging to the group of large whole-colored species, of which *S. pacificus* and *S. "richardsoni"* of Baird are other members, and which represent the large plumbeous whole-colored *S. "alpinus"* of Europe. General appearance that of *Blarina talpoides*, being sooty-blackish and as large as many specimens of the latter. Distinguished from *S. "rich-*

ardsoni" of Baird by superior size and fuliginous coloration; from *S. pacificus* by the same points in which *S. richardsoni* differs, tail an inch shorter, etc.

3. SOREX (NOTIOSOREX) CRAWFORDI Baird, n. subg. et sp.

Sorex (Notiosorex) crawfordi, BAIRD, MSS. ined., 1861.

Teeth 28; upper unicuspid 3; third a little smaller than second and first; upper incisor without internal notched lobe, the posterior hook smaller than the next tooth; lower incisor reaching below the two succeeding teeth, its cutting edge not denticulate, merely sinuate; dentition as a whole very heavy, the teeth uncolored, except points of a few anterior ones. Head large. Tail short; little over half as long as head and body.

Color "light chestnut-brown, paler beneath". Very small; length (alcoholic) 1.90; tail-vertebræ 1.10, with hairs 1.15; hand 0.25; foot 0.40; tip of nose to incisors 0.11, to eye 0.40, to occiput about 0.80; length of skull 0.68, its width 0.31, its height 0.18; width at interorbital constriction 0.17.

Hab.—Fort Bliss, New Mexico, or vicinity (Dr. S. W. Crawford, U. S. A.).

Type No. $\frac{2653}{4437}$, Nat. Mus. (Smiths. Inst.); specimen in alcohol 2653; prepared skull 4437.

In further elucidation of this interesting form, I quote passages from Professor Baird's original MS.:—

"It is much to be regretted that the only known specimen of this species is in exceedingly bad condition. There is enough, however, to show its strongly-marked distinction from any other North American species The muzzle is wider than usual in our small Shrews, owing to the size of the molar teeth; the head, too, appears disproportionately large. The skull is very large for the size of the animal, measuring nearly 0.70; the rostral part is broad, and the interorbital constriction slight; the greatest width of the upper jaw is more than half as much as that of the cranium. The coronoid process of the mandible is short and stout. The molar teeth are of enormous size. Thus the middle of the ante-orbital foramen falls over the line of separation of the first and second molars [*i. e.*, molariform teeth], and the molar series is nearly two-thirds as long as the whole line of teeth. The upper incisor has no inner lobe or spoon-shaped expansion, resembling that of *Blarina* in this respect. There are but three upper premolars [*i. e.*, unicuspid teeth]; all compressed transversely, forming a trenchant edge, the lateral outline pointed. The 1st and 2d premolars are equal and larger than the 3d, which exceeds the posterior hook of the incisor. The lower incisor has no lobes, though the point is hooked upward and the upper outline sinuous. It extends backward to the 1st molar, the 1st and 2d premolars being entirely above it; the latter have each a single cusp. The teeth are entirely colorless, except a slight chestnut tinge to the tips of the incisors and still less on the anterior premolars.

"The ears appear to be much as in *S. cooperi* and its allies, and larger than in *S. hoyi*. The 5th hind claw reaches half-way over the penultimate phalanx of the 4th digit. The heels appear to be hairy behind, without a central linear naked space. The hairs at the ends of the toes appear of unusual length, extending beyond the claws. The color, as far as the hair remains on the alcoholic specimen, is a nearly uniform rufous, rather paler beneath; the fur is long."

4. SOREX (NOTIOSOREX) EVOTIS Coues n. sp.

Teeth 28, and dentition otherwise substantially the same as that of *N. crawfordi*. (Lower incisor with one decided lobe, not seen in *N. crawfordi*, but the difference may be due to age of the teeth, a supposition which the more decided coloration of the points of several anterior teeth of *N. evotis* tends to confirm.)

Bicolor, but not very sharply so. Above, clear light brownish-cinereous, with a decided hoariness; below, cinereous-gray, with scarcely a shade of rusty. Tail colored to correspond. Feet brownish-white. Claws and most of the whiskers colorless. The coloration is very nearly that of some specimens of *Crocidura "leucodon"*, but rather more cinereous above, and less distinctly bicolor.

Tail very short, almost *Blarina*-like; rather scant-haired, with slight terminal pencil, scarcely or not one-third as long as head and body, and about equaling the head alone. Snout not peculiar. Ears extremely large, scant-haired, conspicuous in the fur of the parts, recalling *Crocidura*; structure, however, as well as can be judged, not peculiar. Soles naked to the heels along a narrow linear strip. Pelage short, close, and sleek.

Length (of a well-prepared skin, closely approximate) 2.90. Tail-vertebræ 0.90, with hairs 1.00. Hind foot 0.45. Fore foot 0.25. Snout to incisors about 0.15; to angle of mouth 0.30; to eye 0.45; to ear 0.80; to occiput 1.00.

Hab.—Mazatlan, Mexico (F. Bischoff).

Type No. 9066, Nat. Mus. (Smiths. Inst.).

The condition of *N. crawfordi* does not permit entirely satisfactory comparison; but the material, so far as it goes, indicates specific distinction. The type of *crawfordi* is certainly adult, as shown by the teeth, hence its smaller dimensions are not attributable to immaturity. The more salient points of difference may be contrasted as follows:—

N. crawfordi.—Length 1.90; tail-vertebræ 1.10; foot 0.40; tail about as long as trunk. Color "light chestnut-brown, paler beneath".

N. evotis.—Length 2.90; tail-vertebræ 0.90; foot 0.45; tail about as long as head. Color hoary brownish-cinereous, ashy-gray beneath.

5. BLARINA (SORICISCUS) MEXICANA Baird, n. sp.

Blarina mexicana, BAIRD, MSS. ined., 1861.

Teeth 30; upper unicuspid 4; first and second equal to each other and largest, exceeding a little the posterior hook of the incisor; third

abruptly much smaller (only about half as large); fourth minute, concealed from external view by contact of third with the first molariform tooth. Posterior hook of upper incisor well developed, larger than third unicuspid; no internal snag. Under incisor with two prominent lobes, reaching back below the two succeeding teeth. Teeth all well colored; the points of the incisors quite black.

Unicolor; entirely sooty blackish-brown, merely a little paler below, without any line of demarkation whatever; tail and feet likewise dusky.

Tail rather long for *Blarina*, contained only two and a half times in length of head and body; very scant-haired. Claws rather large. Fur soft and full, almost fluffy, with very little lustre.

Length (of well-prepared skin, closely approximate) 2.50. Tail 1.00; the terminal pencil hardly 0.10 longer. Hands 0.35. Feet 0.50. Longest claws 0.08 or 0.09. Skull (slightly defective behind, estimated) 0.75; its width 0.37; its height 0.25.

Hab.—Xalapa, Mexico (R. Montes d'Oca).

Type No. $\frac{3525}{4438}$, Nat. Mus. (Smiths. Inst.) (skin 3525, skull 4438).

This remarkable species combines the 30 teeth of *Soriciscus* and other dental characters of that group with the external appearance of *Blarina* proper, resembling *B. talpoides* in its uniform blackish color, though it is still darker, as well as much smaller. The tail is relatively longer, though the dimensions above assigned may be somewhat too large. The skull is heavier and less attenuate than usual in *Soriciscus*, to which section the species nevertheless belongs.

ART. XXVI.—NOTES ON THE ORNITHOLOGY OF THE REGION ABOUT THE SOURCE OF THE RED RIVER OF TEXAS, FROM OBSERVATIONS MADE DURING THE EXPLORATION CONDUCTED BY LIEUT. E. H. RUFFNER, CORPS OF ENGINEERS, U. S. A.

BY C. A. H. MCCAULEY,
Lieutenant Third United States Artillery.

Annotated by Dr. ELLIOTT COUES, U. S. A.

LETTER OF TRANSMITTAL.

READING, PA., *July 29, 1876.*

SIR: I have the honor to transmit herewith a copy of a report originally rendered to Lient. E. H. Ruffner, Corps of Engineers, U. S. A., Chief Engineer of the Department of the Missouri, and also intended for publication in the Proceedings of an Eastern academy of science. Its appearance having been unavoidably delayed, the article is now offered for publication by the Survey with which you are connected, or for such other use as you may see fit to make of it; and I shall esteem it as a favor if you will assume the editorship of the paper.

In transmitting the following Notes upon the Ornithology of the region where were found the true sources of the Red River of Texas, and of the country traversed *en route*, it may be well to add a few prefatory remarks. Being on sick-leave in Southern New Mexico in March, 1876, and having made an application to the War Department for duty with the expedition, with the hope of improving my health, and having already joined the expedition when the application was disapproved, I continued as a volunteer. Though my duties mainly related to the survey proper, an effort was made, after each day's work and march had ended, to obtain and prepare as many specimens as possible, in order to gain some idea of the avi-fauna of the country. With very limited time, subsequently restricted by recurrence of sickness, my collection was necessarily meagre. This is the more to be regretted, since, as far as recollection serves me, a portion of the region surveyed had never before been visited in the interests of ornithology. [*]

[* Marcy's well-known report on the Red River, covering the ground only in part, contains no ornithological matter among the several zoölogical papers which it comprises.—ED.]

Leaving the railroad at Dodge City (five miles from Fort Dodge), Kansas, on the Arkansas River, longitude 100° , the route was by long marches to Camp Supply, Indian Territory, east of south, distant ninety-one miles, and thence to Fort Elliott, Texas, a new post on the Sweetwater, west of south, ninety-three miles distant, the latter, at which point the survey commenced, being less than fifteen minutes west of the meridian of Dodge City. South from Dodge, the road is over the characteristic western prairie, crossing the Cimarron River near the State line and the north fork of the Canadian above Supply, and below it Wolf Creek, along which the road runs for several miles, the Canadian itself, and the Washita River. Starting from Fort Elliott, from which we were absent but six weeks (during which time over 600 miles were traveled), returning June 22, the general course was southwest, striking Red River about 100 miles distant, the main intermediate waters touched being north fork of Red River and its main tributary, McClellan Creek, the Salt Fork, a branch called White Fish Creek, and Mulberry Creek, all emptying into the main river. Thence the scene of operations was that part of the Staked Plain (Llano Estacado) embraced between longitude $100^{\circ} 30'$ to 102° and latitude 34° to $35^{\circ} 30'$. The surface of the great plain, the elevation of which is 4,000 feet above the sea, is one unvarying level, "flat beyond comparison", without an object on which to rest the eye of the traveler. The vegetation consists of short gramma-grass, here lower than usual, in accord with its desert surrounding, whilst at long intervals appears a small "soap-weed" (*Yucca angustifolia*), so called from the use made of it by the natives in New and Old Mexico, or a prickly-pear cactus (*Opuntia missouriensis*), both existing here in a dwarfed or depauperate condition compared with their size in more favored situations in the same or a higher latitude.

The sources of the Red River are two small streams, the Tierra Blanca and Palo Duro, which, after their union, bear the river's name. Wearing for themselves, after proceeding a score or more of miles, deep beds by cutting through the resisting strata, these cañons are truly oases in the general surrounding waste.

The streams in their upper parts have fertile banks, with gently rolling land, which, covered with succulent grasses, are the famed resort of wild animals, timber-fringed everywhere, sparsely above, below more freely, with the trees of greater size and frequency. Birds are more frequently seen along these streams than elsewhere, the avi-fauna here finding its best expression.

In crossing the very barren Staked Plain, we miss even the dog-villages, so characteristic of the prairies, and consequently find no Burrowing Owls (*Speotyto cunicularia hypogæa* Cou-s). In the rainy season, the slightest depressions of the surface, almost unnoticed by the ordinary traveler, become filled with water. Without these water-holes, the journey across the barren waste would be hazardous or impossible.

Many years ago, the Mexican scouts affirm a passage practicable in

the rainy season from San Antonio to Santa Fé was staked out by some Mexicans, whence came the name "Llano Estacado", or Staked Plain. No stakes have ever been found by early or late explorers, but the tradition remains, and the name of that section has become established. It was after a heavy rain that the crossing from Fort Bascom, New Mexico, was safely made by General Gregg and his command in 1872. Their longest march between water was 30 miles, a wearisome trip, indeed, with no living thing of any kind or nature in sight. How invaluable are the services of a guide on such an occasion may well be imagined. On encamping at water-holes, we found great numbers of birds, undoubtedly temporarily attracted by the water's presence. In the vicinity of the cañons, in which were the streams tributary to the Red River, the edge of the plain is cut up by short side-cañons, worn by the drainage during many successive rainy seasons. These are familiarly known as the "breaks" by the scouts, and are recognizable at great distances by the *mirages* that can be seen hanging above them. In the immediate vicinity of "breaks", and on short lines some miles away, are found the Southwestern Larks (*Eremophila alpestris chrysolæma*) in great numbers and Western Night Hawks (*Chordeiles virginianus henryi*) in abundance, and the only species I noticed venturing out upon the desert. No transition could be greater than that from the general level of the plain to the bottom of the cañons. The edges are steep and rocky, and the crossing by train often impossible save at long intervals. In these cañons, nature almost completely hides the streams with luxuriant vegetation, as if to make amends for her barrenness above, and fills the trees with life and song. As the streams descend, their cañon-beds gradually enlarge to that of the main stream, which at some places is several miles broad with a depth of 800 feet, whilst the river-bed itself is not over 500 yards wide. Seen from the plain above, the course of the river looks like a huge ribbon of white, incrustated as it is with alkali, glistening and reflecting hot rays. As the water, pure above, in its downward course passes over the gypsum strata, it becomes strongly impregnated. Among the species observed in such places were the Carolina Dove (*Zenaidura carolinensis*), Killdeer (*Ægialitis vocifera*), Mockingbird (*Mimus polyglottus*), and a few Quail (*Ortyx virginiana*). At long intervals are found, at the head of some side-cañon leading up from the main stream, little rills gushing out from near the summit of the plain, hundreds of feet above, looking like mountain-brooks as they descend, tumbling over rocks in mimic falls, with the water fresh and sparkling, all to be lost a mile or two from its source, sunken in the sand before reaching the river below. The localities in which the collector is best repaid for his pains are the upper parts of the Palo Duro, Tierra Blanca, and the lower and well-wooded portions of streams of good water, before they empty into the main river, such as the North Fork, McClellan and Mulberry Creeks, etc.

Should the paucity of species as presented in the report be deemed

notable, it should be borne in mind that, owing to my extremely limited time and facilities, undoubtedly quite a number escaped attention; and that, owing to lack of any appropriation for such purpose, the expedition was without means for collecting specimens during a part of the trip; and that, after the necessary materials had been purchased with private funds, my arrangements were not complete until the arrival of a supply-train, June 2, our return to Fort Elliott being nineteen days later.

Besides the specimens herewith tabulated, my collection embraces a number of embryos and other alcoholic preparations. The classification and nomenclature adopted are those of your "Key to North American Birds".* I have to acknowledge your kind assistance in identifying some of the specimens collected, and also the courteous attention received from Assistant Surgeon T. E. Wilcox, United States Army, during the preparation of my report.

I am, Sir, with great respect, your obedient servant,

C. A. H. McCauley,

Lieutenant Third United States Artillery.

Asst. Surg. ELLIOTT COUES, U. S. A.,

Secretary U. S. Geological and Geographical Survey.

TURDIDÆ.

TURDUS MIGRATORIUS, L.—Robin.

Though none were observed at headwaters in the Staked Plain, they were common along the wooded lower parts of streams, but lacking that friendliness they acquire on long acquaintance in populated districts. At ranches along the route and at the Army posts visited, they are upon the same terms of sociability as elsewhere in settled country.

MIMUS POLYGLOTTUS, (L.) Boie.—Mockingbird.

All the timber-fringed streams, including those passed *en route* to and returning from Fort Elliott, Texas, and particularly Wolf Creek and the "Dry Washita", were melodious with the notes of this magnificent songster. At times it was exceedingly shy, especially when, perched on a low bush or sunflower-stalk, it discovered that it was being approached. On other occasions, the bird would allow an approach to within a few yards, and, continuing its song, occasionally jump into the air, fluttering its wings, and then alight upon the same twig. The songs were as varied and beautiful as those noted some years ago in the Carolinas and Georgia, and the birds were at places more numerous.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
11	♀ juv.	Red River Cañon .	May 23	McCauley ..	186	9	13	4.2	4.5	
20	♂ ad.	Palo Duro	May 28	do	195	10	13	4.5	4.75	
24	.....	Red River	May 30	Sullivan .....	.....	.....	.....	.....	.....
43	♂ ad.	White Fish Creek.	June 19	McCauley ..	216	10	13	4.25	4.5	Stomach contained beetles, etc.

[* I make a few changes, with the author's permission, at my discretion.—ED.]

A large number of nests were seen and examined, and in most instances left, as either the young were hatched or the embryos were very far advanced.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
10	Cañoncito Blanco	June 6	Ruby	1	1	Two young in nest.
11	do	do	McCauley	1	2	
17	Battle Creek	June 13	Ruby	1	4	Three young in nest.
23	White Fish Creek	June 19	McCauley	1	3	
29	do	June 20	do	1	1	

SYLVIIDÆ.

REGULUS CALENDULA, (L.) Licht.—*Ruby-crowned Kinglet.*

A few individuals observed along the Washita and Canadian, evidently migrating.

REGULUS SATRAPA, Licht.—*Golden-crested Kinglet.*

The only one of this species noted was at Cañoncito Blanco, June 4.

TROGLODYTIDÆ.

CATHERPES MEXICANUS CONSPERSUS, Ridgw.—*White-throated Wren.*

Observed in the cañon region after a long day's ride over an alkali district. No water ever tasted as delicious as those fresh brooks that gush at intervals from the steep walls of the plain, to sink in the sand before reaching the river; and no singer's notes seemed brighter or more cheering than the warbling of this bird, which frequented these precipitous cañons, whose sides are thickly covered with cedars and undergrowth. This species was not observed elsewhere during the trip, but here it seemed particularly numerous.

The largest number of eggs observed in one nest was six.

Number of collection.	Locality.	Date.	Collector.	Nests.	Eggs.	Remarks.
32	Red River Cañon	June 12	McCauley	1	6	

ALAUDIDÆ.

EREMOPHILA ALPESTRIS CHRYSOLEMA, (Wagl.) Baird.—*Southwestern Lark.*

This bright little songster was almost a constant companion in the daily surveys on the Staked Plain proper, being there especially noticeable and extremely abundant, and for a while numbers of nests were daily met with. Generally in company, flying to and fro in search of food,

they showed but little signs of uneasiness, and allowed one to approach and pass unnoticed. One day, during a halt, the column happened to stop within a few yards of a bird upon her eggs, who, after flying to and fro in great solicitude, soon boldly approached, and resumed her place upon her nest with full confidence. The escort was directed to change its course to prevent riding over her, she meanwhile remaining as quiet as if she knew we were friends.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
10	♂ ad.	Staked Plain.....	May 20	McCauley ..	185	7	12.6	4.2	2.7	

With the whole surface of the plain unbroken in its clothing of short grass, and little to vary its monotonous vegetation save the Prickly-pear Cactus (*Opuntia missouriensis*) and Spanish Bayonet or "Soap-weed" (*Yucca angustifolia*), the bird was limited in its nesting materials to the slender gramma-grass alone, of which its nest was built, concealed in a clump of unusual growth, the largest to be found, or beneath the shelter of a "Soap-weed". The usual number of eggs was five.

Number of collection.	Locality.	Date.	Collector.	Nests.	Eggs.	Remarks.
7	Staked Plain.....	June 2.....	McCauley ...	1	5	} Average 0.94 by 0.63 inches.
42	do	June 3.....	Ruffner	1	5	
13-48	do	June 4 to 10...	McCauley	7	34	

SYLVICOLIDÆ.

PROTONOTARIA CITRÆA, (Bodd.) Bd.—*Prothonotary Warbler*.

Frequenting Wolf Creek and the Canadian.

HELMITHERUS VERMIVORUS, (Gm.) Bp.—*Worm-eating Warbler*.

Occasionally noted near the crossing of the Canadian.

DENDRÆCA ÆSTIVA, (Gm.) Bd.—*Golden or Summer Warbler*.

This bright, active songster was very common among the groves occurring near the upper part of Red River and heads of its tributaries, darting through the shrubbery, uttering its cheerful notes without cessation. The birds were nesting, and exhibited little or no shyness.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
5		Mulberry Creek ..	May 17	McCauley ..	180	5	7½	2½	1½	} Stomach contained small insects.
15	♂ ad.	Palo Duro	May 26	do	191	5	7½	2½	1½	
28	♂ ad.	Cañoncito Blanco	June 6	do	201	5	7½	2½	1½	
54	♂ ad.	Cañoncito Blanco	June 6	do	227	5	7½	2½	1½	

For beauty in constructing its home, this bird, as an architect, bore off the palm from all others whose nests were met with, No. 8 of the collection being particularly fine. As its European correspondent visits the farm to obtain the wool of the sheep and horse-hairs, so does this bird select the vicinity of the cottonwood grove to obtain the tree's cotton and near by the buffalo's wool, to build up and line, with the dexterity of a skilled weaver, the home for its young.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
6	Red River Cañon	May 30.....	McCauley ...	1	3	} Average 0.62 by 0.50 inch.
8	Cañoncito Blanco	June 3.....	Sullivan	1	2	

DEDRECA DOMINICA, (L.) Bd.—*Yellow-throated Warbler*.

It is very probable that this species is not uncommon, though but few were noted in the localities of which *D. aestiva* seemed to have possession. More prevalent on Palo Duro than any other locality.

ICTERIA VIRENS LONGICAUDA, (Lawr.) Coes.—*Long-tailed Chat*.

Of all the streams that add to the volume of the Red River near its source, none are more pleasing than the Palo Duro at its head. The name signifies "hard wood", having been given to it by the Mexican hunters, who strike it far up in coming from New Mexico, in their journeyings across the Staked Plain, to the buffalo hunting-grounds, or to the Indian reservations, for purposes of surreptitious trade in fire-water or arms. Fringed with brush and often high trees, with nutritious grass-land bordering it throughout, it is a favorite resort of various animals, and attractive to the hunter and naturalist. Here were found many Warblers, Thrushes, and Mockingbirds apparently engaged in rivalry of song, whilst the sprightly Scissor-tails darted to and fro, lording it even over the Kingbirds in the groves where they were neighbors. For a short distance, no place was found offering greater variety to the collector than this stream, which miles below its head passes through a beautiful cañon, from which it emerges to again wind through rolling country. Though here very abundant and more noticeable than elsewhere, this species inhabited the woodlands skirting the streams throughout nearly all the route. None, however, were observed in the regions strongly alkaline.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Ext. nt.	Wing.	Tail.	Remarks.
21	♂ ad.	Palo Duro Creek..	May 29	McCauley ..	196	73	9 ¹⁰ / ₁₆	31	34	} Stomachs contained chiefly <i>Coeloptera</i> .
22	♂	Red River Cañon..	May 30	do	197	74	9 ¹⁰ / ₁₆	31	34	
33	♂	Mulberry Creek..	June 15	do	206	74	9 ¹⁰ / ₁₆	31	34	
53	♂	Cañoncito Blanco.	June 16	do	226	74	9	31	34	
56	♂	Palo Duro	June 17	do	229	74	9	31	34	
57	♀	Palo Duro	June 17	do	230	74	9 ¹⁰ / ₁₆	31	34	

TANAGRIDÆ.

PYRANGA ÆSTIVA, (L.) V.—*Summer Redbird*.

Observed along Wolf Creek and the Canadian, always in pairs; too shy to permit me to secure specimens.

HIRUNDINIDÆ.

HIRUNDO HORREORUM, Barton.—*Barn Swallow*.

Frequenting settlements in Indian Territory; not as common as *P. lunifrons*.

PETROCHELIDON LUNIFRONS, (Say) Cab.—*Cliff or Eave Swallow*.

A species very abundant in the cañon region of Red River and its tributaries. In descending a side-cañon leading down to the river, where the water only poured down in the rainy season, dashing over cliffs a hundred and at times three hundred feet high, I found occasionally the under side of the overhanging rocks covered with the mud nests of this species, curiously wrought and bottle-shaped as they often are. Some nests even then (the middle of May) contained young, whilst most of the other birds met with had scarcely as yet completed building. Also found building at ranches on the prairie near the streams.

COTYLE RIPARIA, (L.) Boie.—*Bank Swallow or Sand Martin*.

Not uncommon along parts of Red River, where occasionally banks, of the most glaring red clay rise up perpendicularly for a hundred feet from the dry alkali bed below.

VIREONIDÆ.

VIREO GILVUS, (V.) Bp.—*Warbling Vireo*.

This exquisite little songster was frequently met with in the groves and thickets, except along alkali waters, where none were heard or observed. Very many specimens might have been obtained if desired, as they appeared to court familiarity, when no harm was suspected, in order to have their songs heard by all they could reach.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
48	♂ ad.	McClellan Creek..	June 20	McCauley ..	221	5.5	20	2.75	2	Stomach: seeds and grasses.

VIREO SOLITARIUS, (Wils.) V.—*Blue-headed or Solitary Vireo*.

Occasionally observed, but not as frequent as *V. gilvus*.

FRINGILLIDÆ.

CHRYSOMITRIS TRISTIS, (L.) Bp.—*American Goldfinch or Yellowbird.*

Observed along the Washita, and Wolf, McClellan, and Mulberry Creeks.

PASSERCULUS BAIRDI, (Aud.) Coues.—*Baird's Bunting.*

Very few specimens noted. Personally all my searches for a nest of this species were unsuccessful, the one secured having been found by one of the escort, Private Ruby, of Company E, Nineteenth Infantry, a German, who was a very enthusiastic oölogist, having had in the "old country" a collection exceeding seven hundred sets of eggs of the European avi-fauna. The nest, found on the ground, is circular, apparently closely built, but withal very frail. Without, the bird had, after choosing its home, placed about a number of old leaves, chiefly good specimens of skeletonized ones, about which to build its nest. This was composed of slight pieces of the bark of grape-vines, which clustered in profusion about the trees near by, such grasses as were suitable, and an inner lining of finest rootlets or fiber. No horse-hair or parts of buffalo-wool were used in its building. It contained but three eggs, freshly laid, which averaged 0.80 by 0.66. The ground-color is a dull white, bespeckled very irregularly, but a little more closely at larger than smaller end, with markings of faint reddish-brown of a light and a darker shade.

Number of collection.	Locality.	Date.	Collector.	Nest.		Remarks.
				Nest.	Eggs.	
12	Cañoncito Blanco	June 7.....	Ruby	1	3	

PEUCEÆA CASSINI, (Woodb.) Bd.—*Cassin's Finch.*

First met with in the thickets along the Palo Duro. It was over an hour until, after crossing and recrossing the stream and following in its quick nervous flight, the author of the peculiarly attractive song, for which this warbler is noted, was first observed. Leaving camp at early dawn—absolutely necessary in long marches during the hot season—and traveling up the stream, the pleasant notes of these birds could be heard as we rode by the thickets everywhere skirting it. It was heard often afterward, and occasionally seen, chiefly in the dense underbrush along Red River, near where it enters its cañon. This begins abruptly, not far beyond the junction of the two streams by whose union it is formed.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.

Like the Golden Warbler (*D. aestiva*), as soon as alarmed, it darted through the shrubbery, often completely evading pursuit.

As the brooding birds would not return until the vicinity was free from any intruder, search for their nests was in general unsuccessful.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
6	Palo Duro	May 26	McCauley	1	3	

SPIZELLA PALLIDA BREWERI, (Cass.) Coues.—*Brewer's Sparrow*.

Frequently seen, especially in those portions of prairie land that sloped down to streams that were tributary to Red River, and in the cañon bottom of that river itself.

Number of collection.	Locality.	Date.	Collector.	Nests.	Eggs.	Remarks.
2	Red River Cañon	May 21	McCauley	1	3	
3 & 4	do	May 23	do	1	6	
33-38	Palo Duro	May 25 to 27	do	2	20	
39-40	Camp's edge of Staked Plain	June 10 to 12	Ruby	2	6	

CHONDESTES GRAMMACA, (Say) Bp.—*Lark Finch*.

Both along the prairies of Kansas and Indian Territory and on that arid waste, the Staked Plain, this sweet singer was not uncommon.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
42	♀ ad.	White Fish Creek	June 19	McCauley ..	215	.....	.....	3.4	3	

The nests were upon the ground, built more for comfort than for resistance to the winds that would test its firmness if placed aloft; the lower parts were coarse grasses, rootlets and dried leaves, whilst the eggs rested upon a soft cushion of buffalo-wool, fine hair and rootlets. One was in an open prairie situation, but to conceal it the birds had placed it beneath a huge buffalo hip-bone, entering by a small opening. In nest No. 24 was found an egg of the Cowbird [*Molothrus ater* of Gray, after Boddart]. Their markings are odd and curious—nearer than any other perhaps to Chinese characters; they varied in color from a rich chocolate to dark sepia.

Of the eggs, the greatest major axis noted was 0.82 inch, and smallest transverse 0.63.

Number of collection.	Locality.	Date.	Collector.	Nests.		Eggs.	Remarks.
16	Battle Creek.....	June 13.....	McCauley.....	1		} All eggs freshly laid at this date.	
24	White Fish Creek.....	June 19.....	Ruby.....	1			3

CALAMOSPIZA BICOLOR, (Townsend.) Bp.—*Lark Bunting* or *White-winged Black bird*.

Very frequently observed, and not particularly shy.

EUSPIZA AMERICANA, (Gmelin.) Bp.—*Black-throated Bunting*.

Whilst none of the districts traversed whose water was decidedly alkaline were entirely bare of inhabitants of the lower orders, as soon as they were passed and water fresh or passably good was met with, the difference in animal life was noticeable to the most casual observer. Leaving the mouth of the Tule, and passing up Red River, over its burning alkali bed, ten miles up, on a small island, quite a grove was found, with scarcely an inhabitant. Continuing on and up a side-cañon in search of water, I found it at last in abundance, most delightful and cool, a rapid brook rushing down in waterfalls, to sink, as usual, before reaching the river. In such places, bird life was abundant. There and in similar places were the Buntings and many others of the *Fringillidæ*, whilst several of their natural enemies, the *Falconidæ*, were almost always in view.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
38	♂	White Fish Creek.	June 19	McCauley...	211	6.5	10	3.25	2.5	

GONIAPHEA MELANOCEPHALA, (Swainson.) Gray.—*Black-headed Grosbeak*.

Occasionally noted in much the same localities, but not as often seen as *Guiraca caerulea*.

GUIRACA CÆRULEA, (Linnaeus.) Swainson.—*Blue Grosbeak*.

Very frequently met with along the Palo Duro and in parts of the Tierra Blanca; also found along McClellan, Mulberry, etc., Creeks, and during part of the trip in the Indian Territory. When noted on the Palo Duro, they were always in pairs, being busily engaged in finishing their nests. In the mouth and crop of the specimen obtained was found

a large quantity of Prickly-pear Cactus (*Opuntia missouriensis*), barbed bristles and all.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
16	♂ ad.	Palo Duro	May 26	McCauley...	191	7.25	10	3.66	3	Stomach: insects and grass-seed.

CYANOSPIZA CIRIS, (L.) Bd.—*Painted Finch*; *Nonpareil*.

Contrary to my expectations, I found this species during the course of the survey, obtaining a specimen on a small tributary of Mulberry Creek, about latitude 34° 50', being farther north than Wilmington, N. C., with an approximate elevation of 3,300 feet. Previous camps had been as far as thirty miles more southerly than this, in the vicinity of both fresh and alkali water, where, however, the species was not observed. The birds seen were always in pairs, and appeared to be building. I was unable to find any nests, but do not doubt that they were breeding there. The colors of their plumage were as bright and exquisite as in Georgia and the Gulf States.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
69	♂	Mulberry Creek (tributary).	June 15	McCauley...	240	5.5	....	2.7	2.5	

CYANOSPIZA CYANEA, (L.) Bd.—*Indigo-bird*.

Occasionally seen, but not as often as *Guiraca caerulea*.

PYRRHULOXIA SINUATA, Bp.—*Texas Cardinal*.

The only previous time I had seen this bird alive was during last March in Old Mexico. In the cities and plazas, it was at home among the vineyards or the shrubbery by the adobe wall about each yard or garden, where it appeared to be as undisturbed by passers-by as the Robin (*T. migratorius*) in our towns. On the Staked Plain it was different, and though about half a dozen individuals were seen in Cañoncito Blanco and elsewhere, they were too shy to be secured.

CARDINALIS VIRGINIANUS, (Briss.) Bp.—*Cardinal Redbird* or *Virginia Nightingale*.

Occasionally observed on the Canadian and the McClellan and Wolf Creeks; very shy. The birds were always in pairs, and could not be approached.

ICTERIDÆ.

MOLOTHRUS ATER, (Bodd.) Gray.[*]—*Cowbird*.

A frequent visitor at our camps, especially when they partook of a permanent nature, or remained, as occurred in two cases, at the same place for five days or a week. During a day's march over the plain, a good-sized flock, perceiving our wagon-train, flew up to and followed it, keeping in rear of the last wagon, for a distance of eleven miles, when camp was reached. An egg of this species was found in a nest of a Lark Finch (*Chondestes grammaca*), obtained at White Fish Creek.

AGELÆUS PHENICEUS, (L.) V.—*Red-winged Blackbird*.

This handsome member of the Blackbird family, though not infrequent, was not as common as *M. ater*, and, very sensibly, it evidently preferred the vicinity of ranches or an Army post to seeking a precarious existence in the wake of a buffalo herd on the Staked Plain. It was seen in largest flocks along the Sweetwater and other beautifully wooded creeks. In December and January last, I found this species wintering at Fort Garland, Colo., whose elevation is over 8,000 feet, and winter climate severe, with frequent cold and piercing winds blowing for days without cessation. Along the Sangre de Cristo Creek, flowing by the post, were flocks numbering hundreds.

XANTHOCEPHALUS ICTEROCEPHALUS, (Bp.) Bd.—*Yellow-headed Blackbird*.

This uninvited visitor to the vicinity of the picket-line, generally in bands of which half were Cowbirds, was only observed at a few places. They seemed, like *A. phæniceus*, to frequent but a few wooded creeks. Possessing habits that cause it to frequent the residence or surroundings of man and bring it under observation, it seems at times strange how long a journey may be made through a region which is part of its habitat without its being observed. While traveling last February over 500 miles with a portion of the Eighth Cavalry through the whole of New Mexico, *en route* from Fort Garland, Colo., to Texas, there was but a single point where this species, popularly called in the regiment the "Ninth Cavalry Birds," was observed or to be seen. In the plaza of the Mexican town of Socorro, N. Mex., hundreds had chosen for their rendezvous some old shade trees on the side of the square, and had frequented them for many years, according to the traditions of the everlasting loafers and cigarette smokers that lounged around on every side.

[* This species is so much better known as *M. pecoris* (Gm.) Sw., that it seems desirable to call special attention to the fact that the change in nomenclature is necessary. I have noted the case in my Checklist (p. 43), and in the B. N. W. (p. 180); but ornithologists seem slow to recognize its requirements. In as far as my writings have any influence, I am myself to blame for this, for I think I have not hitherto followed Gray in formally recognizing Boddart's unquestionable and legitimate priority.—ED.]

Two months later, on my return, the birds were there in immense numbers, as before. Nowhere else up the whole Rio Grande were they visible. A single nest of this species was found in the cañon of the Red River, where the stream, sometimes but a few feet wide, occasionally widens into good-sized marshy pools—the resort of ducks and other water-fowl. A few yards out from the edge, on a clump of thick, rank grass that rose five feet out of water, entwining about them to have them form a firm support, the birds had built their home. Without any mud plaster to hold the strands compactly, they had nicely woven together pieces of coarse, thick grass, and other material of a like nature, in abundance near by.

STURNELLA MAGNA NEGLECTA, (Aud.) All.—*Western Field Lark*.

This variety of *Sturnella* was very abundant, except upon the sterile plain itself. Descending thence, however, to the cañon bottoms, or to some wooded stream, the songster is again heard greeting the marching column daily for several hours after the dawn has broken. This region is a part of its habitat, extending west through New Mexico, where I constantly saw it, during the past spring, in February, along the Rio Grande, below Albuquerque, and in April throughout the entire Territory. Whilst frequenting wooded sections, I have never observed one alight upon a tree or object higher than a sunflower-stalk or low bush from which to sing. In New Mexico, they prefer the low adobe wall surrounding every house, or a grape-vine in the vineyards, and perch there to send forth those peculiarly exuberant songs, which are for the benefit of early risers alone, and with which, we may readily believe, the natives are unacquainted.

The nests were built of sage and thick grass, with fine grasses within. The exterior diameter above is $5\frac{1}{2}$ inches, interior diameter $3\frac{1}{2}$ inches, and depth $3\frac{1}{2}$ inches. The eggs average 1.07 by 0.80 inches, one specimen being 1.00 by 0.80 inches. The ground-color is creamy-white, with markings of a faint and dark or reddish-brown, largest upon the great end.

Number of collection.	Locality.	Date.	Collector.	Nest.		Remarks.
				Nest.	Eggs.	
9	Cañoncito Blanco	June 4	McCaughey	1	6	
50	Red River Cañon	June 12	do	1	6	

ICTERUS SPURIUS, (L.) Bp.—*Orchard Oriole*.

This beautiful and lovely songster was found frequenting most of the heavily wooded creeks, as Mulberry, McClellan, etc., in Texas, and Wolf Creek above in the Indian Territory. Along the Dry Washita and Canadian, many were also seen and heard.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
39	♂ ad.	White Fish Creek.	June 19	McCauley ...	212	6.75	9.6	3.25	3	
51	♂ ad.	Washita	June 23	.....do	224	7.00	9.5	3.25	3	

ICTERUS BALTIMORE, (L.) Daud.—*Baltimore Oriole*.

Occasionally noted along Wolf Creek and other beautifully wooded streams.

ICTERUS BULLOCKI, (Sw.) Bp.—*Bullock's Oriole*.

A very few specimens observed, same locality as last: neither species as numerous as *I. spurius*.

[? *] *QUISCALUS MACRURUS*, Sw.—*Great-tailed Grackle*.

Several specimens observed along McClellan Creek and in other places.

CORVIDÆ.

CORVUS CORAX, Linn.—*Raven*.

As may be imagined, this most striking of the *Corvidæ* was frequently seen. No place could be found that would better suit its preferences for a habitat than the great Llano Estacado. Fearfully monotonous, and with solitude as its main characteristic, rarely crossed by man, save in a few portions where the marches may be made to strike water, it is perfectly congenial to the Raven, offering adequate sustenance in the carcasses of animals that are often too numerous to be pleasant to the traveler.

CORVUS CRYPTOLEUCUS, Couch.—*White-necked Raven*.

More abundant than any other of the *Corvidæ*.

CORVUS AMERICANUS, Aud.—*Common Crow*.

A few specimens observed along McClellan Creek, etc.

PICA MELANOLEUCA HUDSONICA, (Sab.) All.—*American Magpie*.

Careful observations were made at different points for this species without success. I had observed them in great numbers about Garland, Colo., and in the Raton Range near Fort Union, N. Mex., and during a horseback trip in November last had met them along the Fontaine qui Bouille at Pueblo, and frequently on the Saint Charles, south of the place. Having been recorded at altitudes lower than the Staked

[*I deem it prudent to prefix a query to this species, which is one of a group in which identifications are difficult, and a bird not known, I think, to occur in the United States except in maritime portions.

The association of *Icterus bullocki* with the two eastern species of the same genus, as indicated by Lieutenant McCauley's determinations of his specimens, would not, perhaps, have been anticipated.—ED.]

Plain, it was presumed that possibly the species might have extended down the Canadian from Fort Union and the Raton Range to the cañon region of the Llano Estacado, distant from the Canadian about twenty-five miles, for many localities visited possess all the characteristics of the Magpie's habitat in the Rocky Mountain region, save the characteristic dryness of the atmosphere. It is reported, however, in Eastern Kansas (Snow, B. Kans., 1873), and in an atmosphere of much greater humidity than that of the Staked Plain. None were found on the route to Dodge City from the south.

TYRANNIDÆ.

MILVULUS FORFICATUS, (Gm.) Sw.—*Swallow-tailed Fly-catcher; Scissor-tails.*

This peculiarly beautiful and graceful bird was one of the species most frequently seen. They were especially active in the evening, just before dusk, skimming about in pursuit of insects with wonderful rapidity. As the males fly about the camp with their mates, in the twilight, you can single them out by the greater length of their tails. The two elegant feathery tines cross and open at volition, whence the ordinary simile to a pair of scissors. These birds are grace itself when on wing, darting here and there as quick as thought, in buoyant sweeps and curves. The delicate crimson below their wings, as they go glancing by, glows in contrast with the beautiful hoary ash of their general plumage; and as the little heart ceases to palpitate, you pick up your specimen with a pang of remorse, and for once mentally agree with the friend beside you—visiting the Staked Plain in the “invalid” interest, and strongly an anti-collector—that, as he avers, “a bird-skinner is as bad as a butcher”. Even the teamsters call them “mighty pretty”, and no one wonders that the “Texicans” (as our scouts, old buffalo-hunters, title the natives) brag on their beauty, and call them “Birds of Paradise”. In the evening, they were particularly shy, avoiding close proximity to camp; in the early morning, however, they seemed to be less suspicious of our presence. This was very noticeable in going up the Palo Duro, where they would sometimes fly closely by, or alight within a dozen yards and poise upon a branch of a small bush, like the Field-lark. They were found frequenting the fringe of timber bordering the streams as far as their headwaters in the Staked Plain, as well as along the streams in the Indian Territory—Wolf Creek, and others farther north emptying into the Cimarron—all draining portions of the Arkansas Basin. They ruled the wood wherever located, and not only repelled, but hotly pursued any Sparrow-hawk (*F. sparverius*) that ventured near their home, and even maintained authority over the Kingbird (*T. carolinensis*). The greatest tail-length in any of the species secured did not exceed 10 inches.

In the course of a trip last spring along the Rio Grande as far as Fort

Bliss, Texas, and south 300 miles into old Mexico, where I frequently met with the Texas Cardinal (*P. sinuata*) at an elevation of 3,500 feet and below, the Scissor-tails were nowhere seen at any point, not even at the same altitude at which they occur in the Red River country.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
3	♂	Salt Fork, Red River.	May 16	McCauley	178	10.2	14.5	4.6	6.3	The stomachs contained more beetles than flies.
4	♂ ad.	do	May 16	do	179	13.6	14	5	9.3	
6	♂	do	May 17	do	181	11.3	13	4.3	6.6	
23	♂	do	May 29	do	198	13.5	15	5	8.6	
30	♂ ad.	Palo Duro	June 13	do	203	14.7	14.7	5.33	9.75	
32	♀ ad.	Battle Creek	June 15	do	205	9.75	14.50	4.67	5	
34	♀ ad.	Mulberry Creek (tributary).	June 18	do	207	10.75	14.5	4.67	5.75	
47	♂ ad.	McClellan Creek	June 20	do	220	11.25	13	4.25	6.50	
62	♂ ad.	White Fish Creek	June 19	do	235	12.5	14	4.6	6.6	
63	♂ ad.	McClellan Creek	June 21	do	236	10.6	14	4.5	5.6	

Their nests were built well up, generally on cottonwood trees, and were very carefully constructed of small twigs, with the cotton from the trees well interwoven. The interior was made of fine woody fibre and roots, binding the innermost lining, invariably buffalo-wool, set in its place with all the cunning of a weaver's skill. They were circular; interior diameter at the top 3, and depth 2 inches.

The usual number of eggs observed was four, and their average size was 0.90 by 0.66. The ground-color was milk-white, uniform throughout; the markings, varying in size, of lavender and burnt-umber chiefly; some of sepia, at times very dark. They were irregularly scattered over the surface, mainly over the large end; sometimes large spots were found straying up to the smaller end, though that generally was free, save from a few specks. In none of the eggs examined were the blotches grouped thickly and closely about the great end, as in *T. carolinensis*.

Number of collection.	Locality.	Date.	Collector.	Eggs.		Remarks.
				Nest.	Eggs.	
30	White Fish Creek	June 19	McCauley	1	2	
31	do	June 19	Ruby	1	4	
51	McClellan Creek	June 20	McCauley	1	4	

TYRANNUS CAROLINENSIS, (L.) Bd.—Kingbird; Bee Martin.

This species was generally found frequenting the same places where was seen *T. verticalis*, on the main creeks and rivers, except that part of Red River where the water is alkaline. Although not of the genus *Tyrannus*, the "Scissor-tails" evidently ruled over this bird in all the groves where they dwelled together, and appeared by their absolute con-

trol to better deserve the "Kingbird" appellation. The *Tyrannidæ*, four species of which were frequently observed, held complete control in the wood during this their hatching season, as was evident from the fact that their nests were at times found close to those of *Falconidæ*.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
40	♂ ad.	White Fish Creek	June 19	McCauley ..	213	8.5	14.75	5.66	3.6	
41	♂ ad.	.....do.....	June 19	.....do.....	214	8.5	14.2	4.75	3.5	
46	♀ ad.	McClellan Creek	June 20	.....do.....	219	8.5	14.00	4.70	3.5	

For the purpose of securing an absolute identification of the eggs of this species, at a time (June 19) when none had been determined with certainty, a nest was found, both parents (Nos. 40 and 41) were secured, and from such as contained them the embryos were removed entire and preserved in alcohol.

The nest was situated well up, and generally placed among the smaller branches of a tree. Its materials were bits of sage (*Artemisia*) with small twigs and tinier ones above; rather rudely built below, but above better and more compact, using buffalo-wool with fine rootlets and threads to fasten it. As a piece of bird architecture or as a comfortable home, it does not equal that of the Scissor-tail or of the Arkansas Flycatcher (*T. verticalis*). The nests were circular, with an interior diameter above of $3\frac{1}{2}$ inches and a depth of $1\frac{1}{2}$ inches, decidedly shallow, compared with those of the two species just mentioned.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
22	White Fish Creek	June 19	Ruffner	1	3	
52	Mulberry Creek	June 20	McCauley	1	4	
54	McClellan Creek	June 21 .....	.....do.....	1	3	
55	Sweetwater Creek	June 21 .....	.....do.....	1	3	

TYRANNUS VERTICALIS, Say.—Arkansas Flycatcher.

Observed in greatest abundance upon the Palo Duro and White Fish Creeks. This species was found frequenting all the streams flowing down from the brink of the great plain and in the Indian Territory, in localities of a like altitude and possessing the same general characteristics. None, however, were found along the Lower Tule, and other places where the water was excessively alkaline. Whilst searching for nests in a grove on the White Fish, I observed, upon a limb well up, one of this species, on which was sitting the mother bird. At that moment, down toward it, with its graceful swoop, came a Sparrow Hawk (*F. sparverius*), which, from a distant tree, had been quietly observing the spot, and taken its bearings for attack. Quick as a

flash, the mother jumped forward from her nest, with sharp shrieks and calls for aid, that promptly brought her mate from a neighboring tree to her assistance. The Hawk finding himself sorely mistaken in his calling, remembered pressing engagements elsewhere, and turned to leave, hotly pursued by the parents. Circling over and above him, relieving each other every foot as the Hawk flew on, they pecked his head so sharply that he gave a cry of pain, and took shelter in the nearest available tree. It was such a pretty instance of parental care and love that I determined to spare one bird's nest I would otherwise have taken.

Shortly after, although there appeared to be no enemy about, nor cause for alarm, after the departure of the Hawk, I was mystified by noticing the mother in the greatest distress, frequently jumping from her nest, all the while scolding and uttering cries that betokened extreme uneasiness and trouble. As this continued, whilst we were standing quietly under a neighboring cottonwood, one of the men was directed to go up and obtain the nest. As he was climbing up, and had gotten almost within reach, a tree-mouse shot by and ran down the tree, safely eluding capture. The nest safely gotten with its contents, all was clear. The rascally little mouse had made himself completely at home. Burrowing in the buffalo-wool, he had as warm and cosy a retreat as mouse ever dreamt of or wished for. When hungry, he quietly reached up, and his meal was ready and warm. It was purely a case of a "free lunch" in nature. He had eaten all the eggs but two, his retreat being full of fine pieces of eggshells. Of those remaining, he had sucked out nearly all the contents of one, and upon the other he had also begun; a hole had been gnawed in the side of it, and the embryo, which had been well advanced, was lifeless.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
14	♂	Palo Duro	May 25	McCauley ..	189	8.25	15.75	4.9	3.5	Stomach contained <i>Orthoptera</i> and <i>Coleoptera</i> .
26	♂	Red River Cañon ..	May 31	....do	199	9.00	16.00	5.1	3.75
36	♂	White Fish Creek ..	June 19	....do	209	9.00	16.25	5.25	4.00
44	♂	McClellan Creek ..	June 20	....do	217	9.00	14.25	5.00	4.00
60	♂	Mulberry Creek ..	June 17	....do	233	9.00	16.00	5.33	3.75
61	♂	White Fish Creek ..	June 19	....do	234	8.75	16.00	5.00	3.00

The nests obtained were built well up in the cottonwoods generally. The prettiest brought with me was on the outside 5 by 4.5 inches; the interior diameter was 3.5 by 3.25 inches, almost circular, and two inches deep, always deeper than those of *T. carolinensis*. Using large quantities of the fibrous, coarse cotton of the tree, they had matted this well for fully an inch about the limbs; through which, well interwoven, ran bits of sage-brush, coarse grasses, and fine twigs, with a few dried leaves. Above this part came finer grasses and small fibrous

roots, whilst for the interior they had apparently carefully selected choice bits of cotton, at times arranged in strata, over which was buffalo-wool liberally placed and neatly fastened and bound with finest threads. The lining of the interior was unusually soft, being padded in a peculiar manner with the wool itself within. In the homes of the two preceding species, the eggs rest upon the slender roots and threads which thickly cover and bind together the underlying wool; but this Flycatcher is more select; he fastens the tufts of wool below in such a way that the eggs have a resting-place almost as soft as down, and the intertwining threads are scarcely visible. Until we came, what a happy, fortunate mouse the little thief at White Fish was! The ground-color of the eggs was a light cream, uniform throughout, with lavender and purple blotches, with some of a darker purple, all disposed mainly nearest the larger end, but to be found over the whole surface. Occasionally some were scattered over the little end itself. It having been stated that the eggs of this and *carolinensis* were, with difficulty, or very frequently "not distinguishable", I made very careful comparisons of the two. Of the same family, and so closely allied, it might be supposed that they would build similar nests and of the same material. They do, but the nests are of slightly different shape, more oval in most cases examined than the *T. carolinensis*, which is circular and averages $4\frac{1}{2}$ inches diameter outer circumference, and $3\frac{1}{4}$ within, with almost twice the depth. The eggs of this species lie upon the wool itself, whilst the former's interior is a fine network of bark fibres matted above and within the wool. As to the eggs, which I found averaging 0.92 by 0.70 themselves, whilst there would be a great uncertainty in the size, they may be distinguished as follows:—

1. *Shape*.—The egg of this species has its small end well rounded, being decidedly oval; that of *carolinensis* a decided point, although their lengths and greatest thicknesses are about the same.

2. *Color*.—The ground-color of the former being a richer cream color, more of a chrome-yellow tint than this. In all the specimens examined, this distinction was perceptible. To this may be added that the base or large end will at once determine the doubt, the ground-color in this species being uniform throughout, whilst, in the former's, the base has a wash of yellowish pink spread uniformly over it, and imperceptibly fading into the general color. No eggs were found unmarked in this respect, and, as a rule, it was found remarkably distinct.

3. *Markings*.—In this species, the markings are spots of reddish brown or burnt-umber, with scattering ones of a faint shade like lavender; whilst at the larger end occur decided sepias. The blotches are irregular in shape, but generally rounded, some eggs having nearly or quite all of their spots elliptical. They are scattered irregularly over the surface, occurring everywhere, being frequently upon the small end, and of as large a size and the same intensity as elsewhere. Remembering that the grouping in *carolinensis* is entirely or almost wholly upon

the great end, rarely passing the middle, and the opposite one always unspotted, the egg can be readily distinguished.

Number of collection.	Locality.	Date.	Collector.	Nest.		Remarks.
					Eggs.	
21	White Fish Creek	June 19	McCauley	1	2	
23	do	June 19	do	1	5	
53	McClellan Creek	June 20	Ruby	1	4	
56	do	June 21	McCauley	1	4	

MYIARCHUS CRINITUS, (L.) Cab.—*Great-crested Flycatcher.*

Frequenting the thickets along some of the creeks and rivers, and part of the cañon of Red River.

The specimen secured gave evidence of quarreling propensities; of his having been engaged in many fights and having often been worsted.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.		Tail.	Remarks.
29	♀ ad.	Cañoncito Blanco.	June 7	McCauley...	202	8.5	12.5	4	3.75		

MYIARCHUS CINERASCENS, Lawr.—*Ash-throated Flycatcher.*

Occasional; a few noted on McClellan Creek.

SAYORNIS SAYUS, (Bp.) Bd.—*Say's Flycatcher.*

Several along McClellan Creek and a few other points.

CAPRIMULGIDÆ.

ANTROSTOMUS NUTTALLI, (Aud.) Cass.—*Nuttall's Whippoorwill.*

Night after night about our camps *en route* to and along Red River and its headwaters, seemingly half a mile off, or leaving you undecided whether it were but half as far, and often echoed from a distance by the cañon-walls of the streams, were heard the dismal, doleful cries of this *ignis fatuus* of birds to a collector. As twilight approached, they seemed to be plentiful in the neighboring ravine, but a search was generally useless; they could never be distinguished unless flushed, and then were gone like a flash, or else came up behind you on their quiet skimming wing amid tall chaparral, lost as soon as seen. The specimen obtained was the only one actually seen by me, and though it required a long tiresome tramp, searching and following for hours, it was worth it all. From my experience, I would rather engage to secure a dozen Chaparral Cocks (*G. californianus*), with all their fleetness of foot and general shyness, than another specimen of this species. Not as often noticed when camped upon the Staked Plain proper as when by its edge or in the cañons or ravines below, it evidently avoided the desert level, leaving

that habitat to its relative, the Night-hawk. This species was also heard near the Canadian and the Cimarron, *en route* from Fort Elliott, Texas, to Fort Dodge, Kansas.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
7	♀ juv.	Red River Cañon..	May 18	McCauley...	182	8	17	6	.....	Stomach contents: <i>Coleoptera</i> and <i>Lepidoptera</i> .

CHORDEILES VIRGINIANUS, (Briss.) Bp.—*Night-hawk*.

Commonly known among the hunters and plainsmen as the "Bull-bat", from its attempts to rival the musical notes of the "bull-frog". These birds generally came about us several hours before sunset, whether camped on the summit of the Staked Plain or in a valley by the water. Along Red River they were particularly friendly, and flew about and through the camp, passing within a few feet of us here, there, and everywhere in search of insects. In the daytime, they could be easily approached as they sat upon the prairie crouching and lying so close to the ground that even the merest bunch of the short grass seemed to protect them from the fine shot used. Whilst several of our party were riding across a desert stretch down from the head of the Palo Duro, one of the horses almost trod upon a mother on her eggs, when she jumped jumped aside, fell, fluttered a few feet farther, and dropped utterly helpless; her wing was apparently too broken to use, and in her vain attempts to rise, she gave forth the most piercing, touching cries that wounded bird ever uttered. Altogether, it was one of the best decoys ever witnessed, quite surpassing the Quail's execution. Although aware of the trick, she was followed by one of the party; her delusion was continued in a zig-zag line, keeping not more than six to ten feet away, for a hundred yards, when, feeling that the original spot was surely lost, she flew away as happy as a mother bird could be after having saved her family.

One specimen differs slightly in appearance from the usual style of the species, and has white spots upon *six* of the outer primaries. Having been sent to Dr. Coues for his examination, he returned it, confirming its identification as "*virginianus*, although, as might be expected from the locality, it tends toward var. *henryi*". Other specimens seemed to be more decidedly like this variety.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
12	♂+♂	Red River	May 23	McCauley...	187	9.5	22	7.75	4.5	Stomach contents: <i>Coleoptera</i> and <i>Lepidoptera</i> .
18		Palo Duro.....	May 26	...do.....	193	9.0	22	8.00	4.5	
55		Cañoncito Blanco.	June 6	...do.....	228	.....	.....	.....	.....

One of the specimens obtained was secured in the act of entering the hole of a Prairie Dog (*Cynomys ludovicianus*), another of the same brood having succeeded in taking refuge in it before the "rear guard" was cut off.

ALCEDINIDÆ.

CERYLE ALCYON, (L.) Boie.—*Belted Kingfisher*.

Red River and its headwaters, with the streams in many places abounding in fish, and the pools, the haunts of many of the *Anatine*, were apparently without any of this species. They were, however, found very abundant on McClellan Creek, the Canadian, etc.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
45	♀	McClellan Creek..	June 20	McCanley ..	218	11.75	18.00	6.20	4	
65	♂	.....do.....	June 21	.....do.....	238	12.06	18.75	6.25	4	

UCULIDÆ.

GEOCOCCYX CALIFORNIANUS, (Less.) Bd.—*Chaparral Cock; Ground Cuckoo*.

This odd-looking bird, so striking in its appearance, was first observed in the Cañon of Red River, below the summit of the plain, where the chaparral surrounded us. It was noticed frequently by one of the escort whilst guarding the stock, and seemed so little to fear harm that it ran several times within a few feet of him. It required, however, hard work for a day to find the specimens secured, and then their position was only known by the harsh call they uttered, when perseverance in calling them was rewarded at last by securing the pair. The curiosity of this bird is exceeding, and he never fails to gratify it. If there is any unfamiliar sound over the ridge above him, up comes his head over the top, and he stops for a moment to stare. That suffices, however, and if the object be strange and apparently unfriendly or in pursuit, he is off like a flash. Frequenting the chaparral or scrub-oak only, and the rough ravines they cover, he travels on foot, and the celerity of his movements in such a mass of tangle-brush is wonderful.

The species was frequently observed subsequently whenever we descended from the top of the plain to the cañons of the streams.

Once near Battle Creek I observed one flying; it had, however, been alarmed by one of the scouts ahead of the column, and only used its wings to cross a wide ravine, when it immediately ran out of sight some hundreds of yards with the swiftness of a deer. From the locality they prefer, they get part of their name: to the notes they utter is due the other, a coarse *cuckoo* at the best. It is no prettier than the bird; a succession of low chuckles, grating harshly at first, softening at the end, and repeated often if you get near a pair. A few of the notes bring to mind the call of a barn-yard cock to his hen. In the quiet of

an early morning, the *cuckoo*, or call, may be distinctly heard two hundred yards away across a ravine; once heard and fairly caught, you will always remember it. This time of the day is the best to secure them; easiest done by arousing their curiosity. Approaching the neighborhood of the Cuckoo's call, which you can only do by listening, as you go on, you stoop low in the chaparral and imitate their notes, or that of a mating bird. As soon as he catches the unusual sound, if on the alert, you will see him in a second before you. A friend who for a long time resided at Brownsville, Texas, informed me that there and generally along the Lower Rio Grande the Mexican name for this species is "Cha-chala-ca",[*] which they say are the *bona-fide* notes uttered by the Cuckoo, being ordinarily known among the Texans as the Road-runner; and that several had been taken while young from a nest and had grown perfectly tame under the care of one of the natives, when they greatly resembled the Magpie (*P. melanoleuca* var. *hudsonica*) in the traits which become prominent on changing their wild nature to that of a domestic bird. For bright buttons, or anything of brass or glittering, they had an insatiable craving, and would sacrifice the interests of their best friends to satisfy their unnatural appetites. One of the pet "Cha-chalacas" unfortunately, at a favorable opportunity, got his eye upon a breast-pin within reach, belonging to his owner, a fair Mexican belle, promptly "went for it", and bolted it whole. The Mexican love for jewelry, brass-plated or genuine, was, however, too powerful, and the pet Cuckoo was sacrificed.

In New Mexico, I found them called by the native inhabitants *Paisano*, by which, too, he is known farther up the Rio Grande in Western Texas. It signifies a "countryman", and is said to arise from his wildness, frequenting only unsettled places, and keeping away from the sight of man. It is traditional among them that he not only has a natural antipathy for all sorts of small snakes, devouring them with much gusto, but that he does not hesitate to attack the Rattler (*Crotalus confluentus*), and gets the best of him in the fight.

The examination of the stomachs of the pair showed in the male Dragon-flies (*Neuroptera*), Grasshoppers, (*Orthoptera*), and a good quantity of hemp-like woody fibre similar to the scrub-oak. The females showed a Lizard (*Cnemidophorus gularis*) and a great quantity of similar fibre, of which at times they must partake largely.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
♂	♂ ad.	Red River Cañon	May 20	McCauley	183	24.0	20.0	7.5	13.1	Tarsi 2.6 (♂)
♀	♀ ad.	.....do	May 20	.....do	184	20.8	19.8	7.20	12.0	and 2.5 (♀). Bill each 2.1.

[* It may be worth while to remember that this name, under various spellings, is generally applied, or supposed to apply, to a very different bird, namely, *Ortalia vetula*. —Ed.]

COCYZUS AMERICANUS, (L.) Bp.—*Yellow-billed Cuckoo*.

Found frequently on Mulberry, McClellan, and other creeks, some distance from their heads, where the scant timber-fringe at their upper parts had developed into fine shady groves. They were decidedly shy and preferred to perch among high branches, often alighting, where they could have an extended view, upon the bark of a tree, clinging in the most approved Woodpecker style. Occasionally dashing about, with their bright, lustrous plumage flashing through the trees, they would venture down to a common-place sunflower or reed in search of insects. Like many of their kind, the Cuckoos were relying chiefly upon grasshoppers for their food.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
35	♀ ad.	Mulberry Creek ..	June 18	McCauley ..	208	12.5	17.5	6	6.5	

But one nest was found, which contained a single egg, June 17. No young were observed in it or near by. The egg, a pretty pale green and decidedly oval, measured 1.2 inches by 0.83 in diameter.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
19	Mulberry Creek	June 17.....	McCauley	1	1	

PICIDÆ.

PICUS SCALARIS, Wagler.—*Texas Woodpecker*.

Several specimens noted on McClellan, Mulberry Creeks, etc. Not as frequent as *M. erythrocephalus*.

MELANERPES ERYTHROCEPHALUS, (L.) Sw.—*Red-headed Woodpecker*.

Very abundant on McClellan, Mulberry, and other wooded creeks, except at their headwaters, where they were, however, found occasionally. Specimens obtained showed slight yellowish tinge, with a few faint crimson-tipped feathers on the belly.

On submitting one of them to Dr. Coues for his examination, he confirmed its identification, pronouncing it an undoubted *M. erythrocephalus*.

For comparison with the Kansas varieties, I obtained one of the latter, and found the difference marked, if not distinctive. In place of the strong yellowish wash, the belly was pure white, save a few feather-tips, with a faint tinge of lemon. The Texan ones contained much less white upon the tail, on both rectrices and coverts; had feet and tarsi more

bluish than the latter, whilst their bills, black-tipped, were horn-blue throughout, the Kansas variety grading to ashy-white at the base.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
222	♂ ad.	Sweetwater Creek Red River Cañon	May 12 May 29	McCauley .. Lt. Baldwin.	177	9.25	11.6	5.4	3.6	

STRIGIDÆ.

BRACHYOTUS PALUSTRIS, Auct.—*Short-eared Owl.*

McClellan Creek and other streams, in their well-wooded parts, with marshy banks and here and there large pools, the delight of the buffalo, possess their quota of inhabitants of the *Strigidae*. The specimen secured was shot in a grove immediately by the camp, and being brought in not quite dead and shown to one of the captive Falcons (*F. mexicanus*) kept as pets, they at once engaged in a combat, and could not be separated until the last breath of the Owl had loosened her grip.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
49	♀ ad.	McClellan Creek..	June 21	McCauley ..	222	16.75	38.75	11.5	6	Stomach contained a Gopher (<i>Geomys bursarius?</i>).

? SYRNIUM NEBULOSUM, (Forst.) Boie.—*Barred Owl.*

This specimen was secured in one of the deeply-shaded groves along Lower McClellan Creek, sitting lengthwise upon a great high limb. None were noticed at any headwaters of streams, which point they doubtless never frequent, owing to the smaller size of the timber.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
50	♀ ad.	McClellan Creek..	June 21	McCauley ..	223	24.0	52.0	14.75	8.75	Stomach contained a Gopher (<i>Geomys bursarius?</i>).

SPEOTYTO CUNICULARIA HYPOGÆA, (Bp.) Coues.—*Burrowing Owl.*

Both upon the great plain itself and on the rolling prairies from Dodge, Kansas, to the south, up to its edge, scarcely a town of Prairie Dogs (*C. lu-*

loricianus) was without its owlish sentinel. In many of them, they seemed to outnumber the other inhabitants, the road south of the Cimarron being still remembered for its large number of the birds. Their shyness seemed to vary with the sun; at midday or afternoon exceedingly wary generally; in the early morning the reverse. It may have been a morning nap, or a delusive idea that they alone had eyes. Be that as it may, before the sun was well up, they showed the utmost indifference to our approach, and never moved until we were almost upon them. It was particularly so upon a damp or drizzly morning; and as we drove by the dog's town, we merely caught a glimpse of the hind legs and tail of the dog himself scampering into his hole, intent upon the interests of his family; whilst nearer, upon a small sunflower or reed, perched the owl, as immovable as a supreme-court judge. The owl was always apparently lost in thought, had nothing to do in particular, and more time at his disposal than anything else in the world, whilst the dog was always busy and without a moment to spare. The other member of the trio which leads the traditional life of peace in the same dwelling, constituting the "Happy Family" of the boundless prairie and the Far West, the Rattlesnake (*Crotalus confluentus*), was also noted, often in their vicinity. The oft-told tale of their social life having been related by distinguished naturalists, had always been received without the grain of allowance necessary for snake stories, although an actual instance had never been met with. Last spring, however, I witnessed an occurrence which showed that the dogs and the snakes may be found in the same holes, whatever the nature of their association may be.

Marching along in Texas, near the Rio Grande, one day, through a dog town, one of the finest of a pack of hounds belonging to Lieutenant Goodwin, Ninth Cavalry, took after one of the dogs, that, perched on the top of his mound, was barking in a manner peculiarly aggravating. The hound of course got there a second too late—what was ever in time for a prairie dog?—but put his nose in the hole as far as possible, and drew forth a live rattlesnake. The column went on, but the poor hound was left behind.

We were upon the Staked Plain when the owlets were of just the size for a delicious morsel; the rattlesnakes were also plentiful, and, as I naturally killed every one I met with, I made it a point to often examine to see whether any of the young birds had fallen a prey to their next-room neighbors, but without success. This, however, was not conclusive that they sometimes did not; merely that none had been detected in the act.

No hole was examined to get down as far as the eggs, simply for want of time; we frequently saw them apparently paired, at the same hole, and, without doubt, nidification was in progress, from the general size and age of young seen later. The number of eggs has been differently stated, but, although variable, it must often be at least six, for I have seen broods of as many young, well fledged, to which may be added possibly one or more sacrificed to appease the hunger of the snakes, either as

a developed embryo or before. All of the broods referred to were too young to have gone many yards from home; there were none of their kind for a long distance, and the extreme solicitude displayed by the mothers was conclusive that they belonged to one clutch.

During a day's march across the country near McClellan Creek, when we had seen no owls for a long distance, one of the scouts with our party espied, a short distance ahead, a mother with her family, giving them an airing in the morning sun, perhaps ten or fifteen yards from their home. Putting spurs to his horse, he bore down upon them, the frightened mother scrambling for home, anxiously calling her young. Unfortunately for the interests of the family, they were only equal to a fair toddle, and in their confusion two of them were cut off and captured, one of which was set at liberty, at once going for his hole with a lively step. There were six or seven in all, and undoubtedly were from the same hatch; they were in their pin-feathers (June 19). The captive was taken to camp, and such an exceedingly comical object was he, with his little body and huge yellow eyes, that he turned out to be the prime pet of our party, furnishing more amusement than all the others together.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
52	♂ ad.	Staked Plain.....	June 18	McCauley	225	9.6	28.8	7.3	3.1	Stomachs contained <i>Ooleptera</i> , etc.
64	♂ ad.	Staked Plain.....	June 21	do	237	9.5	28.0	7.0	3.0	
69	♂ ad.	Cimarron River...	June 24	do	242	9.6	28.4	7.1	3.0	
70	♂ ad.	Bluff Creek, Kans	June 27	do	243	9.8	28.5	7.2	3.5	

FALCONIDÆ.

NAUCLERUS FURCATUS, (L.) Vig.—*Swallow-tailed Kite*.

A specimen noted, going along Wolf Creek, Indian Territory.

FALCO MEXICANUS, Licht.—*Lanner Falcon*.

Occasionally observed in open country to Red River region, and thence in cañon localities. At Cañoncito Blanco, after obtaining one of the parent birds, an attempt was made to secure the nest, admirably situated in a crevice, about fifteen feet below the top of the vertical cañon-wall. Its height was nearly a hundred feet from the stream's bed, and the wall could not be scaled from below, the top jutted out, a great rock overhanging, preventing any one from getting down from its edge. After shooting one of the brood, which, older and much larger than the others, was advanced enough to fly, the rest were secured by one of the scouts in a decidedly novel manner. Tying a fish-hook to a short rag, fastened at the end of a long pole, he thrust it down into the nest, lying down upon the overhanging edge of the rock. True to their instincts, the young, unable to walk or fly, were ready for a fight; they pecked at the "intruder" one by one, and were rudely fished out in suc-

cession. The total number of the young was four, [*] and from their relative size the three last eggs laid must have been hatched out at or nearly the same time. The captives were thereafter the pets of the camp, and thrived wonderfully, showing their remarkable pugnacity and spirit on every possible occasion, regardless of the size of the opponent. No amount of kindness could ever induce them to forget the use of their claws against their best friend; all efforts at taming them were fruitless. When given, for the first time, a bird, a Killdeer Plover, shot for their benefit, they scrambled over it, and, after a rough diversion, settled down in opposite directions at the end of their lariats, which were used to keep them attached to their owner's tent. Holding on by their claws to their prize, they pulled out the feathers carefully with the skill of experts, and then swallowed both flesh and bones.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
27	♀ ad.	Cañoncito Blanco	June 3	McCauley	200	19	43	14	9.25	The stomach contained a Gopher (<i>G. bursarius?</i>).
66	♂ juv.	do	June 4	do	239					

FALCO RICHARDSONI, Ridg.—*Richardson's Falcon.*

This handsome Falcon was found very abundant, chiefly in the cañon region of Red River. Ascending any of the side-cañons running from the river up to and against the almost vertical wall of the plain, one was almost sure of having several in sight. They were also common, though not in the same abundance, in the lower heavily wooded parts of Mulberry and other creeks, where they were not so extremely shy and wary. None were observed whilst passing through the Indian Territory. As the Red River tributaries were ascended, the large and beautiful groves grew smaller proportionately, until even the scant timber-fringe dwindled to low brush along the bank, with simply an occasional tree. Here various birds, deadly foes by nature, would of necessity apparently forget their enmity, and build in such proximity as could nowhere else be found. One of the parties which ascended the Tule to its headwaters, finding no trees at the highest permanent water, and noticing a solitary one beyond, visited it. It was found three miles higher up, without water, and upon it were several nests. Of these, one belonging to a species of *Falconidae* and another to one of the *Corvine*, were within 6 feet of each other. At a grove on White Fish Creek, where, within 500 yards were over forty nests of various kinds of birds, the nest obtained was taken from a small cottonwood with nests of *Tyrannidae* upon the one adjoining. It was placed in a crotch of a tree, 20 or 25 feet up. The twigs used in building varied from one-fourth of

[* As this species, perhaps, lays but three eggs, may not the larger bird observed in this case have been one of the parents?—Ed.]

an inch to a tenth, mainly of small size; the whole structure being 6 inches high, with an outside diameter above of 8 inches. After having built up 2 inches from below, and considering this foundation firm and secure, the birds began the building of a high and hollow nest with a well-filled leafy interior. An outer circle being completed in the usual way, well braced to the part below, they broke off the tip ends of tiny branches of the cottonwood, leaving an inch or two of the stem, with as many leaves as possible. The ends of these were carefully placed through and twining about the outside circle, and continued until the layer of leaves was as high as the row of sticks without. Keeping each successive row the same, they arrived within an inch of the top, when, deciding that the interior must be made still softer for their young, they selected twigs with the bursting buds of cotton, which were carefully arranged and intertwined. Above, covering the cushion of cotton, were placed a number of leaves, making the whole interior or leafy diameter 5 inches, upon which the eggs were laid. They were of the nearly subspherical shape common to birds of prey, and of a dirty white, with considerable discoloration; of unequal size, with the same length, one exceeded the other in transverse diameter by a tenth of an inch.

Number of collection.	Locality.	Date.	Collector.	Nest.		Eggs.	Remarks.
20	White Fish Creek	June 19	McCauley	1		2	

FALCŌ SPARVERIUS, L.—*Sparrow Hawk*.

This elegant, plucky little Falcon flourishes, as he everywhere does, throughout the section visited, except upon the Great Plain. Every wooded stream had its quota, and as, in seeking food, they descend from feathered prey to the insect world, they must have all been rolling in fat, judging from the great abundance of grasshoppers, of various sizes and hues. They were at all events, wherever we met them, the very picture of laziness, and rarely made the effort necessary to capture a Sparrow. They managed, however, to keep up their natural distrust, and were wary of us whenever we passed. Occasionally venturing to attack one of the *Tyrannidæ*, and invariably getting the worst of it, with a crest-fallen look he kept his enforced and secluded retreat, until, detecting one of us attempting to approach, he left disgusted with things in general. They and larger *Falconidæ* seemed to be living at perfect peace with the doves (*Z. carolinensis*), of which hundreds were about; in fact, it would be a difficult matter for any of them, desirous of such prey, to find a locality where they could be as well suited.

BUTEŌ BOREALIS, (Gm.) V.—*Red-tailed Buzzard* or *Hen Hawk*.

One of the species observed whilst *en route* near the Canadian.

BUTEO SWAINSONI, Bp.—*Swainson's Buzzard*.

This magnificent Hawk was frequently seen along streams passed, and both in Red River Cañon and at the very origin of the waters, far up in the Staked Plain. At other times they were noted out on the level of the plain, miles from timber.

During a reconnaissance up the Palo Duro, at its very source, a small spring, were found a few trees, on one of which, about fifteen feet high and overhanging the water, was a nest of this Hawk with one of the parent birds upon it. As we rode, up the bird quietly withdrew; but being interested in our visit, perched upon a cliff near by, where there was a commanding view, distant about 300 yards. After an attempt to get within range, which was unsuccessful, the bird left at once. Instead of circling about and descending to some other and more distant point of view, nothing was seen of the Hawk during an hour, occupied in rest and a lunch, and it seemed likely that we must wait for several hours at the least for its return. The nest at the top of the tree, where it was well exposed to view, was then rifled of its contents, a single egg. Desirous of obtaining the parent by fair or foul means, a stone of the same size wrapped in white paper was left in its place. One of the party, with his carbine, being concealed in the undergrowth by the water and below the nest, all the others with the horses were withdrawn to the distance of over a mile. Shortly, both the old birds appeared at an immense height, and soon came nearer, sweeping around in graceful circles. After gradual descent, and an apparent consultation, the proprietor of the original egg, deceived by appearances, and influenced by parental feelings, took place cautiously upon the nest, and was secured by a carbine shot.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
19	♂ ad.	Palo Duro	May 26	McCauley . .	194	19	50	15.3	8	Tarsus 2.8, bill 1.5.

The nest was built in the usual style of large rapacious birds, in one of the main crotches of the tree, and of twigs from one-fourth to one-third of an inch in thickness; above was a scant layer of leaves taken from the tree. The egg is of a slightly bluish or a very dull white, with spots of a rusty brown; the major and transverse axes 2.24 by 1.73 inches.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
5	Palo Duro	May 26	McCauley	1	1	

PANDION HALIAËTUS, (L.) Savigny—*Fish Hawk* or *Osprey*.

A very few noted, chiefly on the Canadian. In connection with the well-known parasitism of the Bald Eagle and the Osprey, an occurrence of the kind may be here noticed without being deemed irrelevant, inasmuch as it shows how illy disposed is the Hawk to furnishing unrewarded the Bird of Liberty's provender. A friend who resides near Baltimore, upon one of the small inlets of the Chesapeake Bay, was recently taking a walk near the water's edge, when he noticed a Fish Hawk rise from the water with a prize in his mouth, and, after getting a short distance inland, beset upon by an Eagle, evidently waiting for a meal, and a quiet spectator of the fishing. Being attacked and compelled to give it up, he dropped it, which the Eagle, catching in the air, flew away with, apparently disregarding the pangs of a guilty conscience. The next day he noticed a repetition of the fishing operation by the Hawk, and on the Eagle's approach as before, he promptly dropped it again, and quickly disappeared. The Eagle caught it as before in the air; but, strangely, as he thought, let it go, and it fell to the ground. Being generally interested in nature, the gentleman concluded to go up and examine the cause of the unusual conduct of the thieving "Emblem of Freedom", our Great North American Bird. He did so, and, reaching the spot, found the supposed fish a piece of dried manure. It was the old story of "Revenge is sweet", etc., but at once suggests the conundrum, "Is there naught save mere instinct granted by nature to her creatures?"

HALIAËTUS LEUCOCEPHALUS, (L.) Savigny.—*White-headed* or *Bald Eagle*.

Met with several times in the cañon of Red River. On Mulberry Creek, June 17, a nest of this species was found containing two young about a week old. They were taken to camp, added to the list of pets of the soldiers, and brought in on our return. It was over a month before they acquired the necessary strength or learned to use their legs. Of a generally uncouth appearance, their awkward look was heightened by squatting in the most ungraceful manner upon their "elbows", as the soldiers remarked, the whole tarsus resting on the ground, and their toes and claws continually in their way, for they were evidently conscious of having no place to put them so as to be at ease. This is the one of all the feathered tribe most valuable to the red man. The birds seen were consequently and naturally, to no small degree, mistrustful on our approach. Every chief and young buck of a tribe must needs have his war-bonnet; and as the quills of the Eagle alone will suffice for such purpose, they are always in demand and eagerly sought for. The purchaser of Indian trophies and things has consequently to pay well on his adding this curiosity to his collection.

POLYBORUS THARUS AUDUBONI, (Cass.) Ridg.—*Audubon's Caracara*.

But a single one of the species observed near Lower Mulberry Creek,

though a large number of buffalo carcasses were passed. This is almost the extreme northern limit of its range, and doubtless over the southern portion of the plain it will be found very common.

CATHARTIDÆ.

CATHARTES AURA, (L.) Illiger.—*Turkey Buzzard*.

Common; seen in almost every section visited. Observed also feeding upon carrion in company with *C. atratus*.

CATHARTES ATRATUS, (Bartr.) Less.—*Black Vulture* or *Carrion Crow*.

The most numerous of the *Cathartidæ* observed.

On our return, in June, to Mulberry, McClellan, and other creeks, which the buffalo, in their northern migration, reached after our first visit, we found many carcasses of animals slain by hunters, generally for their hides alone, very little of the meat being used. This had attracted the Vultures in considerable numbers, compared with the quantity observed whilst going in May to the south and west.

COLUMBIDÆ.

ZENÆDURA CAROLINENSIS, (L.) Bp.—*Carolina* or *Common Dove*.

At several small groves of young cottonwoods, near McClellan and other creeks, the number seemed to be limitless, every bush or tree having tenants of this species. Passing one day down McClellan Creek, as we were riding underneath the trees, a Dove suddenly fell to the ground, and, struggling to rise without success, went through the usual various gymnastic feats essential to attain their object. The soldier with me called my attention to it, and starting off to "catch the lame bird", followed through the brush, frequently on the point of getting it, and was much astonished when the Dove rose up and flew off, after having drawn him a hundred yards away. I have frequently during the trip noted that if you suddenly come upon a nest and surprise the mother there, after sitting until she becomes aware that you are staring her out of countenance, and there is no room for hoping that you have missed her, or of saving her eggs, she will be up and off. If, however, she observes your approach, she will generally attempt the well-known fraud described. Near the lower bed of Red River and other alkali grounds traversed, they were also found, but not in the profusion they exist along McClellan, Mulberry, and other creeks containing good water, where it very naturally became a little monotonous to meet three Doves to one of any other species.

Number of collection.	Sex.	Locality.	Date.	Collector.	Measurements.				Tail.	Remarks.
					Collector's number.	Length.	Extent.	Wing.		
17	♀ ad.	Palo Duro	May 26	McCauley	192	9	16	6	3.5	Stomach: seeds, etc.

A very large number of nests could have been secured if desired, as nidification was going on (June 5-19). As a natural result of the existence in large numbers of various reptiles, none of the nests were upon the ground, being invariably on the lower limbs, or if they were well up, in the cluster of the grape-vines that often luxuriantly encircled the trees. The nests were flimsy affairs, and of the eggs, as ordinarily found, the two differed slightly in size. The greatest major axis was 1.14 inches, from which it decreased to 1.08; the extreme variation of the transverse being 0.84 to 0.80, and the general average of all measured being 1.11 by 0.813.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
13	Tule Creek	June 9	McCauley	1	2	
25	White Fish Creek	June 19	do	1	2	
26	McClellan Creek	June 20	do	1	2	

MELOPELIA LEUCOPTERA, (L.) Bp.—*White-winged Dove*.

A single specimen noted along one of the southern creeks. None of *C. passerina* met with during the trip.

MELEAGRIDÆ.

MELEAGRIS GALLOPAVO AMERICANA, (Bartr.) Coues.—*Common Wild Turkey*.

This species was first met with at Wolf Creek, Indian Territory, where numbers were observed, but not in the abundance in which it was found as lately as two years ago. It may be said to be common throughout the whole section visited save in the alkali region of Red River proper. The decrease or disappearance of this game bird from this section, particularly from the Palo Duro and the Washita regions, has been very marked during the last few years.

The young were hatched and able to fly into low trees, June 15, at which time the mothers showed comparative indifference to our approach, all their efforts being combined to get their broods away. Some of the gobblers killed were of large size and great weight, reminding us of well-fattened "Christmas turkeys".

An egg taken from a nest, just starting, was 2.28 by 1.70 inches; ground-color faint sienna, with small spots, various in size, of a darker shade.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
1	McClellan Creek	May 15	McCauley .....	.....	1	

TETRAONIDÆ.

CUPIDONIA CUPIDO PALLIDICINCTUS, Ridgw.—*Southern Pinnated Grouse* or *Prairie Hen*.

This magnificent game bird was first observed in traveling along the road south from Fort Dodge, between the Cimarron and north fork of the Canadian. It was abundant in coveys of from twenty to thirty; south of that less frequently seen. Beyond the Sweetwater, they were not found, nor were they seen in any part of the lower sections visited, until, on our return, we reached the rolling land north of McClellan Creek. This, the only one of the Grouse family proper we met with, avoids the Staked Plain, and ventures near it only where all the conditions of its prairie-life may be fulfilled.

ORTYX VIRGINIANA, (L.) Bp.—*Virginia Partridge* or *Quail*.

The habitat of this variety of the finest of game birds, extending over the great western plains, reaches through that part of the Indian Territory we traversed and across the Pan Handle to the Upper Cañon region. Strictly avoiding the Staked Plain, their range is south through Texas, touching the eastern border of the plain itself, and thence down to some point, perhaps as yet a matter of conjecture, where is found the northern limit of var. *texanus*.

At the most western part of Mulberry Creek, about longitude 101°, two specimens were secured; ten miles or more farther to the west, in the bed of Red River itself, several hundred feet below the level of the plain, I found them with young, well fledged, and as lively as crickets, June 11. In this latter place, the water was as vile and unwholesome as an alkali drink, for a steady thing, is generally acknowledged to be. Sixty miles farther up the river, our camps were by the stream in the cañon; and up beyond, on rolling land along the Palo Duro and Tierra Blanca, fine fresh water and rich grassy lands; but in these sections we never flushed a Quail, nor did we ever hear the "bob-white", so familiar farther east, during our incoming and return. The fine execution of the familiar trick of the mother bird during nidification, when an intruder approaches her home, is too well known to require repetition. It was interesting, however, to watch her movements when she found her decoy unsuccessful. Walking one day through a cluster of young cottonwoods, suddenly up jumped a hen, a half-dozen yards ahead of me, and took sharply to my left, with her usual cries and bodily agony. After going a few steps, and finding her stale decoy a failure, she continued a pace or two, and, observing me still keep on directly ahead, she altered her tune in a second. Forgetting the pain she possessed a moment before, she changed her notes to a series of the sharpest calls that a Quail could utter, evidently signals to her partner, wherever he was.

The old gentleman, in obedience to the sharp remarks of his dame,

promptly set forth and dashed out from before me, with the lovely little chicks running out from the grass beneath. The mother watched them with intense anxiety from the left, and as the cock ran off, calling them to follow, she added a few more notes, quick and decided, evidently remarks directed to the lagging little ones, and intended to hurry them on, and then cut across behind me and joined her family, safe from danger, with some haste and doubtless a great deal of satisfaction.

During our marches, the Quail met showed little wariness and generally allowed us to get very near, and it was only when a horse was turned aside and came directly toward or among them that the covey rose and flew to cover.

Neither the Scaled Partridge or Blue Quail (*Callipepla squamata*), the curiously-striped Massena Partridge (*Cyrtonya massena*), nor the beautiful Arizona quail or Gambel's Partridge (*Lophortyx gambeli*), for all of which Texas is a habitat, were observed in any part of the section visited. Gambel's Partridge, generally called by the ranchmen "Plumed Quail", I observed in great numbers last February at Fort Selden, N. Mex., latitude 32° 25', and thence in traveling south. Returning, over a month later, I did not observe any north of that point. Immediately above Selden, at whose edge it lies, stretches to the north the Jornada del Muerto (Journey of Death), a great treeless desert of ninety miles, without water save that to be purchased at a well sunk midway upon the line of travel; bordered on its western side by two steep volcanic mountain-ranges, Sierra del Caballo and Sierra Fra Cristóbal, the two the same range but for a narrow gorge or cañon between, an effectual barrier along the Rio Grande, preventing a road by its inaccessible banks; upon the east extends a like range, the San Andres Mountains, continued under the name of Sierra Soledad, the whole a long, level plain, shut in by two great impassable rocky walls, relieved only by a sight of the Rio Grande at Paraje—well named in olden time "The Rest"—latitude 33° 33', on its northern limit. No more effectual obstruction to the migration of these birds could be presented. In extreme Eastern New Mexico, however, the valley of the Pecos may render their migration north not only possible, but very probable.

Nests of eggs freshly laid were found May 15 along McClellan Creek, etc.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
58	♂ ad.	Mulberry Creek ...	June 17	McCauley ...	231	9.6	.....	4.6	2.6	
59	♀ ad.	.....do	June 17	.....do	232	9.5	.....	4.5	2.6	

CHARADRIIDÆ.

CHARADRIUS FULVUS VIRGINICUS, (Borck.) Coues.—*Golden Plover*.

Whilst abundant in March along the Upper Rio Grande region of

Texas, bordered by New and Old Mexico, none of this species had, when we were traveling south early in May through Kansas, Indian Territory, and Texas to the Red River, as yet found their way thither or been noticed in that region. The days, especially mornings, were often cold, and northers were not infrequent. On our return, in the latter part of June, this fine game bird had, like the buffalo, come north with the increasing heat, and were abundant on the route, apparently keeping up their journey. As we drove by them, if near the road, they would show no shyness whatever.

ÆGIALITIS VOCIFERA, (L.) Cass.—*Killdeer Plover*.

Very abundant in all sections, including alkaline, throughout our entire trip. In following up any sunken stream, if but a small bit of water was visible, alkali or otherwise, there were always heard the oft-repeated monotonous notes of this Wader.

In some of the smallest creeks running through sandy bottoms, tributaries of the Mulberry, etc., no water, and, save a moist surface, no indication of it, could be found in the afternoons from the great heat during the days; visiting them in the early morning, a good-sized stream would be found in its bed. Hereabouts and abundant were the Killdeer, in batches of twos or threes, and at times alone, running through the grass or along the banks.

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
31	♀ ad.	Mulberry Creek ..	June 15	McCauley ..	204	10.75	20.0	6.5	4.25	Bill 86; tarsus 1.36.
37	.....	White Fish Creek ..	June 19	Ruby .....	.....	.....	.....	.....	.....	Tarsus 1.36.
70	♂ ad.	Sweetwater Creek	June 21	McCauley ..	243	10.80	20.5	6.6	4.30	Tarsus 1.40.

The eggs were of the usual pyriform shape, and color, and averaged 1.53 by 1.09 inches. The birds in two cases observed, instead of laying their eggs directly in the sand, had selected for their "nest" buffalo "chip" (as the plainsmen call the masses of dried manure), conveniently near the water.

Number of collection.	Locality.	Date.	Collector.	Nest.	Eggs.	Remarks.
15	Battle Creek	June 13	Ruby	1	2	Embryo, very far advanced.
18	Mulberry Creek tributary ..	June 14	do	1	2	

EUDROMIAS MONTANUS, (Townsend) Harting.—*Mountain Plover*.

A number noted between Camp Supply, Indian Territory, and Fort Dodge, Kansas, upon the fine prairie land, where were also frequently seen the Long-billed Curlew and the Burrowing Owl, as usual in prairie-dog towns.

SCOLOPACIDÆ.

GALLINAGO WILSONI (Temm.) Bp.—*American or Wilson's Snipe.*

Observed along streams between Camp Supply, Indian Territory, and Fort Elliott, Texas.

TRINGA MINUTILLA, V.—*Least Sandpiper or Peep.*

A very few observed *en route* whilst passing through the southern part of the Indian Territory, near Fort Elliott.

TOTANUS SOLITARIUS, (Wils.).—*Solitary Tattler.*

Occasionally observed along water-courses, as the Canadian, etc.

ACTITURUS BARTRAMIUS, (Wils.) Bp.—*Bartramian Sandpiper or Upland Plover.*

Frequently observed on the prairie-land and near the streams, upon returning in latter part of June. Very friendly, allowing an ambulance to pass on the road within a few yards.

NUMENIUS LONGIROSTRIS, (Wils.).—*Long-billed Curlew.*

Frequent, and perhaps of as general distribution as any other species throughout the section traversed. First seen upon the prairie-lands of Kansas and the Indian Territory; its range and habitat extended over all the places visited, save in cañons themselves and the immediate vicinity of alkali water, where I do not recall having observed it. It was found in the same abundance several miles from water, on the Staked Plain, as upon the prairie or rolling-land lying about the lower parts of the creeks. In going south early in May, the birds were very shy, and could only be approached within range of a shot-gun by driving near in an ambulance, concealing your intention, as you try to "fool" a Hawk. In June, nidification was in progress, and frequently, in riding along, the bird would wait till within twenty-five yards before rising, mounted or afoot making little difference. In early May, they were in flocks of from three or four to ten or twelve; but in June, in smaller numbers, not half a dozen being seen together. Their vocal powers, at no time weak, are apparently strengthened during their hatching; then, as a shrieker, the mother proves herself an immense success. On her nest being approached, she waits until within forty yards perhaps, often less, rises up, and, circling about the spot, sends forth those touching notes so well calculated to induce one to leave to get rid of them. Their immediate effect, however, is the sympathy she seeks. At once appear a few more intimate friends, doubtless to join her in the chorus, each attempting louder calls and harsher than the rest, all circling about as if desirous of attacking the intruder with their long, ungraceful bills. This curlew pandemonium is continued with energy until the invader has gone from the vicinity and there is no sign of his return.

For the extreme delicacy of its flesh, this is to the sportsman making a fall trip through Western Texas one of the highest prized of the game birds.

TANTALIDÆ.

TANTALUS LOCULATOR, L.—*Wood Ibis*.

This large and notable bird has ventured to take up his dwelling in the Staked Plain, one having been observed on the Palo Duro, a few miles below its head; some days later, two others were met with near the upper part of the Tierra Blanca. As he has informed me, this species was previously observed by my friend, Dr. H. S. Turrill, assistant surgeon United States Army, when crossing the Staked Plain with a column of the Eighth Cavalry, under General Gregg, United States Army, in 1872. As usual, those seen were very shy. The one upon the Palo Duro, a magnificent bird, rose from the thick undergrowth bordering the stream, less than a hundred yards away, and took refuge upon the other bank below. The stream, unfortunately, being impassable from recent rains, I was prevented from attempting to follow and secure him.

ARDEIDÆ.

ARDEA HERODIAS, L.—*Great Blue Heron*.

Frequenting the Canadian, lower part of McClellan Creek, and below its mouth, on North Fork of Red River, etc. Here the vegetation changes to a denser, a ranker character; swampy places occur; the passage of the creeks or rivers by wagon-train or horseback is often a matter of difficulty, and the vicinity of the streams assumes in great part a sub-tropical aspect.

ARDEA CANDIDISSIMA, Jacquin.—*Little White Egret or Snowy Heron*.

Occurring in same localities as *A. herodias*.

ARDEA CÆRULEA, L.—*Little Blue Heron*.

Occasional; same range as previous species.

GRUIDÆ.

GRUS CANADENSIS, (L.) Temm.—*Brown or Sandhill Crane*.

A few noted near water-courses; more common near the Canadian. Nowhere seen in that abundance in which I observed them last April along the Rio Grande, in Central New Mexico, near Belen, etc.

RALLIDÆ.

RALLUS VIRGINIANUS, L.—*Virginia Rail*.

A very few found at swampy places on lower part of McClellan Creek.

FULICA AMERICANA, Gm.—*American Coot or Mud Hen*.

Occasionally noted at a few points where there were swamps or large reedy pools of water.

ANATIDÆ.

ANSER HYPERBOREUS, Pall.—*Snow Goose*.

Two fine adult specimens seen on the upper Tierra Blanca, where there are strips of wide marshy pools along the stream. They undoubtedly frequent some of the lower parts of creeks and the Canadian, but were not noticed in passing along. None of the ordinary Wild Geese (*B. canadensis*) were seen in any section visited.

This latter species I observed last February, in large numbers, in the Rio Grande region, at Albuquerque, New Mexico, and below, in April, in about the same-sized flocks, but ranging more extensively from Fort Craig north to Algodones, etc.

ANAS BOSCHALS, L.—*Mallard*.

Abundantly found on all the lower parts of water-courses and at suitable places above.

DAFILA ACUTA, (L.) Jenyns.—*Pintail or Sprigtail*.

Not uncommon on Canadian and other waters.

QUERQUEDULA CAROLINENSIS, (Gm.).—*Green-winged Teal*.

Frequently seen in about the same localities as *A. boschas*.

QUERQUEDULA DISCORS, (L.) Steph.—*Blue-winged Teal*.

Frequenting same sections as *Q. carolinensis*, and more abundant than any other of the *Anatidæ*. Very plentiful on the upper part of Red River, where the formation of pools brings many flocks of this and kindred species into the cañon made by the stream.

In plazas or villages of Old Mexico, where agriculture is promoted solely by irrigation, the ditches are often enlarged and dammed up, serving as a reservoir for the town. Passing through on the coach I have frequently noted flocks of this and kindred species, swimming about in the most friendly manner, having become so nearly tamed by long immunity from danger that they do not mind the passer-by going within less than even a dozen yards. The villagers come and go for water and the dirty children play about its edge without being heeded, the ducks knowing undoubtedly that natives with shot-guns are to be looked for less often than those other visits so "few and far between".

Number of collection.	Sex.	Locality.	Date.	Collector.	Collector's number.	Length.	Extent.	Wing.	Tail.	Remarks.
1	♀ ad.	Sweetwater Creek	May 12	McCauley ...	176	15.5	....	7.4	3	Tarsus 1.3; bill 1.6.

QUERQUEDULA CYANOPTERA, (V.) Cass.—*Cinnamon Teal*.

A number of the species observed in similar localities as *Q. discors*.

SPATULA CLYPEATA, (L.) Boie.—*Shoveler*.

A few noted on the Canadian and the lower part of McClellan Creek

AIX SPONSA, (L.) Boie.—*Summer or Wood Duck*.

Frequently observed in various streams, cañon localities, and elsewhere. Met with by one of our parties upon the hills bordering the Sweet-water, a mile or so from water, waddling about through the prairie-grass as contentedly as if it belonged to the Plover family.

FULIGULA MARILA, (L.) Steph.—*Greater Blackhead*.

Frequenting the Canadian and Lower McClellan Creek.

FULIGULA VALLISNERIA, (Wils.) Steph.—*Canvasback*.

Whilst riding up Red River Cañon, May 24, I suddenly came upon a large reedy pool of the stream, from over which arose a dozen Ducks of various kinds, and among them two of this species, not met with elsewhere.

MERGUS MERGANSER, L.—*Merganser or Fish Duck*.

A few specimens noted frequenting the Canadian; none observed elsewhere.

PELECANIDÆ.

PELECANUS TRACHYRHYNCHUS, Lath.—*White Pelican*.

Some of the localities visited form part of the habitat of this species. At the crossing of the Cimarron (Kansas), a few miles north of the line of the Indian Territory, a fine specimen was shot by one of our escort.

LARIDÆ.

STERNA SUPERCILIARIS ANTILLARUM, (Less.) Cones.—*Least Tern*.

Occasionally a few were noted on the Canadian.

PODICIPIDÆ.

PODILYMBUS PODICEPS, (L.) Lawr.—*Pied-billed Dabchick or Dipper*.

Occasional upon the Canadian.

[NOTE.—The general drift of this list reminds one of that of Dr. S. W. Woodhouse (Sitgreaves's Exploration of the Zuñi, &c.), though the latter contains various species from farther southwest not represented in the region explored by Lieutenant McCauley. The ornithology of the country traversed by the latter is interesting from the number of species more or less perfectly characteristic of the Eastern province, which there meet with Western species, producing some novel combinations. I have examined but very few of the specimens collected by Lieutenant McCauley: presuming, however, upon his accuracy of identification throughout, we have the following unusual juxtapositions of species:—

Eastern.—*Protonotaria citrea*, *Helmitherus vermivorus*, *Dendroica dominica*, *Pyrrhuloxia astiva*, *Euspiza americana*, *Cyanospiza ciris*, *C. cyanea*, *Cardinalis virginianus*, *Icterus spurius*, *I. baltimore*, *Myiarchus crinitus*, *Ortyx virginiana*, *Meleagris americana*.

Western.—*Catherpes conspersus*, *Passerculus bairdi*, *Peucaea cassini*, *Spizella breweri*, *Chondestes grammacus*, *Calamospiza bicolor*, *Goniaphea melanocephala*, *Pyrrhuloxia sinuata*, *Icterus bullocki*, *Corvus cryptoleucus*, *Melanerpes formicivorus*, *Tyrannus verticalis*, *Myiarchus cinerascens*, *Sayornis sayus*, *Antrostomus nuttalli*, *Geococcyx californianus*, *Picus scalaris*, *Sphyrapicus hypogaea*, *Falco mexicanus*.—ED.]



ART. XXVII.—CATALOGUE OF THE LAND AND FRESH-WATER
SHELLS OF NEBRASKA.

BY SAMUEL AUGHEY, PH. D.

PREFACE.

This catalogue of the land and fresh-water shells of Nebraska is the fruit of many years' study of the natural history of the State. It would have been easy to greatly extend the number of kinds, as the many different forms of some species, and which have been described as distinct by conchologists, are well represented in the State. For example, *Limnaea palustris* Müll. has the forms *L. nuttalliana* Lea, *L. elodes* Gould, *L. expansa* Hald. As these shells, however, are, in the opinion of W. S. Binney, all different forms of the same species, they are included in *L. palustris* Müll. In hearty sympathy with the movement to reduce the number of species, I have placed the suspected accidental variations under the name which the species first received.

I have the least confidence in the completeness of my collection of Unios. Many of the rivers of Nebraska have for long distances muddy bottoms. I have often waded in these streams for many miles without finding a single Unio, and then, coming on a limestone bottom, have found it almost covered with individuals belonging to a few species. As the one-tenth of the distances have not yet been explored, many species not included in this list will yet be discovered. It will be seen that a few species of the family *Strepomatidae* are given. It was supposed by Tryon that none of this large family existed in this region. As I was hunting shells here for years before any rewarded my search, many more doubtless remain to be added to this short list. It was thought best to give the principal localities for the shells. I am under obligations to Lawrence Bruner, of West Point, for Unios from the Elkhorn, and for Helices from other portions of the State. Most of all, am I under obligations to a member of my own family, who most efficiently aided me in making my collections and in classifying them, and who, by her constant encouragement, made it possible for this work to be done.

Order PULMONATA.

Suborder GEOPHILA.

Family HELICIDÆ.

Subfamily VITRININÆ.

VITRINA, Drap.

limpida, Gould.—Rare. Cedar and Knox Counties.

HYALINA, (Fér.) Gray.

nitida, Müller.—Rare. Dixon and Knox Counties.

arborea, Say.—Common in eastern counties.

viridula, Menke.—Common all over Nebraska.

indentata, Say.—Common all over Nebraska.

limatula?, Ward.—Rare in Dakota County. Never found it alive.

minuscula, Binney.—Common.

milium?, Morse.—Rare. Found dead specimens in Burt and Dakota Counties.

binneyana, Morse.—Rare. Found one only in Burt County.

exigua, Stimpson.—Rare. Dakota and Cedar Counties.

ligera, Say.—Along the Missouri bluffs.

demissa, Binney.—Rare. Richardson County.

fulva, Draparnaud.—Common.

interna, Say.—Nemaha, Richardson, and Pawnee Counties.

* (?) *lineata*, Say.—Common.

MACROCYCLIS, Beek.

concaua, Say.—Rare, but occasionally found in many counties in Eastern Nebraska.

LIMAX, Linn.

campestris, Binney.—Have found it only in the eastern counties.

Subfamily HELICINÆ.

HELIX, Linn.

solitaria, Say.—Rare. Richardson County.

strigosa, Gould.—Common.

alternata, Say.—Most widely diffused.

cooperi, W. S. Binney.—Rare. Cedar and Knox Counties.

perspectiva, Say.—Otoe, Cass, Nemaha, and Richardson Counties.

striatella, Anthony.—Common.

labyrinthica, Say.—Along the Missouri bluffs.

leporina, Gould.—Rare. Richardson County.

stenotrema?, Fér.—Only found one dead shell in Richardson County

hirsuta, Say.—Common.

monodon, Rackett.—Common.

palliata, Say.—Rare along Missouri bluffs.

* Morse regards this species as a separate genus, which he calls *Helicodiscus*.

HELIX, Linn.

appressa, Say.—Rare. Otoe and Nemaha Counties.

inflecta, Say.—Occasionally found along the Missouri bluffs.

tridentata, Say.—Common.

fallax, Say.—Common.

albolabris, Say.—Common.

albolabris, Say, var.?—Common; small.

multilineata, Say.—Common.

pennsylvanica?, Green.—Rare. Found only a dead shell in Nemaha County.

elevata, Say.—Common.

exoleta, Binney.—Rare. One specimen found in Richardson County.

thyroides, Say.—Common.

clausa, Say.—Widely diffused, but specimens rare.

profunda, Say.—Common.

sayi?, Binney.—Rare. Found only dead shells in Washington County.

pulchella, Müll.—Common along Missouri bluffs.

hortensis?, Müller.—Found dead specimens in Richardson County; may have been brought there by Indians.

Subfamily PUPINÆ.

CIONELLA, Jeffreys.

subcylindrica, Linn.—Common; Europe and America.

PUPA, Dr.

muscorum, Linn.—Rare. Dakota and Dixon Counties.

blandi, Morse.—Along Missouri bluffs.

pentodon, Say.—Common.

decora, Gould.—Rare. Knox County.

fallax, Say.—Common.

armifera, Say.—Common.

contracta, Say.—Common.

rupicola, Say.—Rare. Nemaha and Richardson Counties.

corticaria, Say.—Occasionally met with along Missouri bluffs.

VERTIGO, Müll.

milium, Gould.—Occasionally found in Nemaha and Otoe Counties.

ovata, Say.—Rare. Three specimens in Richardson County.

Subfamily SUCCINEÆ.

SUCCINEA, Dr.

haydeni, W. S. Binney.—Northern Nebraska.

ovalis, Gould.—Common.

mooresiana, Lea.—Central and Western Nebraska.

grosvenori, Lea.—Over Eastern Nebraska.

lineata, W. S. Binney.—Cedar and Knox Counties.

avara, Say.—Common.

verrilli, Bland.—Rare. Cass County.

obliqua, Say.—Common.

Family ARIONIDÆ.

Subfamily ZONITINÆ.

ZONITES, Montf.

fuliginosa, Griff.—Common in a few localities along the Missouri bluffs.

friabilis, W. S. Binney.—Southeastern Nebraska.

lævigata, Pfeiffer.—Southeastern Nebraska.

inornata, Say.—Rare. Otoe County.

gularis?, Say.—Found one dead shell in Richardson County.

arboreus?, Say.—Found only one dead specimen near the Nemaha River.

Family PHILOMYCIDÆ.

TEBENNOPHORUS, Binney.

carolinensis, Bosc.—Have found only a few specimens in Richardson County.

Family LIMNÆIDÆ.

Subfamily LIMNÆINÆ.

LIMNÆA, Lamarck.

stagnalis, Lin.—Rare. Found only north of the Platte. My specimen from Smith's Lake, Dakota County.

columella, Say.—Found only one specimen in Smith's Lake, Dakota County, and that imperfect.

reflexa, Say.—Smith's Lake, Dakota County. Also in Nemaha and Blue Rivers.

umbrosa, W. S. B.—Only as yet found in Bow River ponds and Smith's Lake.

haydeni, Lea.—Bow, Elkhorn, Logan, Elk Creek.

palustris, Müll.—All the streams of Nebraska.

desidiosa, Say.—All the streams of Nebraska.

emarginata, Say.—Bow River.

catascopium?, Say.—My only specimen obtained in Bow was dead and slightly broken.

pallida, Adams.—Bow River.

humilis, Say.—Sparingly in all streams of Nebraska.

kirtlandiana, Lea.—Bow River.

gracilis, Say.—Bow and Logan Rivers.

PHYSA, Drap.

lordi, Baird.—Loup and Wood Rivers.

gyrina, Say.—All the tributaries of the Missouri in Nebraska.

gyrina var. *elliptica*, Lea.—Though *elliptica* is now regarded as a synonym of *P. gyrina*, I have separately designated it, because in the streams of Nebraska it seems to be well marked.

ancillaria, Say.—Elkhorn, Nemaha, Loup, and Blue Rivers.

heterostropha, Say.—All the streams of Nebraska.

virginica?, Gould.—My only specimens found dead in Smith's Lake,

in Dakota County. It corresponds to the description of Gould's species from Colorado!

BULINUS, Adanson.

hypnorum, Lin.—In all the quiet waters of Nebraska.

distortus, Haldeman.—Rare; in the Nemaha River.

Subfamily PLANORBINÆ.

PLANORBIS, Guettard.

glabratus, Say.—Rare; only in the Nemaha River.

campanulatus, Say.—Bow River.

multivolvis, Case.—Rare; Bow River.

trivolvis, Say.—All the streams of Eastern Nebraska.

trivolvis var. *fallax*, Haldeman.—Found in Smith's Lake, Dakota County.

bicarinatus, Say.—All streams of Eastern Nebraska.

exacutus, Say.—All streams of Eastern Nebraska.

deflectus, Say.—All streams of Eastern Nebraska.

deflectus var. *virens*, Adams.—Found in the Nemaha and Smith's Lake in Dakota County.

albus, Müll.—Bow River, Logan.

parvus, Say.—All the streams in Eastern Nebraska.

SEGMENTINA, Fleming.

armigera, Say.—Bow and Loup Rivers.

ANCYLUS, Geoffroy.

diaphanus, Haldeman.—Bow River.

rivularis, Say.—Bow River.

caurinus, Cooper.—Logan, Elkhorn, Nemaha, and Blue Rivers.

Family VALVATIDÆ.

VALVATA, O. F. Müll.

tricarinata, Say.—Papillion and Elkhorn Rivers. Rare.

sincera, Say.—Bow and Elkhorn Rivers.

Family VIVIPARIDÆ.

VIVIPARA, Lamarek.

intertexta, ? — —. Papillion and Nemaha Rivers. Rare.

subpurpurea, Say.—Nemaha and Blue Rivers.

contectoides, W. G. B.—Nemaha River.

MELANTHO, Bowditch.

ponderosa, Say.—Elkhorn and Blue Rivers. Rare.

decisa, Say.—All the streams of Nebraska.

decisa var. *integra*, W. G. B.—All the streams of Nebraska. No clear line of demarkation between *decisa* and *integra* in Nebraska waters.

Family RISSOIDÆ.

AMNICOLA, Gould and Haldeman.

limosa, Say.—Bow, Elkhorn, Blue, and Nemaha Rivers.

granum, Say.—Nemaha River.

POMATIOPSIS, Tryon.

lapidaria, Say.—Eastern Nebraska, along the Missouri bluffs.

lustrica, Say.—Eastern Nebraska.

Family STREPOMATIDÆ.

(American MELANIANS.)

PLEUROCERA, Raf.

neglectum, Anthony.—Rare. Blue River.

GONIOBASIS, Lea.

larvaformis?, Lea.—Found only one dead specimen in Nemaha River.

occulta, Anthony.—Though Tryon regards this as a synonym of *G. depygis* Say, yet I have retained Anthony's name because it most resembles his form. Nemaha River. Rare.

semicarinata, Say.—Nemaha and Blue Rivers.

ANCULOSA, Say.

carinata, Bruguière.—Nemaha, Blue, and Elkhorn Rivers.

Family UNIONIDÆ.

UNIO, Retzius.

anodontoides, Lea.—Blue, Nemaha, and Elkhorn Rivers.

alatus, Say.—Elkhorn, Blue, and Nemaha Rivers.

aspermus, Say.—Elkhorn, Blue, and Nemaha Rivers.

blandingianus?, Lea.—Nemaha River. A dead shell.

camptodon, Say.—Nemaha River.

capax, Green.—Elkhorn and Blue Rivers.

circulus, Lea.—Nemaha River.

clavus, Lamarck.—Nemaha and Blue Rivers.

coccinus, Lea.—Nemaha and Blue Rivers.

complanatus, Soland.—Elkhorn and Papillion Rivers.

congarvus?, Lea.—Nemaha River. Dead shell.

cornutus, Bar.—Elkhorn, Blue, and Nemaha Rivers.

crassidens, Lam.—Blue River.

cylindricus, Say.—Logan, Blue, and Nemaha Rivers.

elegans, Lea.—Nemaha River.

foliatus, Hild.—Elkhorn and Blue Rivers.

fragosus, Con.—Bow and Blue Rivers.

gibbosus, Bar.—Blue and Nemaha Rivers.

gracilis, Bar.—Bow, Blue, and Elkhorn Rivers.

gubernaculum, Reeve.—Republican River.

hebetatus, Con.—All the Nebraska rivers.

higginsii, Lea.—Nemaha River.

UNIO, Retzius.

- latecostatus*, Lea.—Nemaha River.
lacrymosus, Lea.—Nemaha River. Rare.
lavissimus, Lea.—Nemaha and Blue Rivers.
ligamentinus, Lam.—Blue and Nemaha Rivers.
luteolus, Lam.—Blue River and Oak Creek.
metaneveus, Raf.—Nemaha and Elkhorn Rivers.
mississippiensis, Con.—Nemaha and Elkhorn Rivers.
monodontus, Say.—Elkhorn and Blue Rivers.
multiradiatus, Lea.—Nemaha and Blue Rivers.
mytiloides, Raf.—Nemaha and Blue Rivers.
nigerrimus, Lea.—Nemaha and Blue Rivers.
ochraceus, Say.—Nemaha and Blue Rivers.
ovatus, Say.—Elkhorn and Blue Rivers.
parvus, Barnes.—Elkhorn and Blue Rivers.
patulus, Lea.—Nemaha River.
pectorosus, Con.—Elkhorn and Blue Rivers.
perdix, Lea.—Nemaha River.
perplexus, Lea.—Nemaha River.
personatus?, Say.—Blue River. Dead specimen.
phillipsi, Con.—Papillion and Elkhorn Rivers.
pinguis, Lea.—Bow River and Tomaz Creek.
plicatus, Lesueur.—Nemaha River.
pressus, Lea.—Nemaha River.
purpuratus, Lam.—Nemaha River.
pustulosus, Lea.—Blue River.
quadratus, Lea.—Nemaha, Blue, and Republican Rivers.
radiatus, Lam.—Bow, Blue, and Nemaha Rivers.
rectus, Lam.—Nemaha River.
rotundatus, Lam.—Nemaha River.
rubiginosus?, Lea.—Nemaha. Found only a dead, broken shell.
rutersvillensis, Lea.—Nemaha and Republican Rivers.
schoolcrafti, Lea.—Bow River and Iowa Creek.
solidus, Lea.—Papillion, Elkhorn, and Logan Rivers.
spatulatus, Lea.—Bow River.
spinus, Lea.—Bow River. [?—Ed.]
subinflatus, Con.—Nemaha and Blue Rivers.
subovatus, Lea.—Nemaha and Blue Rivers.
sulcatus?, Lea.—Nemaha River. Two dead and broken specimens.
tenuissimus, Lea.—Rare in Nemaha River.
topekaensis, Lea.—Republican and Blue Rivers.
triangularis, Bar.—Blue and Nemaha Rivers.
tuberculatus, Bar.—Blue and Nemaha Rivers.
undulatus, Bar.—Blue and Nemaha Rivers.
ventricosus, Bar.—Blue and Nemaha Rivers.
zigzag, Lea.—Blue River.

MARGARITANA, Shumacher.

complanata, Lea.—Nemaha River.

marginata, Say.—Elkhorn, Bow, and Nemaha Rivers.

ANODONTA, Cuvier.

corpulenta, Coop.—Bow River and Iowa Creek.

danielsi, Lea.—Nemaha, Blue, and Republican Rivers.

decora, Lea.—Nemaha River and Oak Creek.

edentula, Say.—Nemaha River.

ferussaciana, Lea.—Nemaha River and Middle Creek.

footiana, Lea.—Bow River.

grandis, Say.—Elkhorn, Bow, Blue, and Nemaha Rivers.

imbecilis, Say.—Nemaha River.

marryatana, Lea.—Bow River, Iowa and Elk Creeks.

ovata?, Lea.—Nemaha River. Specimens all dead.

plana, Lea.—Nemaha River.

suborbiculata, Say.—Elkhorn and Blue Rivers.

undulata, Say.—Nemaha River.

wardiana?, Lea.—Blue River. Found only a dead, broken specimen

ART. XXVIII.—NOTES ON THE GEOGRAPHICAL WORK OF THE
UNITED STATES GEOLOGICAL AND GEOGRAPHICAL SURVEY
OF THE TERRITORIES.

By A. D. WILSON,
Chief Topographer.

[Plates 35-39.]

OFFICE OF THE UNITED STATES GEOLOGICAL AND
GEOGRAPHICAL SURVEY OF THE TERRITORIES,
Washington, D. C., April 16, 1877.

SIR: I have the honor to transmit herewith my report on the primary triangulation of Colorado; also, a description of the methods of the topographical field and office work.

The primary triangulation was in charge of Mr. James T. Gardner until the fall of 1875, when, on his resignation, the continuation of the work devolved upon me.

I completed the field-work during the summer of 1876, and have finished the computations, giving the results in the appended report omitting minor details.

Owing to the unfinished condition of the work when placed in my hands, and the difficulties met with in going over an immense amount of material with which I was not familiar, it is possible that some unimportant errors may occur; but I endeavored to make it as perfect as possible.

I have attempted to give a general idea of the geographical work in as concise a form as possible, designing only to convey some idea how the geographical work of the survey has been carried on, and to show upon what evidence our final maps rest. Hoping that this report may prove of interest and meet with your approval,

I am, very respectfully, your obedient servant,

A. D. WILSON,
Chief Topographer

Dr. F. V. HAYDEN,
United States Geologist-in-charge.

CHAPTER I.

PRIMARY TRIANGULATION.

When the survey of Colorado was commenced, in the spring of 1873, by the United States Geological and Geographical Survey of the Territories, it was found necessary to inaugurate a system of primary triangulation, in order to locate a number of points with a considerable degree of accuracy, upon which the topographical work might be based.

The first important step was to find a suitable location for the accurate measurement of a base-line. This first step is all important, as the future work depends entirely upon the accurate measurement of the base.

After reconnoitering the country in the vicinity of Denver, Mr. Gardner selected a spot just east of the city, where a "tangent" of the Kansas Pacific Railroad could be used to considerable advantage upon which to measure the greater portion of the base. Mr. Gardner has kindly furnished me with the following details of the measurement:

MEASUREMENT OF THE DENVER BASE.

The base is a little over six miles long, and half of it is on a "tangent" of the railroad. The west end of the base is 4,811.566 feet from the end of the "tangent" and on its western prolongation.

Three and a half days were occupied in twice measuring this base. The measurement was made with a Chesterman steel tape 100 feet long, having a spring-balance attached, by which the tape was stretched, with a tension of 16 pounds. The end of each 100 feet was marked with a knife-edge on the track or on a low stool. The profile of the line was leveled so that all inclined measurements might be reduced to horizontal distances. The temperature of a mercurial thermometer exposed to the sun was read every five minutes, and this was assumed to be the temperature of the tape. After two measurements of the base, the steel tape, without being used for further work, was taken to Washington and compared with the United States Coast-Survey standard for chains.

The following were the results of the two measurements of the Denver base:—

First measurement.

	Feet.
Measured length corrected for temperature and slope	31861. 304

Second measurement.

Measured length corrected for temperature and slope	31863. 102
Total correction applied for slope	— 1. 924
Total correction applied for temperature—	
To first measurement	+ 2. 542
To second measurement	+ 4. 67

Adopted measured length corrected for temperature and slope.....	31862.203
Correction for error in length of tape.....	+ 5.416
Correction for reduction to sea-level.....	- 7.825
Length of base-line.....	31859.794

The uncertainty of this measurement cannot probably exceed one ten-thousandth. Much of this error is doubtless due to the incorrect assumption of the relations of the temperature of the tape to that of an exposed thermometer.

From this base the work was expanded by gradually increasing triangles, with great care, to the high mountain-peaks lying to the west of Denver.

The plan adopted in this work was to use the highest and more prominent peaks as stations, taking great care to select such points as would give a good system of well-conditioned triangles and at the same time, where possible, selecting the sharper and most definite points, as they could be sighted more accurately, especially at long distances when the monuments were not visible. Where the points were not sharp or well defined it was generally found best to sight some object, such as large rocks, or on low points trees, whose distance could be measured from the point where the station was afterward made. Always on occupying a point there was a large stone monument built, which could be sighted afterward with ease at a distance of from 30 to 40 miles. In nearly all cases these monuments are the points given as the stations; in many cases the monuments were built before the point was occupied, and in such case the observations were reduced to center of the monument.

THE SAN LUIS BASE.

When the triangulation had been extended into Southwestern Colorado, a second base or base of verification was measured in the San Luis Valley and connected with the large triangles of the principal system by a smaller scheme.

The base is about $5\frac{1}{2}$ miles in length. It begins on the eastern extremity of a low gravelly ridge on the north side of Kerber Creek, near the stage-road crossing, and stretches northward diagonally across the valley, a distance of about $5\frac{1}{2}$ miles.

The position was selected by James T. Gardner, and the measurement conducted by him with the assistance of Robert Adams, jr., Professor Atkinson, and Clarence Kelsey.

The total time occupied in measuring the base twice was six days, commencing August 24, 1874. Flags were placed along the line at such short intervals that three were always in sight from which the tape could be aligned by the eye. Low stools were used for marking the distances. Their tops were of 2-inch plank and were 1 foot square. Each was supported by four iron spikes 6 inches long. Three of these stools

were placed on the line 100 feet apart. The Chesterman tape was then stretched from the initial point on the first to the second stool, being pulled straight by a strain of 16 pounds, applied with a spring-balance. The 100 feet was then marked on the top of the stool with a pencil-edge. The tape was then stretched from this mark to the third stool. When this 100 feet had been marked as before, the first stool was brought forward. Each time that the tape was stretched, the bulb of a sensitive thermometer was placed against the under side of the tape and its temperature recorded. The difference of level between the stools was ascertained with a leveling-instrument and rod.

The temperature of the tape in the sun, when the breeze was light, was found to be 5° to 6° higher than that of a thermometer exposed to the sun. The results of the two measurements of the base are as follows :

First measurement.

	Feet.
Uncorrected measurement.....	28534. 87
Corrections for slope.....	-10. 67
Corrections for temperature.....	+ 1. 40
Corrections for error of tape from United States standard at 62°	-2. 86
Corrected length of base.....	28522. 74

Second measurement.

Uncorrected measurement.....	28533. 895
Correction for slope.....	-10. 67
Correction for temperature.....	+ 2. 193
Correction for error of tape from United States standard at 62°	- 2. 86
Corrected length of base.....	28522. 558
Difference of two measurements.....	0. 18
Adopted mean.....	28522. 65
Correction to sea-level.....	-10. 89
Length of base.....	28511. 76

These two measurements of this line, $5\frac{1}{3}$ miles long, differ only about 2 inches, which is a much more accurate result than that obtained at the Denver base, where the tape was laid on the railroad track and the temperature of a thermometer exposed to the sun was assumed to be the same as that of the tape. San Luis base is of course entitled to much more weight than the Denver base in the final adjustment of the triangulation.

AZIMUTH OF SAN LUIS BASE.

For determining the azimuth of the base, six observations were made on Polaris at the north end of the base, September 5, and four observations, September 6, at the south end of the base; six observations had

been taken August 30, and ten in the evening of August 31. The mean of the observations at the south end of the base, being reduced to the north end, gave at the north end—

The azimuth of base by south-end observations $340^{\circ} 49' 29''.32$

The azimuth of base by north-end observation $340^{\circ} 49' 24''.62$

In connecting the triangulation brought down from the Denver base with the expansion from the San Luis base, it was found that there was a difference of $9\frac{1}{2}$ inches to the mile in length between the two systems, that from Denver being the greater. This difference is due, no doubt, partly to the errors in measurements of the two bases, and in the accumulating errors of the work as brought from Denver. In this scheme Pike's Peak enters as one of the principal points, and owing to its very flat top, it was difficult to locate with a great degree of accuracy.

The accuracy of the triangulation may be judged by the closure of triangles; the observed angles of each triangle should sum up to 180° plus the spherical excess.

The first sixteen complete triangles used in expanding from the Denver base to the high mountain-peaks, summed up with a mean error of closure of six and four-tenths seconds, and the forty-seven triangles used in carrying the work as far south as the San Luis base and west to the Holy Cross, had a mean error of closure of ten and three-tenths seconds ($10''.3$).

In the whole scheme of triangulation of Colorado, there has been used in the determination of the occupied stations one hundred and forty-three complete triangles, with a mean error of closure of thirteen and three-tenths seconds ($13''.3$).

These errors may be considered small when we consider that natural points were used as stations, and that the angles were taken with an 8-inch theodolite, whose circle was graduated only to ten seconds of arc and reading to five seconds.

METHOD OF ADJUSTING THE TRIANGULATION.

I present below a general description of the methods used in the adjustment of the work, omitting the minor details. In expanding the work from the measured bases, signals were established, forming as nearly equilateral triangles as possible, and the observations on these were repeated several times on different parts of the circle. The errors of closure in this way were reduced to a minimum, and this small error in the first triangles was distributed equally among the three angles. After locating some two or three points in this manner, they were then connected with the mountain stations, on which monuments had been previously built, in order that they might be more accurately sighted, in the following manner:

Having established these outside points, we then have as many different bases from which to compute the next point; so we proceeded by simply computing all the triangles we have on Mount Ouray, throwing

all the errors of closure at the point sought; that is, simply using the uncorrected foresights, except the deduction of spherical excess; after calculating all the triangles in this manner, make a plot of the intersections of these lines as calculated, say on a scale of two feet to one inch (that being the scale used in plotting those at Ouray); see Figure 1, Plate 35.

Now, it will be seen that these lines do not meet at a given point, as they should if the work was perfect. All other things being equal, the most probable location of the point would be in the center of gravity of the small triangles which are formed at the point by the intersections. But there are some other things which are important in determining the most probable position, such as the closure of the different triangles, the value of different sights, &c.

Taking such things into consideration as may be regarded worthy of note, we choose a point, as at Ouray, Fig. 1, where the two sights cross from Station 23 and Station 24, as the most probable position of the station on Mount Ouray, now we calculate the necessary swings from Hunt's Peak and north end base to make those lines meet the others at the chosen point.

Apply these corrections to the angles at Hunt's and north base, recalculate the triangles, and we have the point Ouray located.

It will be seen that, although the triangles on Mount Ouray are fixed, we have not yet distributed the errors at the point Ouray. For instance, we have yet an error of closure in the triangle Hunt's, Station 23, Mount Ouray, of $+2''$; in the triangle Hunt's, Station 24, Ouray, of $+3''$; and in triangle Hunt's, north base, Ouray, an error of $-6''$. Now, how much of this error is due to sighting Hunt's, north base, Station 23, or Station 24 is not settled. The following arbitrary method was used in distributing these errors:—

First. It will be seen that if any one of these backsights become fixed, the others of necessity are fixed also, as the angles between them are already fixed by the location of the point. If we assume a series of swings, say of the sight from Ouray to Hunt's, and tabulate the result as below, we get a series of columns of swings, each one of which will satisfy the conditions of the angles at Ouray, and give a possible arrangement of the swings:—

Table of swings from Mount Ouray.

Hunt's.....	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
North base.....	-1	-2	-3	-4	-5	-6	-5	-4	-3	-2	-1
Station 23.....	+7	+6	+5	+4	+3	+2	+1	+0	-1	-2	-3
Station 24.....	+8	+7	+6	+5	+4	+3	+2	+1	+0	-1	-2
	21	19	17	15	13	11	9	7	7a	9	11

Adding up these columns, we get the aggregate swings each would require. Other things being equal, it is best to select the column which gives the least aggregate of swings, which in this case is marked *a*; but

there may sometimes be reasons why one point is more liable to error than the others, and in that case another column may be selected if its sum differs but little from the smaller sum; as a rule, it is best always to choose the column that gives the least aggregate swing. These corrections, both fore and back, should be recorded immediately in some convenient form, as they are taken to account in all subsequent triangles in which these sides enter. In this manner the work is carried on from station to station until all are located.

The method of plotting the results as calculated from the uncorrected foresights I consider a very good check on the previous work, as any erroneous location in the previous work must appear at the new point.

Figure 4, Plate 35, represents the foresight intersections as plotted from the preliminary calculations for the location of Mount Rito Alto. All of these sights come within a circle of about 5 feet diameter, the center of which is assumed to be the most probable position, and the sights were accordingly swung to that point.

Figure 5 represents the condition of the foresight intersections on Summit Peak. Here we have one of the widest ranges occurring in the calculations of the work of 1876, and this is probably due to this point presenting a broad top as seen from the northeast, and all of the sights from that direction are taken from a long distance; but as four out of the eight sights used meet very nearly, those triangles sum up very close to 180° , while the triangles containing the sights from Mount Rito Alto, Hunt's, Stations 24 and 28, sum up too large. I assumed the error to be mostly on those sights, and was convinced that the intersections of the sights from Blanca and South River Peaks are correct, accordingly swung the other sights to that point.

Figure 6 represents the sights as plotted on Rio Grande Pyramid, and the small triangle the point chosen as the station. Figure 3 shows the condition of sights on West Elk Peak.

Figure 2 gives the intersections on Mount Wilson. The peculiar position of this point makes it one of the best proofs of the accuracy of the previous work that occurs in the whole system, although it was only occupied as a secondary station. But it was sighted from every direction, and the various points from which it was sighted were more or less located by a different series of triangles. The arrow-point shows from which direction the sight was taken, and the name of the point from which it was taken is placed on the other end of the line, or, in other words, nearest the station. All of these sights meet within a small area except one, and that being so much out as compared with the others, it is probable that some error was made in sighting from that station; therefore it was given no weight in the final location of the point. Many more examples might be given, but these few will be sufficient to give an idea of the character of the work, and will also serve to illustrate the general method of adjustment.

I consider the foregoing method of adjustment very simple, and, at

the same time, sufficiently accurate for the class of work to which it is applied.

The primary object of this triangulation is to locate points at short intervals, upon which the topographical work could be based, and that these points should be located with such a degree of accuracy that the errors would not be appreciable within the limits of the territory on our maps, the scale being four miles to one inch, and I believe that this has been fully accomplished.

The accompanying map shows a general plot of the triangulation; all of the occupied stations are given, and a few of the located points. I did not consider it necessary to give the numerous points that have been located by foresight intersections, as it would only serve to make the plot more confusing.

The latitudes and longitudes are based on the stations located for us by the kind co-operation of the United States Coast Survey at Denver, Colorado Springs, and Trinidad, and have been computed from these points.

Azimuths have been taken at intervals over the whole system.

Below will be found a list of the primary points, with their latitudes, longitudes, and elevations; also, a table of azimuths and distances from each station to the surrounding points. The azimuths are given from the south line as zero around to the right; the distances in miles and decimals thereof.

Fig. 1.

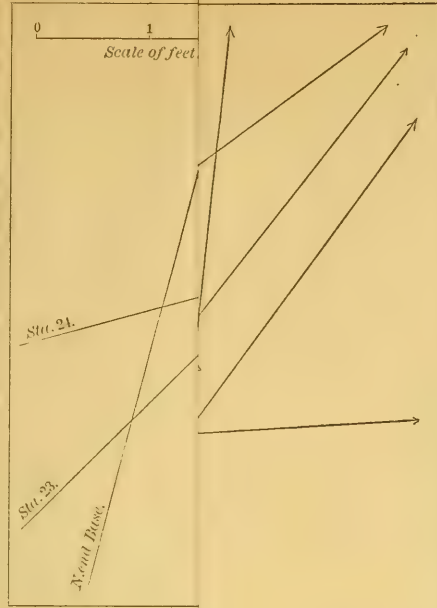


Fig. 4.

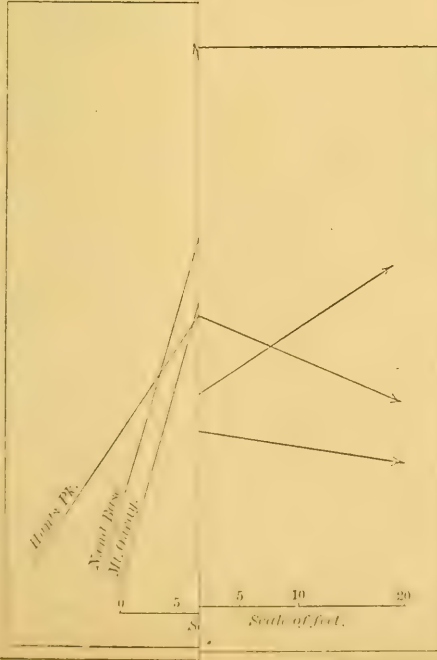


Fig. 1.

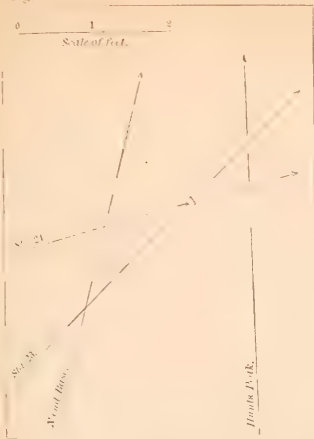


Fig. 2.

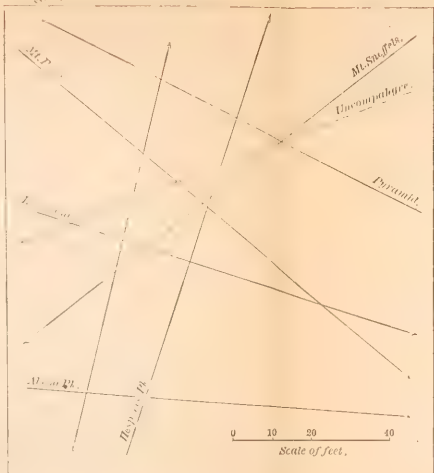


Fig. 3.

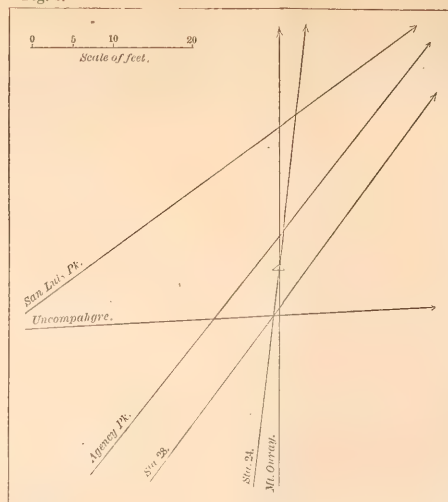


Fig. 4.

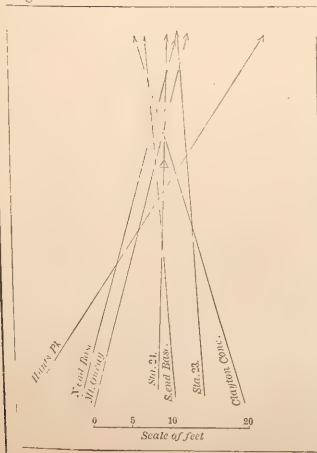


Fig. 5.

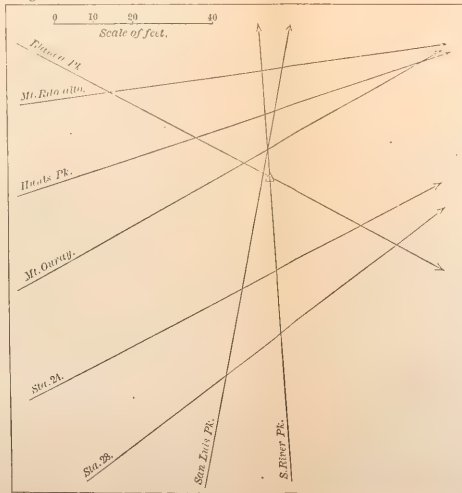
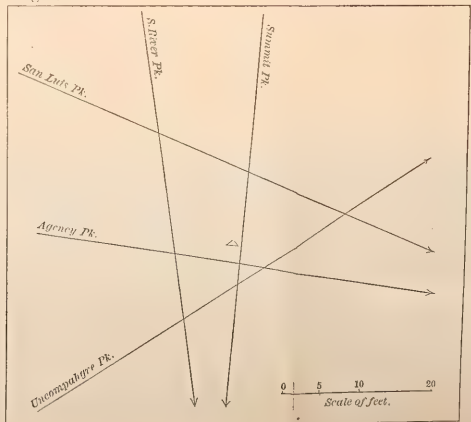


Fig. 6.



A list of the primary triangulation-stations, with their latitudes, longitudes, and elevations above sea-level.

Names of points.	Latitudes.		Longitudes.		Elevations. <i>Feet.</i>
	°	' "	°	' "	
East end of Denver base-line.....	39 45	52.2	104 47	39.2	5,200
West end of Denver base-line.....	39 46	22.7	104 54	25.3	5,200
Derrick Station.....	39 43	54.8	104 57	08.9	5,300
Dry Creek Station.....	39 56	57.0	104 55	51.8	5,500
South Boulder Peak.....	39 57	15.6	105 17	42.1	8,533
Mount Morrison.....	39 40	12.4	105 12	55.3	7,900
Long's Peak.....	40 15	20.8	105 36	38.2	14,271
Mount Evans.....	39 35	21.3	105 38	21.9	14,330
Torrey's Peak.....	39 38	37.4	105 48	01.1	14,336
Park View Peak.....	40 19	52.2	106 07	53.2	12,433
Mount Powell.....	39 45	41.1	106 20	10.2	13,398
Mount Lincoln.....	39 21	09.1	106 06	26.8	14,296
Mountain of the Holy Cross.....	39 28	05.2	106 28	39.1	14,176
Mount Harvard.....	38 55	32.2	106 19	01.3	14,375
Pike's Peak.....	38 50	27.3	105 02	25.6	14,147
Mount Ouray.....	38 25	26.1	106 13	15.7	14,043
Station 24.....	38 19	34.2	106 12	52.9	13,200
Station 23.....	38 16	34.6	106 06	00.6	12,000
Hunt's Peak.....	38 23	03.3	105 50	30.5	12,446
Mount Rito Alto.....	38 13	14.2	105 45	10.1	12,989
Station 28.....	37 55	18.1	106 32	16.4	12,300
Clayton Cone.....	38 12	58.2	105 55	29.3	9,500
Agency Peak.....	38 16	30.7	106 51	47.6	12,120
North end San Luis base.....	38 19	40.3	105 59	04.4	7,800
South end San Luis base.....	38 15	14.0	105 57	07.0	7,800
Blanca Peak.....	37 34	43.5	105 28	55.4	14,413
Culebra Peak.....	37 07	25.1	105 10	56.3	14,079
Fisher's Peak.....	37 05	59.6	104 27	31.9	9,460
Summit Peak.....	37 21	07.3	106 41	35.4	13,323
South River Peak.....	37 34	31.7	106 58	40.2	13,160
San Luis Peak.....	37 59	16.8	106 55	39.2	14,100
Uncompahgre Peak.....	38 04	23.0	107 27	30.1	14,235
Rio Grande Pyramid.....	37 40	52.2	107 23	19.2	13,773
Hesperis Peak.....	37 26	44.2	108 05	02.2	13,135
Abajo Peak.....	37 50	21.7	109 27	29.7	11,000
Mount Peale.....	38 26	18.5	109 13	32.4	13,004
Lone Cone.....	37 53	19.2	108 15	04.4	12,761
West Elk Peak.....	38 43	09.2	107 11	44.2	12,920
Snow-mass Mountain.....	39 07	11.9	107 03	45.5	13,961
Leon Peak.....	39 04	51.0	107 50	24.7	10,954
North Mam Peak.....	39 23	16.6	107 51	43.8	10,973
Mount Princeton.....	38 45	01.3	106 14	19.2	14,199
Massive Mountain.....	38 39	44.7	106 28	13.6	14,368
Platte Peak.....	39 15	40.5	105 05	49.0	9,348
Crestone Peak.....	37 58	05.3	105 34	54.0	14,233
Costilla Peak.....	36 50	06.0	105 13	09.4	12,634
East Spanish Peak.....	37 23	40.5	104 54	59.9	12,720
West Spanish Peak.....	37 22	37.6	104 59	24.3	13,620
Ute Peak.....	37 17	02.5	108 46	24.9	9,884
San Juan Needle.....	36 41	15.2	108 49	50.4	-----
Mount Wilson.....	37 50	26.4	107 59	16.9	14,280
Mount Sneffels.....	38 00	19.0	107 47	18.7	14,156
Pagosa Peak.....	37 26	43.1	107 03	47.2	12,674
Banded Peak.....	37 06	21.6	106 37	24.5	12,860
Station 81.....	37 02	30.6	106 37	31.6	12,043
Station 33.....	38 01	27.8	106 55	11.4	14,000
Sopris Peak.....	39 15	52.9	107 10	21.1	12,972
La Plata Mountain.....	39 01	50.3	106 28	09.2	14,311

A list of some of the more important places in Colorado, with their approximate latitudes, longitudes, and elevations above sea-level.

Names.	Latitudes.			Longitudes.			Elevations. <i>Feet.</i>
	°	'	"	°	'	"	
Black Hawk	39	48	00	105	29	12	7,975
Breckenridge	39	29	00	106	02	18	9,490
Boulder	40	00	42	105	16	36	5,536
Cañon City	38	26	48	105	13	51	5,260
Conejos	37	06	53	106	01	10	7,880
Caribou	39	59	48	105	34	24	9,905
Centreville	38	42	48	106	03	18	7,800
Castello's Ranch	38	57	00	105	17	12	.....
Colorado Springs United States Coast-Survey Station	38	50	00.3	104	49	07.6	5,990
Denver United States Coast-Survey Station	39	45	21.8	104	59	33.5	5,240
Denver School-house	39	45	00.7	104	59	23.4	5,240
Del Norte	37	41	00	106	21	24	7,750
Dayton	39	04	48	106	22	00	9,441
Evans' Ranch, in Estes Park	40	22	30	105	29	09	7,400
Fort Garland	37	25	31	105	25	47	7,945
Fair Play	39	13	29	105	59	39	9,964
Georgetown	39	41	45	105	42	06	8,530
Greeley	40	25	24	104	41	06	4,779
Golden	39	45	30	105	12	39	5,729
Granite	39	02	00	106	00	18	8,883
Gold Hill	40	03	54	105	23	18	8,463
Hot Springs, Middle Park	40	04	48	106	05	32	7,700
Idaho	39	44	54	105	30	39	7,535
Lake City	38	01	54	107	18	42	8,550
Los Piños Agency	38	11	37	106	49	36	9,290
Longmont	40	09	30	105	05	34	4,957
Malta	39	13	42	106	19	45	9,700
Middle Boulder	39	57	38	105	30	22	8,263
Nutrites Tierra Amarilla	36	42	11	106	32	52	7,480
Pueblo	38	16	36	104	33	48	4,703
Parrott City	37	20	39	108	05	00	8,611
Rosita	38	06	00	105	50	12	8,500
Saguache	38	05	43	106	08	30	7,745
Silverton	37	48	42	107	39	48	9,400
Trinidad United States Coast-Survey Station	37	10	13.8	104	30	07.5	6,100
Uncompahgre agency	38	17	15	107	47	18	6,400
White River agency	39	59	08	107	48	24	6,490

Azimuths and distances from east end of Denver base to—

Names.	Azimuths.			Distances. <i>Miles.</i>
	°	'	"	
Pike's Peak	11	46	24	.....
Platte Peak	25	06	31	38.3059
Derriek	75	05	50	8.7224
Mount Morrison	73	57	23	23.3673
West base	95	35	47	6.0341
South Boulder Peak	116	20	55	29.6720
Dry Creek Station	150	18	08	14.6702

Azimuths and distances from west end of Denver base to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Platte Peak	16 06 48	36.7356
Derrick	40 29 03	3.7274
Mount Morrison	66 44 33	17.8974
South Boulder Peak	121 21 43	24.1242
Dry Creek Station	173 59 52	12.2203
East base	275 31 31	6.0341

Azimuths and distances from Derrick to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Platte Peak	13 25 51	33.3759
Mount Evans	65 10 31	37.9258
Mount Morrison	73 09 52	14.6479
South Boulder Peak	120 12 36	23.8186
Dry Creek Station	144 19 05	15.0314
West base	180 26 57	3.7273
East base	214 59 07	8.7224

Azimuths and distances from Dry Creek Station to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Derrick	4 19 54	15.0314
Pike's Peak	4 23 03	.....
Platte Peak	10 37 15	.....
Mount Morrison	38 14 51	24.4825
Mount Evans	57 11 14	45.1500
South Boulder Peak	91 09 55	19.3257
Long's Peak	120 38 52	41.7524
East base	330 12 14	14.6702
West base	353 58 14	12.2203

Azimuths and distances from South Boulder Peak to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Mount Evans	36 09 04	31.1501
Long's Peak	141 17 48	28.6823
Dry Creek Station	270 55 56	19.3260
East base	296 01 03	29.6720
West base	301 06 08	24.1242
Derrick	309 59 25	23.8186
School-house	310 50 51	21.4847
Platte Peak	347 28 40	.....
Mount Morrison	347 46 55	20.0576
Pike's Peak	349 51 00	.....

Azimuths and distances from Mount Morrison to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Mount Evans	76 15 46	23.2914
Torrey's Peak	86 55 37	32.1226
Long's Peak	152 40 34	45.5223
South Boulder Peak	167 49 58	20.0576
Dry Creek Station	218 03 55	24.4828
School-house	245 14 33	13.2302
West base	246 32 04	17.8976
Derrick	252 59 47	14.6479
East base	253 40 36	23.3673
Pike's Peak	350 37 01	57.9658
Platte Peak	347 18 37	28.9083

Azimuths and distances from Long's Peak to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Mount Evans	1 54 55	46.0061
Torrey's Peak	14 36 45	43.6219
Mount Lincoln	23 08 54	67.6855
Mountain of the Holy Cross	40 34 53	71.2500
Mount Powell	48 41 28	51.4254
Park View Peak	100 52 14	28.0021
Clark's Peak	145 44 40	29.3976
Dry Creek Station	206 13 15	41.7524
South Boulder Peak	321 06 14	26.6823
Mount Morrison	332 26 11	45.5223
Pike's Peak	342 29 32	102.2415

Azimuths and distances from Park View Peak to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Mount Powell	15 30 15	40.7758
Mountain of the Holy Cross	17 16 44	-----
Snow-mass Mountain	30 59 44	97.1381
Mount Zirkel	139 53 14	45.2226
Clark's Peak	209 36 01	21.9453
Long's Peak	280 32 01	28.0021
Mount Evans	332 48 14	57.4602
Torrey's Peak	340 30 43	50.2743
Mount Lincoln	358 54 34	67.5222

Azimuths and distances from Mount Evans to—

Names.	Azimuths.			Distances.
	c	'	"	Miles.
Mount Rito Alto.....	3	54	06	.....
Hunt's Peak.....	11	11	13	.....
Mount Ouray.....	21	27	58	.....
Mount Princeton.....	29	15	59	.....
Mount Harvard.....	38	39	16	58. 4479
Mount Lincoln.....	57	01	13	29. 8788
Mountain of the Holy Cross.....	79	41	28	45. 5439
Torrey's Peak.....	111	41	33	10. 1900
Park View Peak.....	153	07	12	57. 4602
Long's Peak.....	181	53	49	46. 0061
South Boulder Peak.....	215	56	27	31. 1501
Dry Creek Station.....	236	24	39	45. 1500
Derrick.....	254	44	34	37. 9258
Mount Morrison.....	256	00	25	23. 2914
Platte Peak.....	277	52	49	.....
Pike's Peak.....	327	54	05	60. 7968

Azimuths and distances from Torrey's Peak to—

Names.	Azimuths.			Distances.
	o	'	"	Miles.
Hunt's Peak.....	4	27	43	.....
Mount Ouray.....	14	36	32	.....
Mount Princeton.....	20	17	50	.....
Mount Harvard.....	28	33	57	56. 3247
Mount Lincoln.....	37	46	49	25. 3864
Mountain of the Holy Cross.....	71	14	36	37. 2951
Mount Powell.....	106	30	37	28. 8329
Park View Peak.....	160	42	10	50. 2743
Long's Peak.....	194	28	08	43. 6219
Mount Morrison.....	266	32	45	32. 1226
Mount Evans.....	291	34	04	10. 1900
Pike's Peak.....	322	47	46	69. 2939
Mount Rito Alto.....	357	58	10	.....

Azimuths and distances from Mount Powell to—

Names.	Azimuths.			Distances.
	o	'	"	Miles.
Mount of the Holy Cross.....	20	28	30	21. 5940
Snow-mass Mountain.....	41	30	56	58. 8606
North Mam.....	72	56	57	85. 4079
Park View Peak.....	195	21	40	40. 7758
Clark's Peak.....	200	16	58	62. 2896
Mount Zirkel.....	165	59	15	76. 0947
Long's Peak.....	228	12	46	51. 4254
Torrey's Peak.....	286	10	43	28. 8329
Mount Lincoln.....	336	30	12	30. 7364
Mount Ouray.....	356	27	51	.....
Mount Harvard.....	358	57	50	57. 6647

Azimuths and distances from Mountain of the Holy Cross to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Snow-mass Mountain.....	52	45	03	39.4744
Sopris Peak.....	69	40	47	39.6828
North Mam.....	86	11	37	74.2561
Mount Powell.....	200	23	05	21.5940
Long's Peak.....	220	00	52	71.2500
Torrey's Peak.....	250	49	21	37.2951
Mount Evans.....	259	08	54	45.5439
Mount Lincoln.....	291	47	55	21.3469
Mount Harvard.....	346	58	25	38.4013
Massive Mountain.....	359	02	21	19.2713

Azimuths and distances from Mount Lincoln to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Mount Ouray.....	5	29	41	42.1342
Mount Princeton.....	9	40	55	31.5288
Mount Harvard.....	20	58	55	29.4930
La Plata Mountain.....	41	16	18	22.5581
Massive Mountain.....	60	02	56	53.6720
Snow-mass Mountain.....	72	55	44	21.3469
Mountain of the Holy Cross.....	112	02	01	30.7364
Mount Powell.....	156	38	57	67.5222
Park View Peak.....	178	54	49	67.6865
Long's Peak.....	202	49	09	25.3864
Torrey's Peak.....	217	35	44	29.8788
Mount Evans.....	236	42	42	67.3390
Pike's Peak.....	301	15	23	67.3870
Mount Rito Alto.....	346	06	51	
Hunt's Peak.....	352	20	09	

Azimuths and distances from Mount Harvard to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Station 28.....	9	53	19	70.2684
San Luis Peak.....	27	18	24	72.6478
Agency Peak.....	33	33	31	53.7261
Uncompahgre Peak.....	46	48	33	85.3480
Snow-mass Mountain.....	108	42	45	42.2966
La Plata Mountain.....	131	31	52	10.9376
Massive Mountain.....	155	26	51	19.9659
Mountain of the Holy Cross.....	167	03	33	38.4013
Mount Powell.....	178	57	34	57.6647
Mount Lincoln.....	200	49	31	31.5288
Torrey's Peak.....	208	13	59	56.3247
Mount Evans.....	218	11	56	58.4479
Pike's Peak.....	274	25	14	69.0670
Green Horn Mountain.....	317	03	01	101.2664
Mount Rito Alto.....	327	41	11	57.4248
Hunt's Peak.....	331	21	36	42.4962
Mount Princeton.....	340	43	03	12.8056
Mount Ouray.....	351	26	28	34.9895

Azimuths and distances from Pike's Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Mount Rito Alto.....	42	15	21	57.6416
Hunt's Peak.....	57	24	25	58.0755
Mount Ouray.....	66	06	30	70.0541
Mount Princeton.....	84	50	12	64.9754
Mount Harvard.....	95	14	02	69.0670
Mount Lincoln.....	121	55	32	67.3390
Torrey's Peak.....	143	16	48	69.2939
Mount Evans.....	148	15	51	60.7968
Long's Peak.....	162	50	12	102.2415
Mount Morrison.....	170	43	35	57.9658
Northwest corner signal-house.....	306	15	21	0.0311
Fisher's Peak.....	345	01	19	124.2428
West Spanish Peak.....	358	26	36	101.0347

Azimuths and distances from Mount Ouray to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Concjos Peak.....	13	43	04	80.4506
Summit Peak.....	19	23	16	78.2971
Station 23.....	26	34	28	38.6946
South River Peak.....	35	26	57	71.6218
San Luis Peak.....	52	12	03	48.8060
Station 33.....	54	17	11	46.9518
Uncompahgre Peak.....	70	36	20	71.5139
Agency Peak.....	73	48	47	36.3576
West Elk Peak.....	111	24	14	56.5627
Snow-mass Mountain.....	136	50	11	66.1018
Mount Harvard.....	171	30	01	34.9895
Pike's Peak.....	245	21	30	70.0541
Hunt's Peak.....	280	08	54	15.3994
North base.....	297	13	31	14.4470
Mount Rito Alto.....	298	43	16	29.0479
West Spanish Peak.....	316	39	09	98.6668
Banca Peak.....	325	05	44	70.8794
Station 23.....	327	09	50	12.1158
Station 24.....	357	04	55	6.7502

Azimuths and distances from Station 24 to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Conejos Peak.....	15 13 16	74. 0074
Summit Peak.....	21 25 46	72. 0972
Station 28.....	32 21 37	32. 9868
South River Peak.....	39 04 01	66. 4614
San Luis Peak.....	59 13 41	45. 2855
Station 33.....	61 45 24	43. 6658
Uncompahgre Peak.....	75 55 21	69. 8995
Agency Peak.....	84 30 19	35. 4229
West Elk Peak.....	117 19 30	59. 6608
Snow-mass Mountain.....	140 20 36	71. 3875
Mount Ouray.....	177 05 09	6. 7502
Hunt's Peak.....	254 47 34	15. 3527
Mount Rito Alto.....	286 01 41	26. 1464
Station 23.....	298 54 53	7. 1124
Crestone.....	305 25 39	42. 4108
Clayton Cone.....	307 14 09	12. 5249
West Spanish Peak.....	313 58 44	93. 6302
Blanca Peak.....	321 57 37	65. 2514

Azimuths and distances from Station 23 to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Station 28.....	44 28 02	34. 1601
San Luis Peak.....	66 30 00	49. 2594
Station 33.....	69 02 06	47. 8940
Uncompahgre Peak.....	79 43 45	75. 2582
Station 24.....	119 01 36	7. 1124
Mount Ouray.....	147 16 48	12. 1158
Hunt's Peak.....	229 06 50	11. 3806
North base.....	240 28 56	7. 2213
South base.....	280 49 35	8. 2065
Mount Rito Alto.....	281 25 13	19. 2785
Clayton Cone.....	317 58 18	5. 5831

Azimuths and distances from Clayton Cone to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Station 24.....	92 44 37	12. 5250
Station 23.....	138 02 22	5. 5831
North base.....	198 21 13	8. 1149
Hunt's Peak.....	202 49 52	12. 5760
South base.....	238 59 06	5. 0472
Mount Rito Alto.....	268 49 15	15. 1625

Azimuths and distances from north end of San Luis base to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Clayton Cone	18	19	00	8. 1149
Station 23	60	30	46	7. 2213
Mount Ouray	117	22	20	14. 4470
Hunt's Peak	210	49	57	4. 5304
Mount Rito Alto	300	20	50	14. 6108
Blanca Peak	331	52	16	-----
South base	340	49	27	5. 399955

Azimuths and distances from south end of San Luis base to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Clayton Cone	58	58	06	5. 0472
Station 23	100	52	38	8. 2065
North base	160	50	40	5. 399955
Hunt's Peak	183	30	36	9. 0072
Mount Rito Alto	281	54	41	11. 0727
Blanca Peak	330	59	04	-----

Azimuths and distances from Hunt's Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
South base	3	30	59	9. 0072
Clayton Cone	22	49	14	12. 5760
Conejos Peak	24	34	53	82. 8471
Summit Peak	30	13	04	65. 2836
North base	30	51	33	4. 5304
Station 28	45	41	06	45. 5127
Station 23	49	10	16	11. 3806
San Luis Peak	63	19	12	60. 2162
Station 33	65	18	23	58. 7249
Station 24	74	57	44	15. 3527
Mount Ouray	100	19	18	15. 3994
Mount Harvard	151	35	40	42. 4962
Mountain of the Holy Cross	159	02	38	-----
Mount Lincoln	172	25	19	67. 3870
Torrey's Peak	184	22	13	-----
Pike's Peak	236	49	58	58. 0755
Mount Rito Alto	317	38	35	15. 2603
Blanca Peak	335	32	54	60. 9589

Azimuths and distances from Mount Rito Alto to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Conejos Peak	35 02 54	78.1410
Summit Peak	40 57 28	78.9709
South River Peak	56 46 10	80.3793
Station 28	64 31 38	47.5060
San Luis Peak	76 17 59	65.9960
Station 33	78 20 56	65.0026
Uncompahgre Peak	84 16 33	93.4435
Clayton Cone	88 55 38	15.1625
Agency Peak	93 54 44	60.5112
Station 23	101 35 40	19.2785
South base	102 02 05	11.0727
Station 24	106 18 51	26.1464
Mount Ouray	119 00 41	29.0480
North base	120 29 27	14.6108
Hunt's Peak	137 45 36	15.2603
Mount Harvard	148 02 17	57.4248
Mount Lincoln	166 19 26	.....
Torrey's Peak	177 59 33	.....
Pike's Peak	221 48 00	57.6416
Crestone	331 47 00	19.7597
Blanca Peak	341 26 04	46.6741

Azimuths and distances from Blanca Peak to—

Names.	Azimuths.	Distances.
	° ' "	Miles.
Conejos Peak	71 53 15	62.9059
Summit Peak	77 09 12	68.3800
South River Peak	90 17 57	82.0941
San Luis Peak	110 04 42	84.0009
Station 28	112 34 27	62.4652
Agency Peak	122 54 17	89.4401
Station 24	142 24 29	65.2514
Mount Ouray	145 33 02	70.8794
Hunt's Peak	155 49 52	60.9589
Mount Rito Alto	161 36 02	46.6741
Crestone	168 32 45	27.3952
Pike's Peak	195 16 58	.....
East Spanish Peak	292 03 26	33.5634
West Spanish Peak	297 65 09	30.3923
Trinchera Peak	318 17 41	26.5818
Culebra Peak	332 10 17	35.4561
Costilla Peak	344 08 29	53.2960

Azimuths and distances from Station 28 to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Conejos Peak.....	2	07	47	43.5849
Summit Peak.....	12	16	37	40.1993
South River Peak.....	45	23	19	33.9197
San Luis Peak.....	102	15	21	21.7661
Station 33.....	108	53	05	22.0217
Agency Peak.....	144	04	12	32.9869
West Elk Peak.....	147	11	18	65.5897
Mount Harvard.....	189	45	06	70.2684
Mount Ouray.....	206	22	43	38.6946
Station 24.....	212	09	38	32.9868
Station 23.....	224	09	22	34.1601
Hunt's Peak.....	225	19	01	45.5127
Mount Rito Alto.....	244	02	36	47.5060
Crestone.....	266	12	27	52.3175
Blanca Peak.....	291	55	39	62.4652
Culebra Peak.....	306	03	24	92.5860

Azimuths and distances from Agency Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Station 33.....	10	06	56	17.5663
Rio Grande Pyramid.....	35	09	02	50.0120
Uncompaggre Peak.....	66	53	47	35.2717
West Elk Peak.....	149	37	43	35.5262
Snow-mass Mountain.....	169	34	54	59.2528
Mount Harvard.....	213	12	47	53.7261
Mount Princeton.....	225	43	04	47.1014
Mount Ouray.....	253	24	35	36.3576
Station 24.....	264	05	55	35.4229
Mount Rito Alto.....	273	13	12	60.5112
Blanca Peak.....	302	03	05	89.4401
Station 28.....	323	51	52	32.9869

Azimuths and distances from Culebra Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Costilla Peak.....	5	52	57	20.0109
Station 81.....	86	23	13	79.9252
Banded Peak.....	89	33	28	79.5925
Conejos Peak.....	98	57	55	77.2461
Summit Peak.....	101	09	45	84.7721
San Luis Peak.....	122	25	02	112.8426
Station 28.....	126	52	58	92.5860
Station 24.....	146	01	48	.....
Mount Ouray.....	147	56	26	.....
Blanca Peak.....	152	21	12	35.4561
Crestone.....	159	28	47	.....
Trinchera Peak.....	185	48	13	11.5657
West Spanish Peak.....	211	08	19	20.4266
East Spanish Peak.....	218	00	08	23.7373
Fisher's Peak.....	272	08	28	39.9836

Azimuths and distances from Fisher's Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Costilla Peak.....	66	46	05	45.8643
Culebra Peak.....	92	34	40	39.9536
Trincheira Peak.....	103	58	01	40.9069
West Spanish Peak.....	123	17	06	34.9867
East Spanish Peak.....	128	59	40	32.4056
Pike's Peak.....	165	22	08	124.2428

Azimuths and distances from Summit Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Ute Peak.....	88	19	59	114.7335
Hesperis Peak.....	95	16	14	76.8418
Pagosa Peak.....	107	39	07	21.3445
Rio Grande Pyramid.....	120	55	27	44.4354
South River Peak.....	134	38	42	21.9605
Uncompahgre Peak.....	140	05	58	65.0359
San Luis Peak.....	163	44	35	45.7052
Station 28.....	192	10	56	40.1993
Mount Ouray.....	199	05	53	78.2971
Station 24.....	201	08	10	72.0972
Hunt's Peak.....	209	45	22	65.2836
Mount Rito Alto.....	220	22	53	78.9709
Crestone.....	234	46	46	74.2785
Blanca Peak.....	256	24	59	68.3800
Trincheira Peak.....	272	24	53	84.4815
Culebra Peak.....	280	14	54	84.7721
Costilla Peak.....	293	12	19	88.8762
Conejos Peak.....	301	34	43	8.1411
Banded Peak.....	347	13	01	17.3964
Station 81.....	350	04	25	21.7147

Azimuths and distances from South River Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Pagosa Peak.....	27	34	38	21.3446
Hesperis Peak.....	81	59	57	61.4667
Rio Grande Pyramid.....	108	02	45	23.6809
Uncompahgre Peak.....	142	41	43	43.2261
San Luis Peak.....	185	30	23	28.5871
Mount Ouray.....	214	58	59	71.6218
Station 24.....	218	35	52	66.4614
Station 28.....	224	07	10	33.9197
Mount Rito Alto.....	236	01	01	80.3793
Blanca Peak.....	269	23	14	82.0941
Summit Peak.....	314	28	17	21.9605

Azimuths and distances from San Luis Peak to—

Names.	Azimuths.			Distances.
	o	'	"	
South River Peak.....	5	32	06	28.5871
Rio Grande Pyramid.....	50	07	49	32.9246
Uncompahgre Peak.....	101	36	20	29.5410
West Elk Peak.....	163	58	40	52.4865
Snow-mass Mountain.....	174	41	23	78.4099
Station 33.....	189	34	27	2.5444
Mount Harvard.....	206	55	30	72.6478
Mount Ouray.....	231	45	42	48.8060
Station 24.....	238	47	08	45.2855
Hunt's Peak.....	242	42	31	60.2162
Station 23.....	245	56	46	49.2594
Mount Rito Alto.....	255	34	22	65.9960
Crestone.....	270	39	49	.....
Station 28.....	282	00	51	21.7661
Blanca Peak.....	289	11	29	84.0009
Culebra Peak.....	301	21	07	112.8426
Conejos Peak.....	337	34	12	52.0272
Summit Peak.....	343	35	55	45.7052

Azimuths and distances from Uncompahgre Peak to—

Names.	Azimuths.			Distances.
	o	'	"	
Hesperis Peak.....	38	33	10	<i>Miles.</i> 55.1859
Mount Wilson.....	61	09	28	33.0635
Mount Snelfels.....	75	33	01	18.6048
Mount Peale.....	105	13	59	99.3589
Leon Peak.....	163	33	21	72.5113
North Mam Peak.....	166	36	04	93.2684
Snow-mass Mountain.....	196	24	06	75.3180
West Elk Peak.....	197	39	52	46.7881
Mount Harvard.....	226	05	56	85.3480
Agency Peak.....	246	32	00	35.2717
Mount Ouray.....	249	50	22	71.5139
Station 24.....	255	09	12	69.8995
Station 23.....	258	50	55	75.2582
Mount Rito Alto.....	263	12	20	93.4435
Station 33.....	276	10	59	.....
San Luis Peak.....	281	16	50	29.5410
Summit Peak.....	319	33	27	65.0359
South River Peak.....	322	24	02	43.2261
Rio Grande Pyramid.....	351	57	17	27.2963

Azimuths and distances from Rio Grande Pyramid to—

Names.	Azimuths.			Distances.
	o	'	"	
Mount Wilson.....	72	28	47	<i>Miles.</i> 34.6032
Mount Snelfels.....	135	45	05	31.2700
Uncompahgre Peak.....	171	59	51	27.2963
Agency Peak.....	214	49	55	50.0120
San Luis Peak.....	229	50	59	32.9246
South River Peak.....	287	47	43	23.6809
Summit Peak.....	300	29	57	44.4354
Pagosa Peak.....	312	12	00	24.1652

Azimuths and distances from Hesperis Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
San Juan Needle.....	38	30	35	66.5990
Ute Peak.....	73	51	09	39.5585
Abajo Peak.....	110	13	46	80.1011
Mount Peale.....	138	01	15	92.6063
Lone Cone.....	163	20	35	31.8935
Mount Wilson.....	190	59	54	27.7089
Mount Sneffels.....	202	41	51	41.8338
Uncompahgre Peak.....	218	10	11	55.1859
Mount Æolus.....	244	18	10	-----
South River Peak.....	261	15	07	61.4667
Pagosa Peak.....	269	41	42	-----
Summit Peak.....	274	21	07	76.8418
Banded Peak.....	285	43	31	83.7462
Station 81.....	288	35	57	85.1524

Azimuths and distances from Abajo Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Mount Peale.....	196	58	04	43.2138
Lone Cone.....	266	40	51	66.0793
Mount Wilson.....	269	30	22	80.4208
Hesperis Peak.....	289	23	24	80.1011
Ute Peak.....	315	19	16	53.6508
San Juan Needle.....	336	16	40	86.6231

Azimuths and distances from Mount Peale to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Abajo Peak.....	17	06	41	43.2138
North Mam Peak.....	227	50	04	98.3309
Leon Peak.....	238	55	19	86.8808
West Elk Peak.....	259	21	38	111.5550
Uncompahgre Peak.....	284	08	19	99.3589
Mount Sneffels.....	290	28	23	-----
Mount Wilson.....	301	04	23	79.0586
Lone Cone.....	305	14	43	65.2196
Hesperis Peak.....	317	19	07	92.6063
Ute Peak.....	342	36	27	83.5474

Azimuths and distances from Lone Cone to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
San Juan Needle.....	21	15	18	88.7630
Ute Peak.....	34	40	35	50.5908
Abajo Peak.....	87	25	18	66.0793
Mount Peale.....	125	50	51	65.2196
Leon Peak.....	194	59	46	85.1437
West Elk Peak.....	224	41	22	81.0506
Mount Sneffels.....	252	15	35	26.5310
Mount Wilson.....	282	59	19	14.8131
Hesperis Peak.....	343	14	27	31.8935

Azimuths and distances from West Elk Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Uncompahgre Peak.....	17	49	39	46.7881
Mount Sneffels.....	33	21	56	58.8282
Lone Cone.....	45	24	51	81.0506
Mount Peale.....	80	41	34	111.5350
Leon Peak.....	125	52	43	42.7650
North Mam Peak.....	142	21	19	58.4113
Sopris Peak.....	181	55	12	37.6256
Snow-mass Mountain.....	194	29	49	.....
Mount Harvard.....	253	00	34	.....
Mount Princeton.....	267	19	11	41.0908
Mount Ouray.....	290	47	47	56.5627
Station 24.....	296	42	52	59.6608
Station 28.....	326	46	51	65.5897
Agency Peak.....	329	25	35	35.5262
San Luis Peak.....	343	48	49	52.4865

Azimuths and distances from Snow-mass Mountain to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Uncompahgre Peak.....	16	38	54	75.3180
North Mam Peak.....	113	33	29	46.6935
Sopris Peak.....	149	48	13	11.6533
Mount Powell.....	221	01	31	58.8606
Mountain of the Holy Cross.....	232	20	59	39.4744
Mount Lincoln.....	252	17	45	53.6724
Mount Harvard.....	288	14	34	42.2966
Mount Ouray.....	316	18	36	66.1018
Station 24.....	319	48	44	71.3875
Agency Peak.....	349	27	41	59.2528
San Luis Peak.....	354	36	27	78.4099

Azimuths and distances from Leon Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Mount Wilson	5	23	55	85. 9096
Lone Cone	15	19	20	85. 1437
Mount Peale	59	51	22	86. 8808
North Mam Peak	176	49	29	21. 2120
Sopris Peak	250	20	17	38. 0282
West Elk Peak	305	28	26	42. 7650
Uncompahgre Peak	243	19	04	72. 5113
Mount Sneffels	357	49	30	74. 2300

Azimuths and distances from North Mam Peak to—

Names.	Azimuths.			Distances.
	°	'	"	Miles.
Mount Peale	48	45	43	98. 3309
Mount Powell	251	57	09	85. 4079
Mountain of the Holy Cross	265	17	15	74. 2561
Sopris Peak	282	44	27	37. 9134
Snow-mass Mountain	293	03	20	46. 6940
West Elk Peak	321	56	07	58. 4113
Uncompahgre Peak	346	20	55	93. 2684
Leon Peak	356	48	40	21. 2120

CHAPTER II.

METHODS OF TOPOGRAPHICAL FIELD AND OFFICE WORK.

The secondary triangulation was carried on by the topographers, in connection with the topographical work, with small theodolites reading to minutes of arc, and carrying a powerful telescope; these secondary triangles summed up with a mean error of closure of about two minutes. But as this work was constantly checked by the primary points, the errors could not accumulate sufficient to be perceptible on the maps.

The topographical field-work was carried on in the following manner:—

First, the region of country to be surveyed would be divided as nearly as possible by natural boundaries into areas sufficiently large to employ a party the whole season.

Before taking the field, the topographer supplies himself with all the information possible as to character of country, &c., and collects all the old maps that might give any idea of the existing trails, roads, or places where supplies may be obtained. Each field-party is composed of a topographer, geologist, assistant topographer, and sometimes a botanist or zoölogist would accompany the party; these, with a cook, and two or three packers, would complete the party. The geologist and

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DEPARTMENT OF THE INTERIOR,
U. S. GEOLOGICAL AND GEOGRAPHICAL SURVEY OF THE TERRITORIES
PAHADENUS GEOLOGIST IN CHARGE.

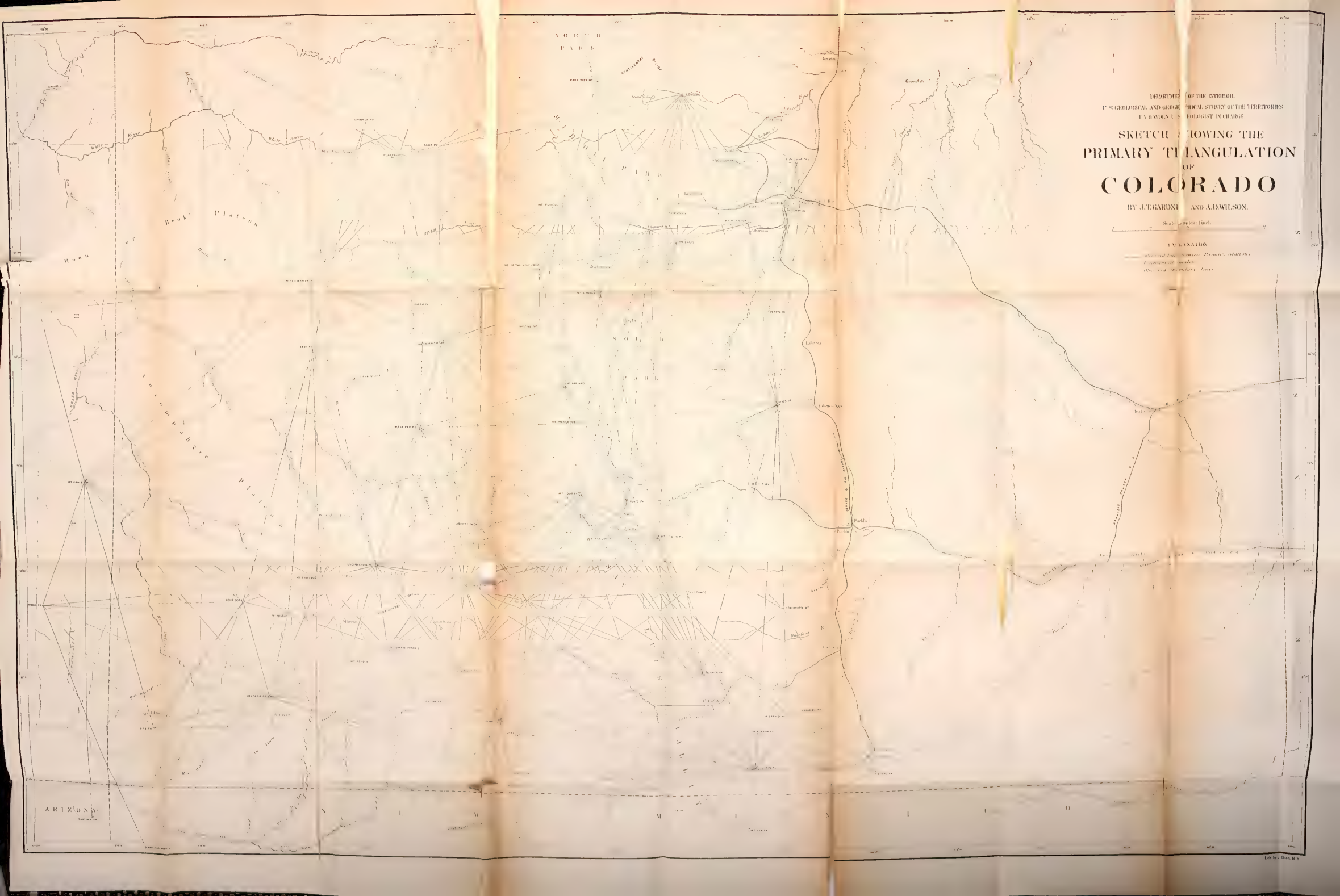
SKETCH SHOWING THE PRIMARY TRIANGULATION OF COLORADO

BY J. E. GARDNER AND A. D. WILSON.

Scale 1 inch = 100 miles

EXPLANATION

- Primary triangulation stations*
- Secondary triangulation*
- Other triangulation lines*



ARIZONA

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topographer working in concert would make a general plan for the summer campaign, and equip themselves with all the necessary instruments and supplies.

On reaching the district, they would select the first commanding point and ascend it; on reaching the summit, the topographer sets up his theodolite, while the assistant hangs up the barometer.

The topographer proceeds to make a careful drainage sketch, on which he would indicate all features of note, while the assistant makes a careful profile sketch of the entire surrounding country on a large scale. Upon these sketches would be marked, by numbers or names, all the points to be sighted, or in some cases the actual bearings are placed upon the sketches.

After this was done, the bearings of all peaks, points, ends of spurs, junctions of streams, in fact every recognizable feature of the surrounding country, would be sighted, and the angles, both horizontal and vertical, recorded in a book, with their numbers or names appended.

From this first station would be selected a number of points occupying commanding positions, as points to be occupied as stations in future, and so on from each station there would be constantly selected points in advance, on which stations were to be made.

After finishing the work on the peak, the party would proceed to the next, and there repeat the sketches and angles, taking great care to check every previous sight possible, and taking all the new points that came within range.

Thus from day to day the country is sketched from every possible view, and the points are each time sighted, giving many checks to the location of all the more prominent features of the country.

The mountainous regions of the country west of the Mississippi River are generally very favorable to this kind of work. Nearly all the mountain-peaks, especially near their summits, are destitute of timber, while the valleys are uniformly so, the timber in nearly all cases growing on the slopes of the mountains.

Therefore, from the mountain-peaks the drainage of the country is clearly visible and sharply defined. Thus the topographer is often able to trace the meanderings of a stream for many miles, as it recedes over the distant plains or valleys.

To do this class of topographical work successfully, it requires a man with a natural faculty for the recollection and recognition of objects which he has seen from different positions, especially in a high, rough, mountain country, where so many points are visible from one peak, and they undergo great changes in appearance as seen from different positions.

Yet this faculty may be cultivated to a wonderful degree when the person is very careful and studies the relative positions of things, also the individual forms and characteristics of mountain structure. It is very much the same faculty that is required in recognizing faces, for each

mountain has its features and individual forms. It also requires men of great physical endurance to carry on such work, owing to the many difficulties and often dangers that are met with in ascending so many rough and high mountains, without any previous knowledge of the country, and the traveling is often found difficult through these unknown regions, where there is neither track nor trail to guide them in their selection of a route, and being compelled by the nature of the work to reach certain points.

DETERMINATIONS OF ALTITUDES.

The altitudes have been determined with mercurial barometers. Each party is generally supplied with two barometers, and with extra tubes and fixtures with which to repair any breakage that may occur. Base barometers have been established at various points over the Territory, always as near the district in which the work was being carried on as practicable, which was often at a greater distance than was desirable, the parties working often far beyond the borders of civilization.

The heights of the mountain stations have been constantly checked by a system of vertical angles between all occupied points, thus binding the whole together, so there are but few points depending upon a single reading of the barometer for their heights, except the valleys and such places as could not be thus checked. I give below an extract from the report of Mr. Franklin Rhoda (who was my assistant during the summer of 1874), which will serve to illustrate the method of connecting the points by vertical angles :—

“METHODS USED IN DETERMINING THE ELEVATION OF POINTS.

“All the elevations given in this report depend upon readings of a mercurial barometer. Where a standard barometer whose elevation is well determined is within a short distance, this instrument gives a very good determination of elevation. In the past summer, however, it was quite impossible to establish a base barometer in the vicinity of the region surveyed, without great expense. All the readings had to be referred to distant stations. Readings on high peaks were referred to the Signal-Service barometer on Pike's Peak at an elevation of 14,147 feet above the sea, while readings on all points under 12,000 feet were referred to the barometer of the United States Geological Survey at Fair Play, whose elevation is 9,964.5 feet. The first of these is 150 miles distant in a straight line from the central part of the San Juan country, while the second is 125 miles distant. These distances are too great to give accurate results with the barometer. At several points in the region we succeeded in getting two readings at the same point at intervals of several days, but finding that the resulting heights as calculated by reference to those distant bases did not agree well enough, it was resolved to collect together all the data possible from the field-notes and see if a fair trigonometric connection between the mountain-peaks could not

be established. The result was, under the circumstances, highly satisfactory. It must be remembered, however, that the instrument used read only to minutes of arc. Supposing an error of a minute in a reading, which is not at all uncommon, the resulting error in the difference of level of two peaks from a single observation will be 15.3 feet for a distance of 10 miles and 23 feet for a distance of 15 miles. If, as is sometimes the case, the error be more than one minute, the error in the elevation will be still greater. Another large and uncertain element in the problem is refraction, which in the high mountains is so changeable as to add much to the uncertainty of the results. In many cases the observations were taken during storms, and often the peaks were sighted through breaks in the clouds, making the refraction still more uncertain. From each station angles of elevation or depression were taken to like surrounding peaks, and especially to previous stations. Had the foresight and backsights between the several stations been simultaneous, the error of the refraction correction would have been very nearly neutralized; but these two sets of observations were never taken at the same time, and in only one case on the same day. From each of two stations I always succeeded in finding some peaks which had been sighted from both. With this material on hand, the distances were obtained from Mr. Wilson's plot of his secondary triangulation, which will not probably involve in any case used a greater error than five-hundredths of a mile, which includes the error due to shrinkage of paper, as these distances were all hastily taken off from the map with a scale. Having, then, the horizontal distance between the two stations, and the angle of elevation or depression from one to the other, of course the difference of level can be determined. But on account of the errors which have crept into these angles from the cause above mentioned, one determination of the difference of level is not sufficient. For a still finer approximation, wherever vertical angles had been taken from two stations to the same point, the height of that above and below each station was calculated. From this another determination of the difference in the height of the two stations was determined; then the height of another unvisited point was calculated, and so on for all the near points sighted from both stations. Each point gives one determination of the difference of the two stations. In some cases it will be found that one result is far out from the rest. This may be due to the fact that sights to different points which have received by mistake the same number in the notes have been used. Such cases are thrown out and a mean of the rest assumed as the true difference of level. It was found that on account of errors of refraction and imperfections of the instrument, sights over 15 miles in length could not be depended on at all. In the following calculation no sights of that length were used, and in fact very few over 10 miles have been used. In making the calculation, the following formula was used, taken from Lee's tables:—

$$\Delta h = 0.00000485 K A \pm 0.000000667 K^2;$$

in which dh is the difference of level of the two points, K the horizontal distance in yards, and A the number of seconds in the vertical angle used. In this formula are contained corrections for both curvature and refraction, the latter element being assumed equal to 0.078 of the curvature. On examining the notes carefully it was found that there were sights to many hundreds of different peaks, and it became a difficult problem to utilize all this material and at the same time do it according to a system. After a number of experiments on different methods it was found that to bring order out of this chaos it was necessary to take up each link in the chain separately, and use all the data that could be found pertaining to it, and determine the difference of level of these two stations finally. Next the same process had to be gone through with the line from the second point to the next station beyond, and so on. In doing this, it was found that some of these lines were much better determined than the others. In finally reducing these differences of level to a common datum point, this fact might multiply the errors in the work. For instance, a number of well-determined differences of level might be transferred through a poorly-determined line, thus vitiating all with the error of the one. In order to obviate this the following scheme was adopted: A central chain of well-determined lines was carried through the heart of the mountain mass, from Mount Wilson, the most westerly of the high peaks, to station 8, five miles east of Uncompahgre Peak, in the northeast corner of the mass. From this main line several secondary branches were carried wherever the short lines could be well determined. This system covered the whole mass of mountains. Other stations, which could not be well enough determined independently, were connected with different points in the main lines. In the central line we have the following parts: From Mount Wilson to station 30, a peak east of it and distant 9.3 miles, is a fall of 383 feet, which is the mean of five determinations having a range of 32 feet; thence east to Sultan Mountain, a distance of 6.88 miles, with a fall of 536 feet, the mean of six determinations, range 23 feet; thence northeast to station 16, distant 6.60 miles, a rise of 175 feet, the mean of nine determinations, range 35 feet; thence northeast to Hardie's Peak, 7.51 miles, a rise of 456 feet, the mean of eight determinations, range 54 feet; thence north to Uncompahgre Peak, distant 11.14 miles, a rise of 238 feet, the mean of nine determinations, range 49 feet; thence east to station 8, distant 4.92 miles, a fall of 1,380 feet, the mean of ten determinations, range 67 feet. This completes the central or trunk line, whose length is 46.35 miles. From Sultan Mountain a branch was extended eastward from this peak to station 25, distant 10.28 miles, a rise of 209 feet, the mean of twelve determinations, range 67; thence to Rio Grande Pyramid, distant 8.63 miles, a rise of 197 feet, the mean of nineteen determinations, range 95. From station 25, a branch extends to Mount Oso, distant 7.29 miles, a rise of 64 feet, the mean of seven determinations, range 37. From station 30, a secondary branch was ex-

tended south and west. Station 30 to Engineer Mountain, distant 6.98 miles, a fall of 926 feet, the mean of eight determinations, range 22; thence west to station 36, distant 6.76 miles, a fall of 417 feet, the mean of eleven determinations, range 51; thence to station 37, distant 3.65 miles, a rise of 94 feet, the mean of five determinations, range 35. Another important sub-line extends from Sultan Mountain to the northwest. The first link in the chain is the line from this point to station 28. The heights of stations 30 and 16 above Sultan Mountain having been already well determined from the central chain, I made use of all the connections between station 28 and each of these points, reducing all of them to a common point. The result from this was the following: Sultan Mountain to station 28, distant 7.86 miles, a fall of 484 feet, the mean of eighteen determinations, range 76 feet; thence to station 9, distant 3.77 miles, a rise of 324 feet, the mean of eight determinations, range 43 feet; thence to Mount Sneffels, distant 5.94 miles, a rise of 952 feet, the mean of six determinations, range 36 feet; thence to station 34, distant 6.65 miles, a fall of 1,161 feet, the mean of five determinations, range 23 feet. This completes all the well-determined chains. Other stations on which barometric readings have been taken were connected with as many points in the main lines as possible, and these being reduced to a common point, a mean was taken. Such points are the following: Sultan Mountain to station 10, a fall of 223 feet, the mean of eleven determinations, range 76 feet; Uncompahgre Peak to station 5, a fall of 1,498 feet, the mean of ten determinations, range 85 feet; Uncompahgre Peak to station 11, a fall of 3,624 feet, the mean of eight determinations, range 111 feet; Sultan Mountain to station 51, a fall of 835 feet, the mean of three determinations, range 75 feet; Sultan Mountain to station 48, a fall of 1,061 feet, the mean of six determinations, range 59 feet; Hardie's Peak to station 13, a fall of 1,175 feet, mean of fore and back sights, range 6 feet. Besides these, there are two which depend on single determinations. First, from Sultan Mountain to the point in Baker's Park where the road crosses Cement Creek in Silverton, distant 3 miles, a fall of 3,961 feet; second, from Mount Sneffels to station 32, which is obtained from sights to a common point between them, distant from Mount Sneffels 2.04 miles, and from station 32, 3.75 miles, the fall is 5,050 feet. This difference of level is checked by sights to distant points to the south of station 32. These two cases are admitted because the distances were so short as to preclude the possibility of any considerable error. From these results a table was made out showing the heights of each station above or below a common datum point. Sultan Mountain was selected as the datum point from its central location, and also from the fact that it was situated on the great central chain of levels, at its junction with two principal sublimes. A second column was added, giving the height of each station as determined by the single barometric reading taken thereon. A third column was made out of the first two, by adding the

number in the first column to the one in the second when preceded by the minus sign, and by subtracting it when plus. This column represents the elevations above sea-level of Sultan Mountain as determined from the barometric readings at the several stations. It will be seen that the twenty-three results have a range of 203 feet. A mean of all these was assumed as the true height of Sultan Mountain; and by reversing the previous process and adding the plus differences of height in the first column and subtracting the minus, a fourth column was obtained, giving the elevation of each station as reduced from the mean of the twenty-three readings. A fifth column was added, giving the date of each reading on the different stations. From this it will be seen that the observations extend from August 1 to October 6—more than two months. By examining the table carefully it will be seen that nearly all the earlier readings give heights above the mean and the latter below it. Whether this is merely accidental, or due to some physical law, I cannot tell. It will be seen that several of these stations, whose height relative to the rest has been well determined, do not appear in the table. This is due to the fact that at those stations, either from storms or other causes, we failed to get barometric readings.

"Name of station.	Height above or below Sultan Mountain.	Absolute height of station from barometric reading.	Resulting height of Sultan Mountain.	Final height of station.	Date of barometric reading.
"Station 5.....	- 629	12, 770	13, 399	12, 737	Aug. 1, 1874.
"Station 8.....	- 511	12, 960	13, 471	12, 855	Aug. 6, 1874.
"Uncompagbre Peak.....	+ 869	14, 337	13, 468	14, 235	Aug. 8, 1874.
"Station 10.....	- 223	13, 082	13, 305	13, 143	Aug. 10, 1874.
"Station 11.....	+ 2, 755	10, 684	13, 439	10, 611	Aug. 12, 1874.
"Station 13.....	- 544	12, 895	13, 439	12, 822	Aug. 14, 1874.
"Hardie's Peak.....	+ 631	14, 101	13, 470	13, 997	Aug. 15, 1874.
"Station 16.....	+ 175	13, 593	13, 418	13, 541	Aug. 17, 1874.
"Rio Grande Pyramid.....	+ 407	13, 801	13, 394	13, 773	Aug. 22, 1874.
"Sultan Mountain.....	.....	13, 298	13, 298	13, 366	Aug. 31, 1874.
"Silverton.....	- 3, 961	9, 377	13, 338	9, 405	Aug. 31, 1874.
"Station 27.....	- 777	12, 491	13, 268	12, 589	Sept. 3, 1874.
"Station 29.....	- 160	13, 120	13, 280	13, 206	Sept. 4, 1874.
"Station 30.....	+ 531	13, 927	13, 396	13, 897	Sept. 6, 1874.
"Station 32.....	+ 4, 258	9, 027	13, 285	9, 108	Sept. 9, 1874.
"Mount Sneffels.....	+ 792	14, 162	13, 370	14, 158	Sept. 10, 1874.
"Station 34.....	- 369	12, 988	13, 357	12, 997	Sept. 11, 1874.
"Mount Wilson.....	+ 914	14, 185	13, 271	14, 280	Sept. 13, 1874.
"Station 36.....	- 812	12, 538	13, 350	12, 554	Sept. 14, 1874.
"Station 37.....	- 718	12, 623	13, 341	12, 648	Sept. 15, 1874.
"Station 38.....	- 320	13, 014	13, 334	13, 046	Sept. 20, 1874.
"Station 48.....	- 1, 061	12, 321	13, 382	12, 305	Sept. 30, 1874.
"Station 51.....	- 835	12, 518	13, 353	12, 531	Oct. 6, 1874.
"Mean.....	.....	.....	13, 366	.....	.....

"With the elevations of these stations determined, the heights of unvisited points were obtained by applying the difference of level as obtained from the vertical angle to the height of the station from which the angle was taken. As most of the unvisited points are sighted from many stations, we have for each a number of determinations, of which the mean is taken. Many of these points are quite as well determined as some of the stations."

OFFICE-WORK OF THE TOPOGRAPHER.

On the return of the parties to the office, the topographers would each calculate and construct a projection on a scale of two miles to one inch, on heavy mounted drawing-paper. On each sheet would be plotted, by latitudes and longitudes, all the primary points that had been located in the district, with a sufficient number of secondary points from which to plot the remainder of the stations, with large eight-inch circular protractors reading to minutes of arc.

After locating all the stations, they establish all the points that have been sighted from the numerous stations, upon the sheet. When all the points are placed upon the sheet in the foregoing manner, the drainage is located by plotting first all points along the streams that have been sighted, such as junctions, noted bends, &c., then filling in all the minor details from the drainage-sketches, carefully studying all the different sketches that contain the streams in question.

The sketches are made on a scale from three to four times larger than that at which the final maps are plotted; so there is generally more detail on the sketches than can be represented on the maps. Plates 36 and 37 represent these sketches, and are actual tracings from the field-book, with the notes, &c., as taken from stations 115 and 125 by myself.

Turning to the sketch, it will be seen that every junction and important bend is sighted, and that all the prominent peaks are indicated in their relative positions as nearly as could be judged. Comparing this with the map as plotted (see Plate 39), we find that it is somewhat distorted, as might be expected when we consider that the sketch was made entirely by guess. But at the same time it will be seen, after all the points are actually located, that the remainder of the drainage can be sketched in very approximately.

Now we have the frame-work of the map upon the paper; it is inked in and we are ready to commence the drawing of the hill-structure, which we indicate by contour-lines, each representing 200 feet of vertical distance. By these lines we propose to give the approximate heights as well as forms of the mountains as nearly as we know them from the numerous height and profile sketches which we have taken from every occupied station. I will state here that I do not attempt in this paper to give all the minor detail of this work, proposing only to give a general idea of the methods used in constructing the maps. First, all the heights are calculated and tabulated in some convenient form for reference.

Having our points and drainage located, we start, for instance, with the heights of the points (*a*) and (*b*) (see Plate 38); the difference between these two points we find to be about 3,000 feet, the contours being 200 feet apart, we will have fifteen to be distributed between these two points; they are accordingly spaced in from the sketch nearer together or farther apart as the slope is greater or less. Next we find the point

marked (9) to be about the same height as (*b*), and the point on the stream marked (5) to be nearly the same as (*a*); consequently we have fifteen contours to space in between these points. But we find from the height of (*c*) that five of these come between points (*c* and 5), therefore coming much nearer to each other as the slope is greater than between (*c* and 9), where they are nearly equidistant from each other as the slope is comparatively even and gentle.

Now we turn to the sketch from Culebra Peak, which will give us the profile of the ridge from (9) to (*d*), and in the same manner space in the contours. We can now connect these lines, carefully studying the sketch, to see how deep the ravines are cut, and the general forms of the ridge which lead from (9) to the valleys below. In this manner all of the mountains are carefully drawn. Having sketches such as are given from stations 115 and 125 from every point that has been occupied, with the heights of all located points, besides many more that do not appear as located points, such as valleys, passes, benches, &c. Plates 36, 37, and 38 will give some idea of the field-sketches, while Plate 39 will show the map as finished in the office, only at a much reduced scale. This plate is taken from a proof of the engraved sheet to illustrate the result of this method of work.

To give some idea of the amount of work that has been done by the topographical corps in the survey of Colorado, I will state that we have established 1,280 topographical stations within an area of about 70,000 square miles, and from each station all the surrounding country was sketched as previously described. My assistant made over one thousand pages of profile sketches during the field-season of 1875, each page being 6 by 10 inches, while I myself made some five hundred pages of drainage-sketches, and took the thousands of angles that were necessary to locate all the points.

In referring to the sketches given, the system of numbering the points may not be clearly understood. Turn to Plate 37, for instance, you will see there such numbers as (16-115), (14-115), (29-116), &c., which mean simply No. 16 from station 115, No. 14 from station 115, and No. 29 from station 116. These numbers are obtained in the following manner:—Beginning at station 1, we sight, say, one hundred points; it will be seen at once that there must be some short and efficient method adopted by which these points can be designated when sighting them from the stations that are to follow. To give each a descriptive name becomes impossible, owing to the number and the time it would take, which is a very important consideration to the topographer, for his time is so much taken up by the ascent and descent of the mountain that he is compelled to economize time in every possible manner. Number each point, commencing with one, place these numbers on the sketches over or by the point to be sighted, and when the angles are taken and recorded, place the number of the point after its angle. From the next station as you sight the points, place the same number

after the angle, but instead of the simple numbers write (1-1), (2-1), (3-1), which signify, as before stated, point 1 from station 1, point 2 from station 1, &c. ; and this designation or name, as it may be called, is always used thereafter, except where they are afterward occupied as stations ; it is then more convenient to substitute the number of the station in place of the old one.

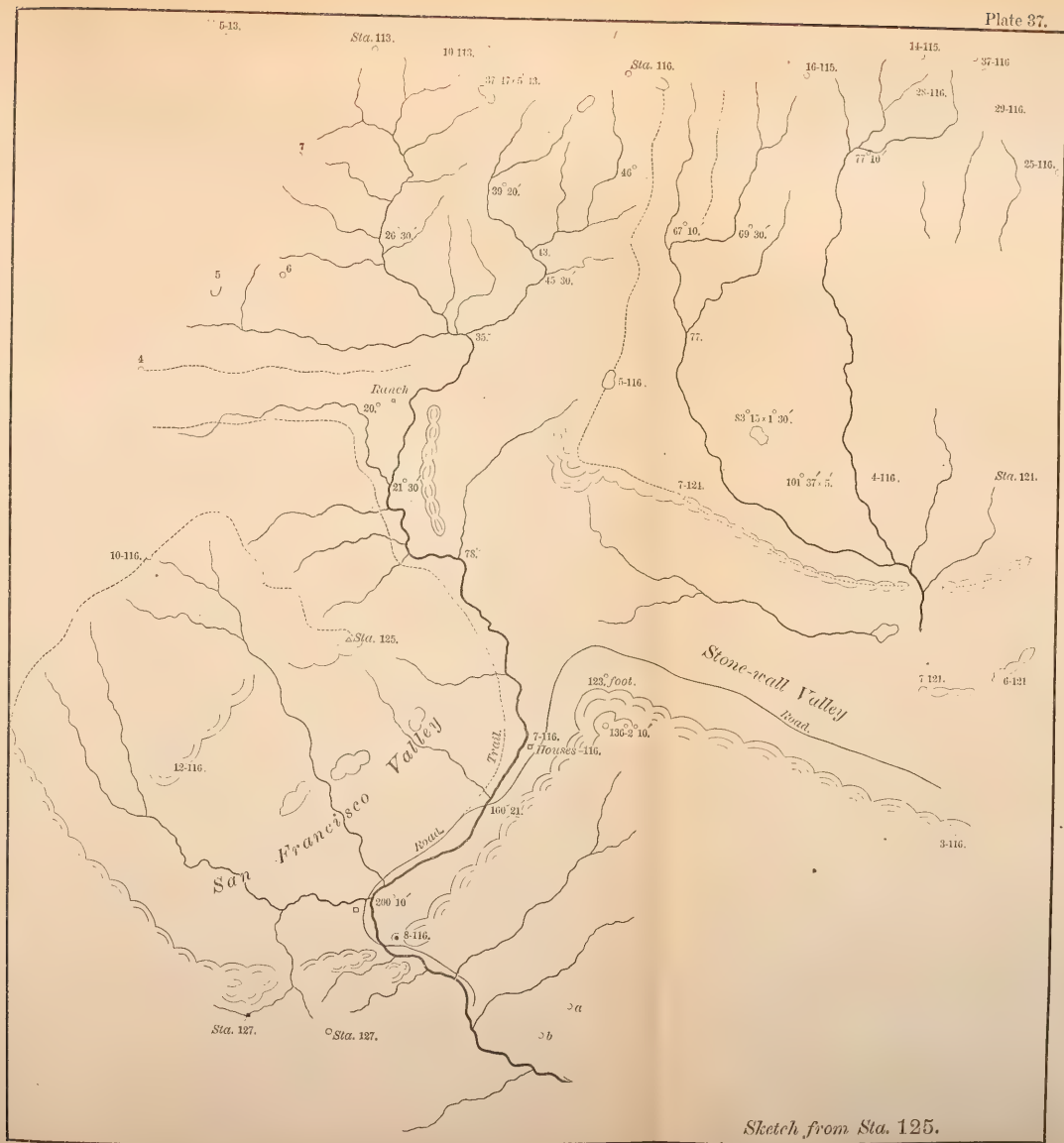
Any new points sighted from station 2 are numbered again, commencing with one as before, and these become (1-2), (2-2), (3-2), and so on from station to station as above, (16-115), (14-115), the first number always referring to the number from the given station, while the second gives the number of the station.

This system of numbering was originally developed by myself, and I have used it for several years in connection with this class of topographical works, and find it about as short and at the same time as complete a system of giving names to the many points that are necessary to sight as any that I have seen. It also facilitates the plotting very much. For instance, in plotting you come to a point in the notes of station 125 marked 14-115 ; you know at once by turning to station 115 that you will find another bearing to this point 14, and that you will probably find it sighted from the intermediate stations. Thus much time is saved in looking for the necessary checks to any point that you may wish to locate.

Sometimes the bearings are simply placed on the sketches, especially of points that are not likely to be sighted often, such as minor points, stream junctions, &c. ; in that case the horizontal angle is first recorded, then follows the vertical angle, with a plus or minus sign placed before it to show whether it be an angle of elevation or depression, thus : $83^{\circ} 15' + 1^{\circ} 30'$.

Over the more settled portions of the country the principal roads have been meandered with compass and odometer.

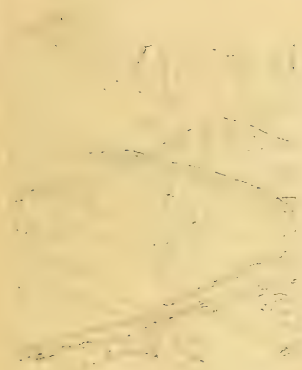




Sketch from Sta. 125.



F



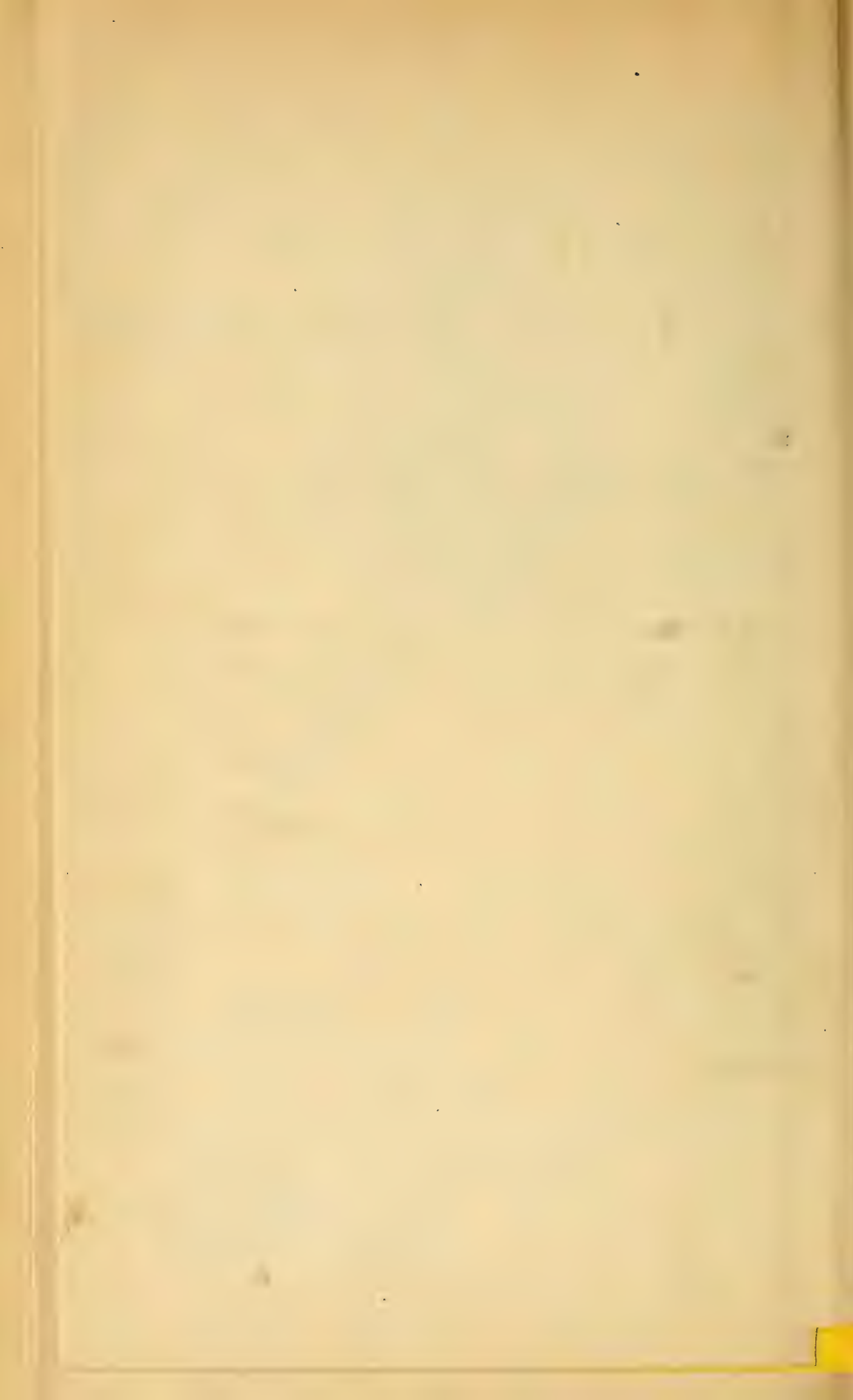


Profile Sketch from Sta. 115.

ate 39.







BULLETIN No. 4, VOL. III.

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ART. XXIX.—THE FIRST DISCOVERED TRACES OF FOSSIL INSECTS IN THE AMERICAN TERTIARIES.

BY SAMUEL H. SCUDDER.

Ten years have elapsed since I published the first results of a small collection of insects, found by Prof. William Denton in the Tertiary beds of White River.* With the possible exception of four insects, described in 1868 by Dr. Oswald Heer, from the Miocene of North Greenland,† they are the first insects found in the Tertiary strata of America. Since that time, many others have been found and a few described, but they have not lessened the interest with which these should be regarded. In the earlier volumes of this publication, the *Coleoptera* and *Physopoda* of Mr. Denton's collection have already been described,‡ and in this place we offer descriptions of the remainder, all of which will be fully illustrated in a general work on the fossil insects of the American Tertiaries, to be published by the Survey.

Some obscurity attaching to the precise locations at which the specimens were obtained, it may be well to remark that, since the issue by this Survey of the new drainage map of Colorado, it is possible to indicate them with better accuracy. Both localities are on the Lower White River; the lower, "Fossil Cañon", so near the mouth that, from the plateau above the cañon, one may see the valley of the Green River; this locality is, therefore, in Utah. The other locality, "Chagrin Valley", is about 60 miles farther up the river, and, therefore, is doubtless in Colorado. The former is on the northern, the latter on the southern side of the river. The larger part of the collection is from the upper locality.

Concerning the collection as a whole, there is little to add to what I have stated on former occasions. One or two corrections may, however, be made. There are no *Lepidoptera* in the collection (nor have I yet seen any from America), the supposed Noctuid proving to be one of the *Syrphidae*, badly preserved, and the possible Slug-caterpillar, a Dipterous larva; the "*Myrmica*" proves to be one of the *Formicidae*. There are also no *Orthoptera* in the collection. A more careful study shows that a single probable exception, *Dicranomyia stigmosa*, must be made to my former statement, that the insects of one locality are completely distinct from

* See Proc. Bost. Soc. Nat. Hist. x, 305-306, xi, 117-18; Amer. Nat. i, 56, vi, 665-68; Geol. Mag. v, 220-22.—Hollister, The Mines of Colorado, 378-387.

† Flora Fossilis Arctica, 129-130.

‡ See Bulletin, vol. i, 2d series, 221-223, vol. ii, 77-87.

those of the other. It is possible that better specimens may prove that the individuals from the two localities, which have here been combined, belong to distinct forms; but, at present, we see no valid reason for their separation.

Besides the insects mentioned under the families, but not referred to genera, the collection contains forty-six species. Of these, the *Diptera* claim twenty-five, or more than one-half. The proportion in specimens is still greater, since the species belonging to the other suborders are rarely represented by more than a single specimen. Nine different families of *Diptera* occur, six of them with more than one representative; and of these, so far as the perfect forms are concerned, the *Tipulidæ* and *Mycetophilidæ* are richest, including several genera which must be considered as new. It will be remarked that, while *Tipulidæ* are more abundant in this collection than any other family of insects, they are entirely absent from the collection made by Mr. George M. Dawson in the Tertiary beds at Quesnel, British Columbia,* while the latter collection contains more *Mycetophilidæ*, the next family, than Mr. Denton's.

The writer is greatly indebted to Professor Denton for permission to retain the collection for so long a period. Where no habitat for a species is mentioned, it is uncertain from which of the two localities it was taken.

HYMENOPTERA.

Family FORMICIDÆ.

Camponotus vetus.—A single specimen, very fairly preserved, lying upon the side; a remnant of one wing is left, and a faint indication of the antennæ, but the legs are wanting. The head has a flat summit, the upper half of the sides roundly protuberant, the lower half rather broad, and tapering but little; the thorax is long and moderately slender, compacted into a single mass, with a low arch, more than twice as long as high. The first segment of the abdomen increases rapidly in size posteriorly, and has a rounded knob above at its hinder end; the abdomen is long and slender, composed of five joints, the second the largest, gradually tapering to the pointed tip. It seems to agree better with *Camponotus* than with any other genus, but has a differently shaped head and first abdominal joint, and is smaller than the species of that genus, so that it is only placed here provisionally until other and better specimens are obtained. Length of body 3.75^{mm}; of thorax 1.15^{mm}; of abdomen 2^{mm}.

Liometopum pingue.—The single specimen representing this species is a male, as the number of abdominal segments show; but the wings are wanting. The insect is viewed from above. The head and thorax are slightly darker than the abdomen, but otherwise the whole body is uniformly fuscous, somewhat darker than the stone. The head is very small, subquadrate, slightly broader behind, and the posterior angles

* See my paper in the Report of Progress, 1875-76, Geol. Surv. Canada.

nearly rectangular; the anterior margin of the head is broadly and pretty regularly rounded, and the whole head is of about equal length and breadth. The thorax is very regularly ovate, broadest next the insertion of the front wings (traces of the origin of which can be seen), nearly twice as long as broad, rapidly tapering on the metathorax. The peduncle, as seen from above, is square, half as broad as the head, the hinder edge showing by its thickening that it was probably elevated at this point. The abdomen is plump, rounded ovate, scarcely less rounded posteriorly than in front, only one quarter longer than broad, broader than the thorax, composed of six segments, of which the first, third, and fourth are about equal in length, and the second half as long again. Length of whole body 7.5^{mm}; of thorax 3^{mm}; breadth of same 1.8^{mm}; of peduncle 0.9^{mm}; of abdomen 2.3^{mm}; length of hind femora 4.3^{mm}; breadth of same 0.36^{mm}. Fossil Cañon.

On account of the smallness of the head, I venture to place this insect in the genus *Liometopum*. It has the aspect of a *Hypoelinea*, but the head is only half as broad as the thorax.

Family ICHNEUMONIDÆ.

Ichneumon petrinus.—A fragmentary specimen, preserved on a dorsal aspect; parts of the front wings, the thorax, and basal half of the abdomen are preserved. The body is blackish and the wing-veins testaceous; the wing, excepting the fusco-testaceous stigma, is hyaline, covered sparsely with very delicate and moderately long hairs; the stigma is long and slender, the heavier main portion about two and a half times longer than broad, the slender basal extension as long again. Unfortunately, the wing is preserved only so far as, but not including, the areola, so that many characteristic parts are wanting; the second median and first subcostal cells are united, the vein separating them being present only below, where it is directed parallel to the principal longitudinal veins; the vein from which it springs is bent at an angle of about 70°, so that the part representing the first subcostal cell tapers rather rapidly in its apical half, while its basal half (if the cross-vein were continued) would be of the same size and shape as the second median cell or a parallelogram nearly twice as long as broad; the vein separating the first and second median cells is continued in a nearly direct line below; the third median cell is long and rather slender, with somewhat produced angles basally. The first segment of the depressed abdomen is fully half as long again as broad, increases a little and regularly in size toward the extremity, at its base is about half as broad as the extremity of the thorax, and at its tip less than half as broad as the broadest part of the thorax; the second segment is considerably larger, and also enlarges apically, but its length is indeterminate. Length of thorax 2.6^{mm}; breadth of same 1.5^{mm}; length of wing to tip of stigma 4.25^{mm}; breadth of base of abdomen 0.5^{mm}. Chagrin Valley.

DIPTERA.

Family CULICIDÆ.

Culex proavitus.—A poorly preserved specimen, in which only fragments of the legs can be seen, and the wings are so crumpled and folded as to prevent tracing the neuration. What can be seen resembles the neuration of the *Culicidæ*, and the veins and borders are heavily fringed with long hairs. The body is slender and the insect minute; the proboscis is about as long as the head and thorax combined, and the last joint of the equally long palpi is cuneate, the base rounded. Length of body 2.2^{mm}; of proboscis 0.9^{mm}. Fossil Cañon.

Corethra exita.—A specimen, viewed from above, with expanded wings, and destitute of legs, palpi, and all but the basal joints of the antennæ. The broad head, stout basal joint of antennæ, general form and size, with such of the neuration of one wing as can be determined, indicate the genus; seven of the abdominal segments are very clearly marked, and the specimen appears to be a male. The body is slender; the head, thorax, and abdomen of equal width; the wings slender and of about equal length with the body. The fourth longitudinal vein runs in a nearly straight line over the basal half of its course, but is gently arched beyond; the fifth originates from the fourth in the middle of its straight portion, runs nearly parallel with it so long as it continues straight, and afterward diverges considerably; the first longitudinal vein appears to run to the tip of the wing. Length of body 4.25^{mm}; of wing 4.25^{mm}; breadth of latter 0.8^{mm}. Chagrin Valley.

Family CHIRONOMIDÆ.

Chironomus depletus.—A single mutilated specimen of this insect remains, and is doubtfully referred to *Chironomus*. The thorax is moderately robust, and the abdomen rather plump for a *Chironomus*. The antennæ are broken, and only the costal border of one of the fore wings can be seen; this shows that the second longitudinal vein terminates in the middle of the apical, and the first longitudinal apparently in the middle of the basal, half of the wing. The legs are moderately long, slender, the tibiæ finely spined, the spines arranged on the middle legs in a somewhat verticillate manner, and terminating with two or three long spurs; the femora are rather short, the tibiæ considerably longer, but not so long as the tarsi. Length of body 3^{mm}; of wing 2.3^{mm}; of fore femora 0.68^{mm}; of fore tibiæ 0.6^{mm}; of fore tarsi 1^{mm}; of middle tibiæ 1^{mm}; of middle tarsi 1.25^{mm}. Chagrin Valley.

Chironomus patens.—A single specimen, very well preserved, represents a species which is provisionally referred to *Chironomus*. Nearly all the parts are present, and the neuration of one of the wings is nearly perfect, showing the structure of *Chironomidæ*, but differing apparently from any genus yet characterized. The antennæ are parted and bent, but apparently perfect; they seem to be fifteen-jointed, the joints square,

the apical no larger than the others, and all apparently furnished (as indicated at one point only) with a fringe of profuse, exceedingly delicate hairs, as long as the joints. The body is slender and the wings three times as long as broad; the costal vein runs only to the tip of the wing, and the margin beyond it is very faint; the first longitudinal vein runs uninterruptedly to the middle of the apical fourth of the wing; the second longitudinal nearly to the tip; the third longitudinal vein takes its rise from the second in the middle of the basal half of the wing, and parts widely from the second, leaving an unusual space devoid of neuration next the apex of the wing; the fourth arises from the third rather abruptly a little beyond its base, and has close beneath it the remnant of a vein or a fold in the wing; the next vein forks just beneath the origin of the fourth longitudinal vein, and leaves beneath it, next the posterior margin, a broad space without veins; the two basal cells are very short, and there appear to be no other transverse veins in the whole wing; all the veins are hirsute. The legs are long and slender, and covered with spinous hairs arranged in exact longitudinal rows, giving the legs a striped appearance under the microscope; the femora are rather short, and the tibiæ and tarsi of very unequal length, excepting on the hind legs; the tibiæ and all the joints of the tarsi are furnished apically with small spurs. Length of body 3^{mm}; antennæ 1^{mm}; wings 2.1^{mm}; fore femora 0.5(?)^{mm}; middle femora 0.6^{mm}; hind femora 0.8^{mm}; fore tibiæ 0.8^{mm}; middle tibiæ 0.9^{mm}; hind tibiæ 1.4^{mm}; fore tarsi 1.8^{mm}; middle tarsi 2.3^{mm}; hind tarsi 2.1^{mm}. Chagrin Valley.

An indeterminate species of this family, whose generic affinities cannot be discovered, from the entire absence of neuration in the wings and the loss of every other characteristic feature, presents a side view of the body with fragments of legs. The insect is minute, measuring but 2.75^{mm} long. It may possibly belong to the *Cecidomyiide*. Chagrin Valley.

Another similar specimen, but distinct from the above, exhibits a dorsal aspect, and little besides the trunk is left. The thorax is comparatively stout, the head nearly as broad as the thorax, and the abdomen very slender and equal. The body is 3.25^{mm} long. Chagrin Valley.

A third indeterminate species probably belongs to this group, but the specimen is too indistinct to be of much value. It is a female. The antennæ are a little longer than the head; the head a little narrower than the abdomen, the latter tapering to a point. The costa of one wing is present, and the rather short and moderately stout legs of the opposite side. Length of body 1.8^{mm}; of middle femur 0.8^{mm}; of same tibiæ 0.5^{mm}. Fossil Cañon.

Family CECIDOMYIDÆ.

Lasioptera recessa.—A single specimen of a minute fly, with the antennæ perfect, the body preserved on a side view, with parts of the legs and the wings folded together over the back, raised from the body. The head is moderately large, and appears to be a little narrower than

the thorax. The antennæ show fourteen joints, without counting the basal joint, and perhaps one or two more next the base, where the antennæ are parted; the joints are submoniliform, slightly broader than long, subequal; the last joint subconical, twice as long as broad. The wings show a principal vein, which strikes the costa about the middle, and apparently another, striking the costa half-way between this and the tip, a feature which does not accord with the structure of the *Cecidomyia* generally; but the wing at this point is very obscure, so that the appearance may be accidental. The legs are apparently about as long as the body, and rather slender. Length of body 1.4^{mm}; of antennæ 0.6^{mm}; wings 1^{mm}.

Lithomyza (λίθος, μύζω), nov. gen.

Ocelli present. Antennæ nine-jointed, scarcely longer than the thorax, the first joint cylindrical, the remainder submoniliform, ovate, about twice as long as broad, minutely and sparsely pubescent. Wings resembling those of *Anarete* in neuration, but differing considerably in shape, being broadest beyond the middle and tapering toward the base. The first longitudinal vein extends beyond the middle of the wing; the auxiliary vein runs close beside the first longitudinal vein, but only half as far, terminating independently; the second longitudinal vein extends to the tip of the wing, curving downward in the distal part of its course; the third longitudinal vein forks as in *Anarete*, but the independent or fourth longitudinal vein beneath it in *Anarete* is absent from *Lithomyza*. The tibiæ are destitute of spurs, but furnished with a posterior row of slight recumbent spines.

Lithomyza condita.—Represented by a single specimen in an unusually perfect condition, although somewhat indistinct. The joints of the antennæ are difficult to determine, but with little doubt are nine in number; although short, they are not so abbreviated as in *Anarete*, the joints being twice as long as broad; toward the tip, they grow smaller. The legs are long and bristly. The fork of the third longitudinal vein is at the centre of the wing, and nearer the base than the extremity of the first longitudinal vein. There is a faint indication of a transverse vein between the first and second longitudinal veins, about midway between the fork of the third longitudinal vein and its separation from the second. There is also a faint and very doubtful indication of an oblique cross-vein just beyond the transverse vein mentioned, running from the first longitudinal vein to the costa. Length of body 2.7^{mm}; of antennæ 0.75^{mm}; of wings 2^{mm}; fore legs 0.7(?)^{mm}; middle legs 2^{mm}; hind legs 2.4^{mm}; hind tibiæ 0.56^{mm}; hind tarsi 1.28^{mm}. Chagrin Valley.

Family TIPULIDÆ.

Dicranomyia stigmosa.—The neuration and the presence of a stigma in a fine, nearly perfect specimen of this species indicate a form closely

allied to *D. pubipennis* O. S., but the absence of any pubescence at the tip of the wing at once distinguishes it from the recent species. At first, I supposed that it differed from other species of *Dicranomyia* in the absence of the auxiliary vein; but, after careful study, a faint trace of its apical portion was found in the same position relative to the origin of the second longitudinal vein as in *D. pubipennis*; as there, also, the first longitudinal vein curves downward to, and terminates on, the second longitudinal vein, directly opposite the cross-vein, uniting the discal cell with the third longitudinal vein, instead of on the costa; the subcostal cross-vein arises before the deflection of the first longitudinal, runs parallel with it until it curves, when it turns in the opposite direction to the costa. The discal cell is closed, but the cross-vein separating it from the second posterior cell is very faint, in which respect it agrees better with other *Dicranomyia* than with *D. pubipennis*. The stigma is confined to that part of the space between the first and second longitudinal veins which lies beyond the origin of the third longitudinal vein, but it also extends upward to the costa; it is nearly circular and faintly fuliginous. An oblique supernumerary vein runs obliquely to the centre of the stigma from a point in the first longitudinal vein directly above the origin of the third; that is, from the inner edge of the stigma. The outer and posterior margins of the wing are profusely fringed with very delicate hairs, longer than the thickness of the stout costal vein. The antennæ are fourteen-jointed, about twice as long as the head, the basal joints of the flagellum subglobular, the others obovate, the apical one more than twice as long as broad; they are delicately verticillate, the hairs being but half as long as the width of the joints. The male anal lobes are broadly obovate, deeply and abruptly excised externally at the base, so as to leave a sharp right angle outwardly and a narrow peduncle on the inner side. Together the lobes are broader than the tip of the abdomen, and each is about half as long again as broad. Length of body, including the lobes, 6.5^{mm}; antennæ 1.2^{mm}; wings 7.5; anal lobes of male 0.55^{mm}. Fossil Cañon.

A second specimen of what is apparently the same species, judging from the anal lobes, is somewhat stouter, but is destitute of all other appendages, excepting indeterminate fragments of the rostrum, so that no further knowledge of the species can be gained from it. The rostrum, however, would seem to be scarcely longer than the head. Chagrin Valley.

In another specimen, also a male, the body, one of the wings, and part of the legs of one side are preserved; the whole is much fainter than in the other specimens, but the auxiliary vein can be traced midway between the costal and first longitudinal veins throughout nearly its whole length. What is apparently the rostrum is a very little longer than the basal joint of the antennæ, and a very little shorter than the head. The character of the male appendices adds to the proof that this belongs to the same species as those previously mentioned, but the

stigma of the wing is lost by the incompleteness of the preservation. The legs are very slender and delicately hairy throughout, with no sign of spurs, although it should be remarked that the extremities of the tibiæ are not well preserved. Length of middle femora 5.25^{mm}; middle tibiæ 4.5^{mm}; hind femora 5.75^{mm}; hind tibiæ 5.5^{mm}. Chagrin Valley.

Another specimen is a female, with remnants of wings, having most of the veins scarcely traceable; enough of the right wing remains to be sure that it is this species, with which the size agrees. Fossil Cañon.

Still another is similarly preserved; but, on account of the partial folding of the wing, no stigma can be seen, and the first longitudinal vein seems to unite, or almost unite, with the second, so far from the branching of the latter, that I was at first inclined to separate it, but the difference proves to be very slight. The antennæ of this specimen are pretty well preserved, but so bent as not to allow of direct measurement; the size agrees well with other specimens, although it is slightly smaller than the second specimen mentioned, which, however, is rather larger than the average. The specimen is a female. Fossil Cañon.

A head preserved on the same stone as the last specimen probably also belongs to this species.

In the last specimen to be mentioned, we have the upper surface of an abdomen of a male *Dicranomyia*, apparently of this species, twisted so as to present a lateral view of the tip, showing the structure of the under surface of the appendices. The under inner edge is evidently thickened, and a slight hook projects a little beyond the broad lobe; as the lobe itself is preserved in a different view from what holds in the other specimens, and therefore has a slightly different contour, the specimen is judged to belong to this species only from the size of the abdomen and of its anal lobes. Chagrin Valley.

Dicranomyia primitiva.—Two specimens, a little smaller than *D. stigmosa*, but still more closely resembling *D. pubipennis*, together with a third, which is simply a body, to which is attached the costal outline of a wing, and near which lies a leg, represent the female of this species. The two first mentioned are rather faintly preserved, but permit the venation to be traced with certainty, though with difficulty, and with one of them a portion of a detached (middle or hind) leg may be seen. The neuration of the wing differs from that of *D. stigmosa* in the shape of the discal cell, the inner border of which is straight, and strikes the incomplete fifth longitudinal vein exactly where the lower cross-vein strikes it, so that the two are continuous, and produce no break of direction in the fifth longitudinal vein. The auxiliary vein is not preserved, and there is no adventitious vein in the stigma, which otherwise is as in that species. The wing is not so slender as in *D. stigmosa*. Length of body 5.5^{mm}; wing 5.5–6^{mm}; femur 5^{mm}; tibia 5.75^{mm}; first two joints of tarsi 3.5^{mm}. The measurements of the leg are doubtful. Fossil Cañon.

Another poorly preserved specimen, which, by the structure of the

male forceps, is plainly to be referred to this genus, is judged, from its size, to belong to this species, none of the characteristic parts of the neuration being preserved. The body is a very little smaller than in the females of this species, and the male forceps are ovate and rather large. Length of body without forceps 4.5^{mm}; forceps 0.35^{mm}; breadth of one of them 0.2^{mm}. On the same stone with this is a leg which probably belonged to it, though some distance from it; the length of the femur is 5^{mm}; tibia 4.5^{mm}; the tarsi are broken.

Dicranomyia rostrata.—A single specimen, larger than the other species of *Dicranomyia*, and about the size of *Tipula decrepita* Scudd., is provisionally referred to this genus. The head is very small, the thorax rather robust and very strongly arched, and the abdomen shows it to be a female. The antennal joints are fifteen in number, the basal one stout, the apical slender obovate, the others globular; the palpi are four-jointed, the last three joints equal, and together as long as the first, the whole rather longer than the head, and therefore rather long for a *Dicranomyia*. The legs are wanting, the single wing detached, broken at the base, and longitudinally folded. Such of the neuration as can be disentangled agrees wholly with the peculiarities of this genus. Length of fragment of body, without head, 6^{mm}; breadth of head 0.5^{mm}; length of antennæ 2^{mm}; palpi 0.9^{mm}. Fossil Cañon.

A second specimen is referred to this species, but with some doubt, as it only consists of a trunk, with no appendages, excepting the male forceps. The specimen is slightly smaller than the female, as we should expect, and the plates at the extremity of the body differ from those of the other fossil species described in being of a regular, short, obovate form. Length of body, without forceps, 6.25^{mm}; of forceps 0.6^{mm}; width of same 0.28^{mm}. Fossil Cañon.

Spiladomyia (σπιλάζ, μυΐα), nov. gen.

This genus is founded upon a peculiar form of fly allied to *Dicranomyia*. The palpi are no longer than the head; the thorax is comparatively slender, the legs very long and slender, and the wings shaped much as in *Dicranomyia*, with a peculiar neuration. The auxiliary vein terminates some way beyond the middle of the costal border; the first longitudinal vein terminates in the second, close to the tip of the wing; the second originates from the first beyond the middle of the wing, but some distance before the tip of the auxiliary vein; the third longitudinal vein originates from the second, near the middle of its course, beyond the tip of the auxiliary vein; a little distance beyond its origin, but much nearer the tip of the wing than usual, it is connected by a cross-vein with the fourth longitudinal vein; the first and second posterior cells are therefore very short; there is, then, but a single submarginal cell, three, or, if a very slight fork at the apex of the posterior branch of the fourth longitudinal vein be counted, four posterior cells, and no discal cell.

Spiladomyia simplex.—A single specimen and its reverse show nearly all the parts of the body, but all are faintly preserved, so as to be very difficult of study. The specimen is a female; nearly all the legs are preserved, and all but the base of the wings; the latter, however, trail along the abdomen, so that parts are obscured, and the neuration is exceedingly faint. The head is small, the eyes almost exactly circular, the palpi a little shorter than the head, the antennæ composed of cylindrical joints, a little longer than broad, the legs slender, with femora, tibiæ, and tarsi of nearly equal length, and the wings as long as the body. The anterior branch of the fourth longitudinal vein is abruptly bent at its base, so as nearly to connect with the cross-vein uniting it with the third longitudinal vein, and the first and second posterior cells are scarcely more than three times as long as broad. The third posterior cell is but very insignificant, as the posterior branch of the fourth longitudinal vein forks but slightly, and near its tip. The neuration of the lower part of the wing is uncertain. Length of body 7.5^{mm}; palpi 0.35^{mm}; fore femora 4.5^{mm}; middle femora 4.5^{mm}; hind femora 4.5^{mm}; fore tibiæ 4.65^{mm}; middle tibiæ 4.5^{mm}; hind tibiæ 4.5^{mm}; fore tarsi 4^{mm}; middle (or hind) tarsi 4.5^{mm}. Measurements of tarsi uncertain. C. agrin Valley.

Pronophlebia (πρώω, φλέβιον), nov. gen.

This genus differs from all *Tipulidæ* known to me, in the early origin of the third longitudinal vein, which springs from the second almost immediately after its own separation from the first longitudinal vein, and some way before the tip of the auxiliary vein; the second longitudinal vein arises near the middle of the wing, and branches, the inner branch apparently forking near its tip. These characteristics readily serve to distinguish it from other *Tipulidæ*. The head is small, the antennæ long, very slender, and more than thirteen-jointed. They are too imperfect in the specimen studied to allow of any further statement. The palpi are not preserved, but the thorax is strongly arched, and the neuration indicates that the genus belongs to the *Tipulidæ brevipalpi*, and with other signs, that it is probably one of the *Limnophilina*, although the auxiliary cross-vein appears to be exactly opposite the origin of the second longitudinal vein. It is perhaps most nearly allied to *Trichocera*.

Pronophlebia rediviva.—The single specimen of this species is spread at full length, but the stone containing it is broken. The specimen is a male. The antennæ are considerably longer than the head and thorax together, and the joints are shaped and ornamented as shown in the figure of *Dolichopeza* in Walker's *Diptera Britannica*. The head is small, and the eyes so well preserved that they can be seen as in a living creature. The wings are very long and slender; the auxiliary vein terminates some distance beyond the middle of the wing; the first longitudinal vein about midway between that and the tip; the second longitudinal vein arises just within the middle of the wing, and the third longitudi-

nal vein less than half the distance from that to the tip of the auxiliary vein; the second longitudinal vein forks just beneath the tip of the auxiliary vein, its upper branch bends just beneath the tip of the first longitudinal, and its lower branch appears to fork just beyond the middle of its course. Cross-veins appear to divide the interspace between the second and third longitudinal veins (the second submarginal cell) into three equal parts; and there is certainly a cross-vein in the interspace between the fourth and fifth longitudinal veins (the second basal cell) directly opposite the origin of the third longitudinal vein. Length of body 9.25^{mm}; antennæ 2.6^{mm}; wings 9.25^{mm}.

Cyttaromyia (ζύτταρος, μύια), nov. gen.

This genus of *Tipulidæ* differs somewhat remarkably from any known to me. It appears to belong among the *Tipulidæ brevipalpi*, the first longitudinal vein terminating in the second much in the manner of *Dicranomyia*, with which, however, this genus seems to have little else in common. Although the first longitudinal vein terminates in this way, no trapezoidal cell is formed near its extremity after the manner of the *Tipulidæ longipalpi*, but this portion is quite as in *Dicranomyia*. The position of the auxiliary vein is indeterminable from the fragment I have seen; but the "posterior intercalary vein" of Loew issues from the lower outer angle of the discal cell at a long distance from the great cross-vein, and indirect continuation of the fourth longitudinal vein. All these characteristics place it with the *Tipulidæ brevipalpi*; but the points wherein it differs from them, as indeed from all other *Tipulidæ*, are not a little extraordinary. Apparently, it has certain relations with the *Amalopina*, and has some resemblance to *Symplecta*, but it may be questioned whether it should not form a section by itself in the neighborhood of the *Ptychopterina*.

The first longitudinal vein terminates in the upper branch of the second at no great distance from the tip of the wing; at the same point, it is connected with the costa by an oblique cross-vein, running in continuity with its terminal portion. *There are three submarginal cells and a secondary discal cell.* The large number of submarginal cells is due to the forking of the posterior branch of the second longitudinal vein, just as two submarginal cells are formed in *Anisomera* by the forking of the anterior branch of the same vein. The secondary discal cell is formed by the division of the third submarginal cell by a cross-vein, which unites with the elbow of the basal portion of the lower branchlet of the fork of the second submarginal vein, and leaves two cells beyond the supplementary discal cell, just as there are two cells (the first and second posterior) beyond the true discal cell; the latter lies directly below the secondary discal cell, but is twice as large as it. This is an anomaly quite unique, so far as I am aware, among the *Tipulidæ*.

Cyttaromyia fenestrata.—This species is represented by the portion of a wing and its reverse, containing a little more than the distal portion with nearly all the important part of the neurulation. The striking pecu-

liarities of this have been pointed out in the description of the genus; but a few minor points, probably of specific value, may be added. The second longitudinal vein originates far back toward (perhaps before) the middle of the wing, and half-way to the tip forks abruptly, the anterior branch immediately arching over and running to a point just above the extreme tip of the wing; the space between this portion of its course and the first vein is infuscated, forming a stigma; the posterior branch forks half-way toward the tip, the upper branchlet being in almost direct continuity with the main branch, while the lower diverges suddenly from it and unites with the cross-vein from the third longitudinal vein, after which it runs parallel to the other branchlet; the third longitudinal vein springs from the posterior branch of the second directly after its origin. The first and second posterior cells are of the same length as the lower two submarginal cells, and the discal cell is of a similar length. The lower part of the wing is confused from folding, but there is a cross-vein uniting the fourth and fifth longitudinal veins next the inner extremity of the discal cell; the discal cell extends further by its own width toward the base of the wing than the secondary discal cell, and there is a slight appearance on the stone, as if the middle of the cross-vein forming the inner limit of the discal cell were united by a cross-vein to the second longitudinal vein shortly before it branches, thus forming a prediscal cell of irregular shape and about as long as broad. Length of fragment 5.5^{mm}; width of middle of wing 2^{mm}. Fossil Cañon.

Tipula decrepita.—A single specimen, poorly preserved, is to be referred to the genus *Tipula* (s. str.). The head is small, the antennal joints very slender, obovate, between two and three times as long as broad, the thorax well arched, and the abdomen indicating a female; the legs are wanting; both the wings are present, but poorly preserved, and one of them imperfect; even the perfect one is badly folded longitudinally, but the costal border is nearly uninjured, and indicates the generic affinities, from the peculiar nature of the venation toward the apex; instead of forming toward the termination of the first longitudinal vein—a large stigma-like cell, the second longitudinal vein appears to form, with a slight vein springing from below, a long and exceedingly slender cell, above and outside of which the wing is slightly clouded. Length of body without head 6^{mm}; diameter of head 0.6^{mm}; length of wings 8.5^{mm}.

Tipula tecta.—A single specimen, preserved on a dorsal aspect, is of a larger size than the other *Tipulidæ* from this locality; its precise relationship cannot be determined until other specimens are discovered, as it has no head nor legs, except a very slender fragment of a tibia; and the wings, being longitudinally folded and partially concealed by the body, along which they lie, show only that the neuration is not discordant with that of the crane-flies, with which its other features agree. The specimen is a female, with a slight, not greatly arched, thorax, and full and plump, though still slender, abdomen, nearly as

broad in the middle as the thorax. Length of thorax 1.4^{mm}; breadth of same 1.25^{mm}; length of abdomen 4.75^{mm}; breadth of same 1.15^{mm}; length of wings 7^{mm}. Fossil Cañon.

Family MYCETOPHILIDÆ.

Mycetophila occultata.—A single poorly preserved specimen and its reverse present an upper view of the insect, with the wings folded over the back, the legs crowded together, and the antennæ lying beside the body. The antennæ are about as long as the head and thorax, the joints scarcely longer than broad, nearly cylindrical, scarcely at all moniliform. The legs are comparatively slender, hairy, and unarmed, not very long. The character of the venation shows the insect to belong to the *Mycetophilidæ*, but what genus is represented is somewhat obscure from doubt about the exact location of some of the veins; neither the auxiliary vein nor any of the basal veins above it can be seen, nor can the axillary be traced; judging from the other veins, it is probably allied to *Mycetophila*, although, in the possible presence of a second cross-vein uniting the cubital vein with the extremity of the radial, it should be referred to a distinct genus, probably allied to *Empheria* and *Tetragoneura*. The presence of such a vein being doubtful, we have preferred to point out its affinity to *Mycetophila*. The radial vein ends in the middle of the outer two-thirds of the costa, and at its tip a distinct stigma, nearly three times as long as broad, occupies the space between the radial and costal veins. The tip of the wing is broken on one specimen and obscured on the other, so that the length of the costal vein cannot be determined, although it appears to extend slightly beyond the tip of the cubital vein; the cubital is connected by the cross-vein to the radial but a short distance from its origin, and bends but little upward from the medial vein to reach it; the middle discal vein, on the contrary, bends downward considerably, and forks at a distance from the base, less than half-way from the median cross-vein to the tip of the radial vein, and an unusually broad space is left between its upper branch and the cubital vein, while the fork of the hind vein is nearer the base than the separation of the cubital from the medial vein. Length of body 3.5^{mm}; antennæ 1.1^{mm}; wings 3.5^{mm}; tibiæ (of fore legs?) 0.75^{mm}; tarsi (of same legs) 0.4^{mm}. Chagrin Valley.

Sackenia, nov. gen.

Body shaped much as in *Boletina*. Antennæ longer than the thorax, one-fourth slenderer at the apex than near the base, gently curved, 2+14-jointed. Legs very long and slender; femora and tibiæ of about equal length; tarsi a little longer than the tibiæ; the hind tibiæ and tarsi together a little longer than the abdomen; the tibiæ with one or two apical spurs beneath and spined throughout. Wings rather broad-ovate: the smaller veins at the extreme base obliterated in the specimen ex-

amed; auxiliary vein terminating on the costa beyond the end of the basal third, the first longitudinal vein in the middle of the outer half; the second longitudinal vein is unusually curved downward at the tip, so as almost to reach the apex of the wing; the united third and fourth longitudinal veins part from the second very near the base of the wing or within the small transverse vein; they divide near the center of the wing and the fifth and sixth longitudinal as near the base as the third and fourth; the sixth longitudinal vein is straight, and appears to reach the margin of the wing.

The genus resembles *Boletina* more than any of the genera figured by Winnertz, but differs strikingly from it in the approximation to the base of the forking of the third and fourth, and of the fifth and sixth longitudinal veins. In this particular, it closely resembles the *Sciarinae*, but differs from them still more in the length of the auxiliary and first longitudinal veins, and in that the former reaches the costa. The costal vein does not appear to pass beyond the tip of the second longitudinal vein, but this point is obscure. I have dedicated their genus to the distinguished dipterologist Baron Osten Sacken, to whom I am indebted for many suggestions in the determination of these fossils.

Sackenia arcuata.—This species is represented by a single female specimen, more than usually well preserved. The body is pale testaceous, the wings wholly hyaline, but the veins faint testaceous; the antennæ are a little longer than the head and thorax together, very slender, of the color of the thorax; the basal joints are subglobular, slightly broader than long, the remainder twice as long as broad, and beyond the middle of the antennæ slightly moniliform. In the wings, the base of the hinder cell, using Winnertz's terminology, lies within the base of the upper discal cell, both being nearer the base of the wing than the middle transverse vein, while the base of the middle discal cell is far outside of either of these, near the centre of the wing. The costal vein appears to terminate where the cubital reaches the margin, and the axillary vein nearly or quite reaches the border. The legs are partly detached, and the basal portion of the front pair obscure, but, apparently, the front tarsi are about three times as long as the front tibiæ. Length of body 5.65^{mm}; antennæ 2^{mm}; wings 4.25^{mm}; hind femora 3^{mm}; hind tibiæ 2^{mm}; hind tarsi 2.4^{mm}; fore tarsi 2^{mm}. Chagrin Valley.

A second specimen of the same species is similarly preserved, but wants the wings. The legs, however, are better preserved, and show a pair of apical spurs to the tibiæ. The antennæ are imperfect, but the proboscis is seen. The length of the curved body is a little more than 5.5^{mm}. The legs are detached and confused, so that it is impossible to separate the middle and hind legs; one leg (a front leg, to judge from its length) has the following measurements: femur 1.2^{mm}; tibia 1.4^{mm}; tarsi 1.7^{mm}; another (probably a hind leg): femur 2.1(?)^{mm}; tibia 2.25^{mm}; tarsi 1.75^{mm}; another (probably the opposite of the same): tibia 2.25^{mm}; tarsi 1.75^{mm}. Apparently, all the tarsi are broken. The tibial spines,

both in this and the first mentioned specimen, are delicate, and a little more than half as long as the thickness of the tibiæ.

Gnoriste dentoni.—A single specimen, a little broken, but otherwise in good preservation. The head and thorax are nearly black, the abdomen dark fusco castaneous. Legs and base of antennæ fuscous. Wings rather narrower at tip than in the European *G. apicalis* Hoffm., hyaline, covered with microscopic hairs, with a very slight and increasing infuscation toward the apex, the veins testaceous, the costal and second and third longitudinal veins much heavier than the others, and the fifth longitudinal vein with its lower fork scarcely heavier than the veins about it. The extreme tip of both wings is broken, so that the extent of the costal vein cannot be seen; but, in the approach of the proximal end of the fork of the fifth longitudinal vein to the root of the wing, the species agrees with the American *G. megarhina* O. S. more than with the European species mentioned, for it lies scarcely further from the base than the transverse vein connecting the first and second longitudinal veins, and slightly nearer than the separation of the third and fourth longitudinal veins. Only the basal four joints of the antennæ are preserved; the basal joint is obconic, broadly rounded at the apex, nearly twice as long as broad, the other three cylindrical, the second nearly half as long again as broad, the third and fourth less than a third longer than broad. The legs are profusely covered with hairs, but the hinder pair appear to be spineless, except at the apex of the tibia and of each tarsal joint, where there are three or four slender and rather short spines; the claws are very small and delicate, strongly curved, and delicately pointed; the short tibiæ of the front legs, however, have at least a single row of fine distant spines on the upper (?) edge. Length of body 4.4^{mm}; first joint of antennæ 0.2^{mm}; second joint 0.125^{mm}; third and fourth joints each 0.11^{mm}; wings 4.5^{mm}; middle (?) tarsi 2.2^{mm}; first joint of same 1.1^{mm}; second 0.45^{mm}; third 0.28^{mm}; fourth 0.2^{mm}; fifth 0.17^{mm}; claws 0.038^{mm}. Fossil Cañon.

Family CYRTIDÆ.

Aerocera hirsuta.—A single very fragmentary specimen appears to belong in the neighborhood of *Aerocera*, but is too imperfect to mention with any certainty. The size of the insect, the small head, robust and coarsely haired thorax, stout and abbreviated abdomen, indicate a form resembling that of *Aerocera*, and the tibiæ appear to be destitute of spurs; but the legs are not very slender, and the neuration of the fragment of the wing does not agree well with Westwood's figure of *A. globulus* Panz. in Walker's Diptera Britannica. There are, however, only a few longitudinal veins next the base, disconnected and faint, so that they afford very slight indication of the real character of the wings, and, the transverse veins being obliterated, nothing can be said of the basal cells. Length of body 4.5^{mm}; head 0.6^{mm}; height of same 1.3^{mm}; thorax and abdomen of about equal size. Fossil Cañon.

Family SYRPHIDÆ.

Eristalis lapideus.—A poorly preserved specimen, showing little that is characteristic, but which belongs near *Eristalis* or *Helophilus*. The body is preserved on a dorsal aspect, with wings partially expanded; the head is nearly wanting, the thorax without markings. The wings are distinct only on the basal half, and even here show no neuration at all beyond the general course of the principal veins at the very base; the alulæ, however, are very distinct, very large, their breadth (along the wing) fully equal to half the breadth of the thorax, dark, with obliquely transverse dark ridges, indicating that they were wrinkled in nature, much as in *Volucella* or *Oestrus*. Abdomen long, broadest in the middle of the basal half, beyond tapering considerably, the tip roundly pointed; apical half of basal joint black, forming a distinct transverse straight band; the number of abdominal joints appears to be five. Length of thorax 3.5^{mm}; breadth of same 3.25^{mm}; length of abdomen 6.5^{mm}; wings 12^{mm}; breadth of same 3.5^{mm}. Chagrin Valley.

Family MUSCIDÆ.

There are five species of Dipterous larvæ in the collection, all belonging to the *Muscidae*, and representing at least two very different groups, each of which has more than one representative.

Musca ascarides.—First there is a species to which a considerable number of specimens belong, which may take the name here given. Some of the specimens are complete; others consist of emptied skins only. When contracted, the body is thick, especially on the anterior half, and about twice as long as broad, closely resembling the larva of a bot-fly. Both extremities are rounded, the anterior very broadly, while the posterior half tapers very regularly. In one specimen, which is not so much shrunken, the body is fusiform, and about three and a half times longer than broad; the head and hinder extremity tapering in a nearly equal degree. In the emptied skins, as in the others, it may be seen that the normal form is a blunt, squarely rounded head, behind which the body is nearly equal, and then tapers toward the tail. At the anterior extremity may be nearly always seen a portion of the mandibles, consisting of a pair of very slender rods or blades converging anteriorly and terminating in two attingent rounded lobes, attached to the inner edge of the blades. The anterior spiracles are seen in a single specimen as a simple, rounded, dark spot just outside the middle of either lateral half; the two lateral tracheal vessels may be seen in nearly all the specimens, and especially at the hinder extremity, and fragments of them are frequently scattered about on the stones; they are very large. The integument is generally rather dark, and more or less blotched, and covered profusely and almost uniformly with backward-directed hairs; these are short, tapering, and moderately stout, though minute. Length of contracted bodies 11.5^{mm};

breadth of same 6.25^{mm} ; length of bodies not contracted 17.5^{mm} ; breadth of same 5.75^{mm} ; length of skins 25^{mm} ; breadth of same 7.25^{mm} ; length of blades of mandibles 3.25^{mm} ; diameter of tracheæ 0.6^{mm} ; of anterior spiracles 0.4^{mm} ; distance of latter apart 2.75^{mm} . Chagrin Valley.

Musca bibosa.—Another species is represented by a single body, and one skin and its reverse, which seems to belong to the same. It is closely allied to *M. ascarides*, but differs from it in some essential features. When contracted, the body does not taper regularly from the middle of the front half to the tail, but the whole hinder half is much slenderer than the front, and toward the tip has nearly parallel sides, so that the body is flask-shaped, and about twice as long as broad. A similar, though not so abrupt, change of contour is seen in the skin. The structure of the mandibles and of the tracheæ may be seen to be the same as in the preceding species, but the integument is naked, being entirely destitute of any of the hairs which roughen the skin of *M. ascarides*. Length of contracted body 14^{mm} ; breadth of same in front 7.5^{mm} ; behind 3.75^{mm} ; length of skin (a small one) 16^{mm} ; greatest breadth of same 5.25^{mm} ; length of mandible blade 2.75^{mm} ; diameter of tracheæ 0.75^{mm} . Chagrin Valley.

A third species is represented by three or four contracted skins, which are too uncharacteristic to name, though it may be seen that they are distinct from the others. As preserved, they are almost black; the skin is much wrinkled and smooth; the body pretty regularly and bluntly obovate, nearly twice as long as broad; at the end of one, two colorless oval patches lie united, side by side, pressed against the extremity, and doubtless represent the head, and prove it to be different from the other species; it is, however, impossible to say what its affinities may be. Length of body 8.5^{mm} ; breadth 4^{mm} . Chagrin Valley.

Musca hydropica.—A fourth species is represented by two bodies and a skin, which present an entirely different appearance from the preceding three species, but which may temporarily be given the same broad generic name. In this species, the form, even when contracted, is far more elongated than in the others; the body is nearly five times as long as broad, is broadest just behind the roundly pointed head, tapers rapidly toward it, but gently posteriorly to the middle, behind which it is equal. In the skin, the part of the body preserved is equal and very broad, excepting toward the head, where it rapidly narrows, the head being well rounded or slightly produced; the mouth-parts, instead of being withdrawn a little from the front extremity of the body, as in the species already described, lie at its very boundary, and the blades are parallel, instead of posteriorly divergent. The integument is covered rather profusely with very short, conical, tapering hairs, scarcely more than twice as long as their breadth at base. The larva is very distinctly banded with darker and lighter colors, as the empty skin shows, the posterior third of each segment being occupied by a very dark band, darkest on the dorsal surface, while a faint pale transverse line breaks

the anterior portion into two equal halves of the same width as the blackish band. Length of body 23^{mm} ; greatest breadth of same 5^{mm} ; breadth posteriorly 3^{mm} ; breadth of skin 9.5^{mm} ; length of segments on same 4^{mm} ; length of mandible blades 3.5^{mm} . Chagrin Valley.

Musca vinculata.—There is still another species, allied to the last-mentioned, which may bear the name here proposed. It is represented only by part of emptied skins, all lying on the same stone, and which differ from the preceding species in being absolutely devoid of any hairs, and in having different and much fainter markings. The general color of the best-preserved specimen is a pale brown, and the markings are scarcely darker transverse bands, narrowing on the sides, but occupying nearly the entire length of a segment dorsally, and broken into equal parts by two transverse rows of very faint and minute pale dots. No specimen is sufficiently perfect to show the shape or the length, but the shape appears to be similar to that of *M. hydropica*, and the insect much smaller than it, for the breadth is 4.5^{mm} , and the length of one segment 2^{mm} . Chagrin Valley.

Nearly all of these species, and especially *Musca ascarides*, so closely resemble the larvæ of bot-flies, that I could scarcely persuade myself that they could not belong to the *Oestridæ*. The appendages of the skin, however, are much more delicate than is usual in *Oestridæ*, and are uniformly distributed over the surface or are altogether absent. The empty skins, too, have every appearance of belonging to the same insects as the complete bodies, and although these are not cast skins (in which case they would be proved natural inhabitants of the water), for they still contain the harder parts of the internal organs in many cases, but remains of partially decomposed larvæ, it would seem improbable that so large a number of Oestrid larvæ could be found, when the only way in which they could have reached their present condition would be through the droppings of animals affected by the bots standing in the water. Of course, the reference I have given them is only provisional.

Indeterminate remains of the imagines of three or four species of small *Muscidæ* also occur in the collection from both places.

Family HELOMYZIDÆ.

Heteromyza detecta.—A single specimen and a very poor reverse of it occur on the same stone with *Spiladomyia simplex*. Both wings and the thorax are preserved, with short fragments of moderately stout hairy legs. The venation is obscure, and the species referred provisionally to *Heteromyza* until better specimens decide more certainly to which of the groups of *Muscidæ* it belongs. The venation is very similar, so far as it can be determined, to *Het. senilis* Scudd. from the Tertiaries of British Columbia, but the former species is much smaller, and there is a peculiarity about it which is not quite clear: at the bend of the costa, in-

dicating the termination of the auxiliary vein, there is a short, distinct, oblique cross-vein nearly in continuation of the base of the costa, but bent slightly downward, which reaches the first longitudinal vein; the latter runs close to the costa and strikes it about midway between the tip of the auxiliary vein and the tip of the wing; the costa apparently runs exactly to the tip of the second longitudinal vein; the third and fourth longitudinal veins run parallel to each other to a very little way beyond the extremity of the auxiliary vein, where they are united by a short cross-vein, beyond which they both diverge from each other in opposing curves, equally turned aside from their former course; the third longitudinal vein runs to the tip of the wing; the fourth is united half-way to the border of the wing by a long oblique cross-vein, running at right angles to the fifth longitudinal vein. The extremity of the basal cells apparently lies about half-way from the base of the wing to the tip of the auxiliary vein, but this point is very obscure. Length of wing 1.65^{mm} ; breadth of same 0.95^{mm} ; length of thorax 0.75^{mm} ; breadth of same 0.55^{mm} . Chagrin Valley.

COLEOPTERA.

Family CARABIDÆ.

Bembidium exoletum Scudd. Bull. Geol. Geogr. Surv. Terr. ii, 77-78.

Family DYTISCIDÆ.

Laccophilus sp.—The femur and tibia of the hind leg of a species allied to *L. maculosus* Germ. Fossil Cañon.

Family STAPHYLINIDÆ.

Gyrophæna saxicola Scudd. loc. cit. ii, 78. Chagrin Valley.

Leistotrophus patriarchicus Scudd. loc. cit. ii, 78-79.

Oxytelus pristinus Scudd. loc. cit. ii, 79. Chagrin Valley.

Family ELATERIDÆ.

Epiphanis deletus Scudd. loc. cit. ii, 80-81. Fossil Cañon.

Oxygonus mortuus Scudd. loc. cit. ii, 81. Fossil Cañon.

Family BRUCHIDÆ.

Bruchus anilis Scudd. loc. cit. ii, 82. Chagrin Valley.

Family CURCULIONIDÆ.

Entimus primordialis Scudd. loc. cit. ii, 84. Chagrin Valley.

HEMIPTERA.

Family FULGORIDÆ.

Aphana atara.—A single finely preserved specimen, giving the upper surface of the body, the displaced tegmina of one side, and a part of the middle leg of the opposite side, is referred provisionally to *Aphana*. It

plainly belongs to the true *Fulgorina*, and seems to agree better with *Aphana* than with any other genus concerning which information is at hand, but it is much smaller than the species of *Aphana* (as it is larger than those of *Pæocera*), and differs from it in the structure of the head and the brevity of the tegmina. The head is small, being scarcely more than one-third the width of the body, the eyes not prominent, the front scarcely angulated, and the vertex of about equal length and breadth; it is marked above with two longitudinal blackish stripes, and the thorax with a median, and, on either side, a broad lateral black stripe, all of them bordered by paler parts and the median marked with a median pale line. The front of the thorax is strongly and regularly convex, and the posterior border of the mesonotum is rectangular. The tegmina are about three times as long as broad, with nearly parallel borders, the tip roundly pointed. The apical fifth is filled with fine, closely parallel, longitudinal veinlets, extending from the tip of the radial vein to the inner border, forming an area of equal width throughout. The radial vein is parallel to the costa throughout. The ulnar veins originate almost exactly as in *Aceraphia*, but the upper one does not fork before the middle of the wing, when it sends downward a single shoot, while the lower forks almost immediately, and again emits a vein beyond the middle of the wing. The wing itself is apparently diaphanous, but is mottled lightly with faint fuliginous along the costal border, and more heavily, but irregularly, with dark fuscous on the basal half of the wing, especially next the extreme base, and in a rather broad and straight but irregularly margined and oblique band, crossing the wing from just below the sutural angle equally backward and outward. Middle leg moderately stout; femur and tibia of equal width, straight, apparently with sharp edges. Abdomen full, rounded, broad, the extremity broadly rounded; it is dusky, especially beyond the base, the neighborhood of the spiracles darker, the fifth to the seventh segments with a medio-dorsal (or medio-ventral?) raised line marked in black. Length of body 9.5^{mm}; breadth of head 1.8^{mm}; of abdomen 5^{mm}; length of tegmina 10^{mm}; width of same 3.5^{mm}; length of femora (somewhat doubtful) 2^{mm}. Chagrin Valley.

Delphax senilis.—A fairly preserved specimen with spread wings, but with almost no characteristic sculpture. The head and exposed part of thorax are blackish; the rest of the body and the wings, especially the tegmina, dusky. The head is less than half as broad as the thorax, and short. The thorax is broad and rounded, and the body nearly equal, though enlarging slightly posteriorly. The tegmina are slightly narrower and considerably longer than the body, equal, and at the tip broadly rounded; they show no trace of neuration, but the preservation of the whole is perhaps too obscure to expect it. The wings are a little shorter than the tegmina, crumpled and folded, and show a few longitudinal veins, and others, which, from the nature of the preservation, cannot be traced. Legs and appendages of the head are wanting. Length of body 2^{mm}; tegmina 2.4^{mm}. Chagrin Valley (?).

Family TETTIGONIDÆ.

Tettigonia obtecta.—A single specimen, with the merest fragments of wings and no legs, but otherwise pretty perfect, belongs, with little doubt, to this family, although its generic affinities are uncertain. The head is not quite so broad as the body, bluntly angulated in front (at an angle of about 130°); the eyes are rather small, the beak stout and about as long as the head. The abdomen is moderately stout but long, tapering to a blunt tip; the segments eight in number, growing longer apically, the seventh being twice as long as the second. Length of body 7.6^{mm} ; breadth of same 2^{mm} ; length of rostrum 0.65^{mm} ; diameter of eyes 0.28^{mm} . Chagrin Valley.

Bythoscopus lapidescens.—A single specimen, broken at the edge of a stone, and so preserving only the abdomen and part of the wings. The abdomen is long and slender, composed of nine segments, the extremity indicating that it is a female. The wing (the tegmina appear to be entirely absent) reaches the tip of the abdomen, and the apical cells are from a third to nearly half as long as the wing, the upper the longer; the apex is produced but rounded. Probable length of body 5.5^{mm} ; length of fragment 3.5^{mm} ; breadth of abdomen 1.5^{mm} . Chagrin Valley.

Family LYGÆIDÆ.

Pachymerus petrensis.—A single specimen, of which most of the right half is destroyed, represents this species, which is placed here provisionally, principally because it appears to be closely related to fossil species put in this group by Heer. It seems to be a larva, and to belong either to the *Rhyparochromidæ* or the *Anthocoridæ* of the British Catalogue. The outline of the head is vague and broken, but the front is apparently bent at a right angle. The antennæ are about half as long as the body, four-jointed; the basal joint only about half as long again as broad, the others subequal, very slightly smaller at the base than at the apex, but otherwise equal, the second a very little the longest, the last pointed at the tip. Thorax and abdomen of about equal length, the former equally broad throughout (or nearly so); the fore and middle femora short and stout, about as long as their separation from each other. Abdomen expanding suddenly at the base, so that the second segment is broadest and apparently half as broad again as the thorax, beyond tapering rather rapidly to a rounded tip. This form of the abdomen does not appear consonant with *Pachymerus*. Length of body 3^{mm} ; antennæ 1.5^{mm} ; fore femora 0.35^{mm} . Fossil Cañon.

Family PHYSOPODA.

Melanothrips cincta Scudd. Bull. Geol. Geogr. Surv. Terr. i, ii, 221
Chagrin Valley.

Lithodothrips vetusta Scudd. loc. cit. i, ii, 222. Fossil Cañon.

Palæothrips fossilis Scudd. Geol. Mag. v, 221. Fossil Cañon.

NEUROPTERA.

Family PHRYGANIDÆ.

Phryganea aperta.—A single well-preserved specimen with its reverse; the wings are doubled beneath the body, and unfortunately are overlaid by the larva skin of a Dipterous insect, obliterating all the important parts of the neuration. The portion that remains resembles that of *Gæra*, but it is impossible to determine with any certainty, while the structure of the antennæ is more as in *Phryganea* proper. The head is detached from the body, and faint traces of the antennæ are preserved, but detached; a single pair of spurs show at the end of the tibiæ, and the spines of the under edge of the same tibiæ are alternately long and short. The abdomen is very well preserved on a side view. Length of body 8^{mm}; (portion of) antennæ 7^{mm}; tarsi 3.5^{mm}; wings 10^{mm}. Chagrin Valley.

ART. XXX—DESCRIPTION OF TWO SPECIES OF CARABIDÆ FOUND
IN THE INTERGLACIAL DEPOSITS OF SCARBORO' HEIGHTS,
NEAR TORONTO, CANADA.

BY SAMUEL H. SCUDDER.

In the last number of the Canadian Journal of Toronto, Prof. G. J. Hinde describes the glacial and interglacial strata of various localities near Toronto, in one of which some coleopterous remains were found. These having been submitted to me for examination, the following descriptions are published:

Loricera glacialis, nov. sp.—Of this species, a pair of elytra are preserved, nearly complete, but cracked and flattened somewhat out of shape. It is allied to *L. neoscotica* Le C., but differs from it and from all other American species of *Loricera* in the much greater depth of the striæ and in the presence of distinct submarginal foveæ. The elytra are of a glistening, somewhat blue-black color. It is difficult to tell whether there are eleven or twelve punctured striæ; the striæ are strongly impressed, faintly though rather coarsely and profusely punctulate, the third interspace with three small, distinctly but not deeply impressed foveæ, arranged as in *L. neoscotica*, two near each other just above the middle of the elytra, and one behind the middle of the apical half; fifth interspace sometimes furnished with a pair of very faint foveæ near the middle of the elytra, much as in *L. decempunctata* Esch., about as far from each other as from the sutural border; and finally the ninth interspace, different from all the species of *Loricera* I have been able to examine, has eight or more small but distinct and deep foveæ, mostly situated in the apical half of the elytra, sometimes connected by oblique ridges with the next stria within. The interspaces are crossed by very fine wrinkles, scarcely visible with a simple lens. The elytra are shaped as in *L. decempunctata*, particularly at the apex. Length of elytron 4.4^{mm}; breadth 1.6^{mm}.

I had at first taken this for a *Diachila*, but the peculiar disposition of the foveæ on the third interspace is characteristic of *Loricera* (with the species of which it agrees in size) and is different from their relative position in all other *Carabidæ* with which it could be compared.

Loxandrus gelidus, nov. sp.—The following fragments of this species have been examined:—a very nearly perfect elytron, but badly cracked and pressed apart; the greater part of another; parts of three united

segments of the abdomen; the prothorax, slightly cracked; and a portion of one of the mandibles. A species is indicated a little larger than *L. agilis* LeC., and in many respects resembling it. The elytra are shaped as there, with the same apical sinuation; they are piceous, with a metallic-blue reflection, exactly as in many species of *Loxandrus*; there are nine distinctly and rather deeply and equally impressed striae, rather faintly and not very profusely punctate; the interspaces appear as if minutely cracked, and with a simulation of excessively faint and small foveae throughout, while the third has a more distinct, though still rather shallow and rather large, fovea considerably behind the middle of the apical half of the elytra; a second fovea appears in the third interspace, as far from the apical fovea as that is from the apex, but it is situated laterally, encroaching on the stria within it. It is perhaps due only to an excess of the simulating foveae that there is apparently a row of approximated punctures, quite like those of the neighboring striae, for a very short distance between the base of the sixth and seventh striae. The first stria turns outward next the base, apparently to make room for a scutellar stria, which does not appear to exist in this genus, but which may probably form in this species the limit of the minute portion of the elytron which passes beneath the scutellum in repose; plainly, however, it is correlated with the unusual basal curve of the first stria, in which respect the fossil differs from all the species of *Loxandrus* I have examined. The obliquely cut marginal foveae agree with those of *L. agilis*. The prothorax is quadrate, the front margin very slightly angled, quite as in *L. erraticus* Le C., the sides broadly rounded, fullest anteriorly, with an exceedingly slight median sulcus (indicated by a slender crack), and more distinct posterior sublateral sulci (indicated by wider cracks), and between which the hind border is scarcely convex, and not at all as in *L. erraticus*. The surface of the prothorax is smooth; the abdomen is also smooth. The part of the mandible remaining is only the basal "molar" portion, armed with six or seven mammilate conical teeth, or rather transverse ridges. Length of elytron 5.75^{mm}; breadth 2^{mm}; length of prothorax 2.25^{mm}; breadth 3.5^{mm}; breadth of abdomen 2.25^{mm}.

This species differs from all *Loxandri* known to me in the coarseness of the punctuation of the elytra, the roughness of the interspaces, the position of the fovea of the third interspace, the intercalated false stria at the base of the seventh interspace (which can hardly be entirely fortuitous, since it is correlated with unusual unevenness of the surface elsewhere), the basal deflection of the first stria, and the presence of an inconspicuous scutellar stria. Nevertheless, it has all the aspects of a *Loxandrus*, and disagrees in more essential points from other *Carabidae*.

ART XXXI.—REPORT UPON THE INSECTS COLLECTED BY P. R. UHLER DURING THE EXPLORATIONS OF 1875, INCLUDING MONOGRAPHS OF THE FAMILIES CYDNIIDÆ AND SALDÆ, AND THE HEMIPTERA COLLECTED BY A. S. PACKARD, JR., M. D.

BY P. R. UHLER.

[Continued from p. 475.]

LEPIDOPTERA.
RHOPALOCERA.

Papilio daucus Boisd.

Seen flying in Clear Creek Cañon and in the gorge near the Ute Pass, August 6 to 13.

Pieris oleracea Harris.

Not uncommon near Denver, at Golden, and in the Clear Creek Cañon, August 5 to 18.

Pieris protodice Boisd.

Moderately common in Denver and on the plains west of the city, early in August.

Nathalis iole Boisd.

Not common; only two specimens seen, the one at Denver, August 5, and the other at Colorado Springs, August 12.

Colias philodice Godart.

Quite common in and near Denver, August 5 to 8.

Colias eurytheme Boisd.

Extremely abundant in and near Denver, also at Golden and in Clear Creek Cañon, August 5 to 8. It was not common at Colorado Springs, nor near Cañon City.

Danais archippus Cramer.

Very common on the plains and less so in the cañons, August 5 to 18.

Euptoieta claudia Cramer.

Not found in abundance. A few specimens were met with in the hilly region west of Denver, on August 18.

Argynnis hesperis Edwards.

Not uncommon in Beaver Brook Gulch and in Clear Creek Cañon, August 6 and 7.

Another and larger species was observed at the same time in Clear Creek Cañon, but it was so wild as to be unapproachable with the net, and flew most of the time over the rapids of the creek.

Melitæa nubigena Behr.

Not rare in Clear Creek Cañon and in Beaver Brook Gulch, August 6 and 7.

Melitæa mata Reak.

One specimen taken west of Colorado Springs, not far from the mountains, August 16. No others were seen.

Grapta hylas Edwards.

Two specimens of this insect were seen, August 16, on the cottonwood trees growing beside the irrigating canal which bounds Colorado Springs on the western side. Having laid my net down, while engaged in turning over chips and stones and examining the flowers, I was not able to recover it soon enough to capture these beauties. One of them lodged for a second on the trunk of a tree, in full view, but the next moment flew off to a distance, and, although I wasted about a quarter of an hour in trying to secure it, my labors were unsuccessful.

Vanessa antiopa Linn.

One specimen captured, August 6, in Beaver Brook Gulch; two others seen; but not taken.

Pyrameis huntera Drury.

One specimen seen on the plains west of Denver, August 5. It settled on the ground within full sight, but I was too busy with other insects to spend the time in following it up.

Pyrameis atalanta Linn.

One specimen from Clear Creek Cañon, August 6. Only one other specimen was seen, and that was torn and battered, like the one taken.

Limenitis weidemeyeri Edw.

This beautiful species was tolerably common in Clear Creek Cañon, and up the Beaver Brook almost to the top of the mountain; certainly at an altitude of more than 7,000 feet above sea-level. They generally flew in the bright sunshine, with moderate rapidity, over the water, and occasionally lodged upon the willows or other bushes projecting above the current. Some were dusky and much battered, while others were fresh and clean. I noticed that there was a marked difference in the width of the white band across the wings. Both sexes were present on August 6 to 8.

Satyrus sp.

Two specimens captured, August 6, in Clear Creek Cañon. A few others were seen, but they kept beyond my reach.

Satyrus sp.

A pair from Manitou, August 14. They were captured in the midst of the bushes on the side of the hill adjoining the road leading up the Ute Pass. No others were noticed. It is interesting to observe that here are two parallel species, each frequenting a cañon of the Rocky Mountain belt, but occupying separate territory, and perhaps representative of two distinct faunal districts.

Thecla sp.

A specimen of this exquisitely beautiful butterfly occurred to me on the bank of the creek, near Manitou, on August 13.

Chrysophanus helloides Boisd.

A few specimens occurred on the plains, near Denver, on August 5. It is very wary, hiding among the dense foliage of the flowers, and selects its resting places with such tact that it promptly becomes invisible to the collector who is following it.

Lycæna melissa Edw.

Found sparingly in Clear Creek Cañon, August 6; near Denver, August 5, and later; at Colorado Springs and Manitou, August 12 to 16, quite common on low plants and very variable; and one specimen from Cañon City, August 11. The latter specimen has an arcuated orange band on both front and hind wings, while one from Colorado Springs has a similar band on the hind wings alone.

Lycæna rapahoe Reakirt.

This modest bluet was seen in small numbers at Denver, August 5, but not much later, and near Colorado Springs on August 12 to 16.

Pholisora catullus (Fab.) Scud.

Taken in Clear Creek Cañon and west of Denver, August 6 and 18. Not common in either locality.

Hesperia tessellata Scudder.

On the low hills west of Denver and near Sloan's Lake on bare patches of ground in grass, August 18. A few specimens were met with at almost every interval of two or three rods.

Hesperia comus Edwards, MS.

In company with the preceding, and equally frequent. On being aroused, these species did not fly to the patches of flowering plants and weeds near by, but invariably alighted on the spaces between the buffalo-grass, where their colors sufficiently harmonized with the soil to give them a fair degree of protection.

Anthomaster uncas (Edw.) Scud.

Somewhat common on the hills west of Denver on August 18.

Pamphila manitoba Scud.

Uncommon in Clear Creek Cañon, August 6.

Pyrrhosidia napa Scud.

One specimen from the hills west of Denver, August 18.

These Hesperians were kindly determined for me by Mr. Samuel H. Scudder.

HETEROCERA.

The following list of moths, collected by me in Colorado, in 1875, was prepared by A. S. Packard, jr., M. D. :—

Fam. ZYGÆNIDÆ.

Gnophala vermiculata Grote & Robinson.

Common in Beaver Brook Gulch and in Clear Creek Cañon, August 6 and 7.—(P. R. U.)

Lycomorpha miniata Pack.

One specimen seen flying from the mountain heights into Beaver Brook Gulch, August 6.—(P. R. U.)

Lycomorpha palmeri Pack.

Found in the same place as the preceding, and also flying in the full sunlight. I have no doubt of these being but varieties of a single species.—(P. R. U.)

Fam. BOMBYCIDÆ.

Crocota ferruginosa Walker, and var. *brevicornis*.

From Clear Creek Cañon, August 7.

Fam. NOCTUIDÆ.

Erebos odora Drury.

Broken specimens of this insect were lying about in the hotel at Beaver Brook, showing the species to be not uncommon at that place.—(P. R. U.)

Tarache angustipennis Grote.

Inhabits the region of Colorado Springs.

Mamestra discalis Grote, n. sp.

From Clear Creek Cañon, August 6.

Mamestra olivacea Morrison.

Obtained at Beaver Brook, in Clear Creek Cañon, August 6.

Mamestra sp.

Indicates a species distinct from *M. illaudabilis* Grote. Collected in Clear Creek Cañon.

Mamestra (Dianthæcia) meditata Grote.

From Colorado Springs, August 13.

Hadena arctica (Boisd.).

Taken at night in Clear Creek Cañon, August 6.

Tribadium spumosum Grote.

On flowers in the tall grass at Bijou Creek, August 19.

Rhododipsa volupia (Fitch).

From the plains near Denver.

Porrina sanguinea (Geyer).

On sunflowers near Colorado Springs.

Eulencyptera cumatilis Grote.

Caught flying about the lantern of the hotel at the mouth of Beaver Brook.

Lygranthæcia jaguarina (Guenée).

Common on flowers of golden-rod, at Bijou, August 19. These insects were flying with great activity in the full daylight, settling upon the flowers and rolling themselves in the pollen. They were shy, and flew over long distances when approached.

Lygranthæcia packardi Grote.

Found with the preceding at Bijou August 19, and at Colorado Springs August 16.

Grotella septempunctata Harvey.

A few specimens were met with on bushes near the creek at Manitou, August 14.

Bleptina caradrinalis Guenée.

Captured in Clear Creek Cañon, August 7.

Fam. PHALÆNIDÆ.

Eupithecia sp.

Too much rubbed for identification. Caught around the lantern at Beaver Brook, August 6.

Glaucopteryx magnoliata (Guenée).

Obtained in the same locality as the preceding, but earlier in the evening.

Ochyria abrasaria (H.-Schf.).

Captured in the same locality and at the same time.

Phibalapteryx intestinata Guenée.

Taken in the vicinity of Colorado Springs, August 12.

Hydria undulata Hübner.

Found in the same place as the preceding.

Gnophos haydenata Pack.

Captured at the mouth of Beaver Brook, in Clear Creek Cañon, August 6.

Thamnonoma flavaria Pack.

Taken in the same place and at the same time as the preceding.

Eois gemmata Pack.

Collected in Clear Creek Cañon, August 7.

Acidalia quinquelineata Pack.

Also found in Clear Creek Cañon, August 7.

The above list comprehends all the species that reached Baltimore in good condition. Many specimens were destroyed by insects in the boxes while on the railway trains, among which were some forms not included in this list.

COLEOPTERA.*

Fam. CICINDELIDÆ.

Cicindela pulchra Say.

Vicinity of the mouth of the Cañon of the Arkansas, on dark, sandy soils, not common, August 11.

Cicindela punctulata Fab.

The black variety was common in many places near Denver and in the city; also in and near Clear Creek Cañon. Specimens of the green variety were found as far south as Cañon City, August 11.

Cicindela duodecemguttata Dej.

On dark, sandy loam adjoining Beaver Brook in the Gulch, August 6. One specimen from the banks of the South Platte, west of Denver.

Fam. CARABIDÆ.

Calosoma obsoletum Say.

One specimen from the plains west of Denver. No others seen.

Pasimachus elongatus Le C.

One specimen taken by Dr. Hayden near Larkspur, on the Denver and Rio Grande Railroad. Others were captured by myself in the vicinity of Colorado Springs and on the hills west of Denver, August 16 to 18.

Platynus sp.

From the hills west of Denver, August 18.

Evarthrus substriatus Le C.

Common under stones and about the roots of yucca, near Colorado Springs, August 16.

Pterostichus sp.

Under stones and dried dung in the suburbs of Denver, August 8.

Chlœnius sericeus Forst.

In damp situations west of Denver, August 9.

Cratacanthus dubius Beauv.

Quite common in Denver and the vicinity under stones and rubbish, August 5-18; also at Colorado Springs, August 16; and in Clear Creek Cañon.

* I am indebted to Dr. George H. Horn and Otto Lugger for the determination of many of the species enumerated in this list.

Piosoma setosum Le C.

Found only at Colorado Springs, August 13 to 16; not common; living beneath rubbish on the ground.

Harpalus caliginosus Fab.

Very common at Denver, running among the dense weeds, and sometimes concealed beneath stones and rubbish, August 6 to 18. One specimen from Clear Creek Cañon.

Harpalus oblitus Le C.

Distributed everywhere, as well upon the plains as up into the mountains. I took specimens at Denver, high up Beaver Brook, near Colorado Springs, in Manitou Park, and near Cañon City, August 5 to 18.

Harpalus fallax Le C.

In alluvial soil near Cañon City, August 11; not very abundant. A few specimens were also found under stones in the vicinity of Colorado City, August 16. Not seen near Denver.

Harpalus ochropus Kirby.

A few specimens occurred west of Colorado Springs and near the Garden of the Gods, August 13.

Harpalus sp.

Found on the hills west of Denver, August 8.

Bembidium bifossulatus Le C.

In Clear Creek Cañon and Beaver Brook Gulch, August 6 and 7; also near the South Platte River, west of Denver.

Bembidium americanum Dej.

Very common near Sloan's Lake, west of Denver; but I did not meet with it in any other locality.

Fam. DYTISCIDÆ.

Laccophilus decipiens Le C.

Common in pools of water near Denver, August 5 to 8. Later in the month, these pools had dried up, and their insect inhabitants were no longer to be seen.

Rhantus binotatus Harris.

Very abundant in the same pools as the preceding; also in Sloan's Lake, August 8.

Fam. HYDROPHILIDÆ.

Hydrophilus triangularis Say.

In the pools near Denver, August 8. None found elsewhere.

Tropisternus nimbatus Say.

Very common in the pools of water on the plains in the vicinity of Denver; also in Sloan's Lake, and in standing water near Colorado Springs.

Tropisternus glaber Hbst.

In company with the preceding near Denver, but not at Colorado Springs.

Philhydrus sp.

A few specimens taken from the same pools as the preceding.

Fam. NITIDULIDÆ.

Carpophilus pallipennis Say.

Swept from bushes in the entrance to the Cañon of the Arkansas, August 11; not abundant.

Phenolia grossa Fab.

On plants near Cañon City, August 11. Only a few specimens taken.

Pallodes silaceus Erich.

Beaten from shrubs near the entrance to the Cañon of the Arkansas, August 11.

Fam. EROTYLIDÆ.

Cypherotylus boisduvali Chev.

From the mountains adjoining Clear Creek Canon, August 6.

Fam. COCCINELLIDÆ.

Hippodamia quinquesignata Kirby.

Quite common in Clear Creek Cañon, in Beaver Brook Gulch, August 6 and 7. Not seen near Denver, nor southward outside of the higher mountains.

Hippodamia convergens Guer.

Abundant on various flowering plants on the plains near Denver and on the low hills west of that city; also at Colorado Springs, August 5 to 16. Not met with in the mountains.

Hippodamia parenthesis Say.

Very abundant on plants in damp situations away from the mountains, everywhere from Denver to Cañon City. It was particularly abundant on the plains in the vicinity of Colorado Springs, August 16. In the mountains, a few specimens were seen at low levels in Clear Creek Cañon.

Hippodamia lecontei Muls.

Not common at Denver, but more so on the hills west of the city. One specimen from Manitou Park, August 14.

Coccinella transversalis Muls.

Common at Denver, at Colorado Springs, and in the vicinity of Cañon City, August 8 to 18.

Coccinella novemnotata Hbst.

Common in Clear Creek Cañon, at Denver, and in the vicinity of Cañon City.

Fam. HISTERIDÆ.

Hister sp.

A few specimens found beneath dried dung, near Denver, and in the vicinity of Colorado Springs.

Saprinus lugens Er.

One specimen from beneath a stone in Beaver Brook Gulch, August 6.

Fam. SCARABÆIDÆ.

Canthon hudsonius Forst.

One specimen from the hilly region west of Denver, August 18.

Diplotaxis carbonata Le C.

A few specimens were found in shelter under the bunches of yucca near Colorado Springs, August 13.

Tostegoptera lanceolata Say.

Found creeping out of holes in the patches of buffalo-grass on the hills near the Garden of the Gods, August 13 and 16. A few specimens had taken shelter under the tufts of grass, but generally they were clumsily crawling over the surface of the ground. Each hill furnished a few specimens, and they were usually found on the exposed summits, rather than on the sides or in the valleys. A careful search on the hills at Manitou failed to disclose any of them, and none were found in any of the other localities visited.

Collops quadrimaculatus Fab.

Common on sunflowers, in the valley of the Arkansas, east of Cañon City, August 10.

Fam. CLERIDÆ.

Trichodes ornatus Say.

Taken upon a tall golden-rod overhanging the stream, in Beaver Brook Gulch, August 7. Not met with in any other locality.

Hydnocera humeralis Say.

Common upon bushes in the mouth of the Arkansas Cañon, August 11. Although usually common upon small oaks, I failed to find specimens at Manitou, where small oak trees abound on the hill-sides.

Fam. MALACHIDÆ.

Listrus senilis Le C.

Rare, and taken near Cañon City, upon bushes, August 11, and at Colorado Springs, August 16.

Fam. CERAMBYCIDÆ.

Batyle ignicollis Say.

Rare, and met with only in the entrance to Beaver Brook Gulch, where it was flying in the bright sunlight, August 6.

Crossidius discoideus Le C.

One specimen from Beaver Brook Gulch, taken from a small *Helian-*

thus. At Colorado Springs, it was very common and variable in size, being found embedded in the crown of the sunflowers, and remaining there over night. They were noticed to be more active in the early morning and in the afternoon than at other times, and then might have been seen flying from one flower to another. Usually their markings were red, but at Denver two or three yellow-marked specimens were taken.

Sphænothecus suturalis Le C.

Upon flowers at Cañon City, but not common, August 11.

Cremastochilus knochii Kirby.

A few specimens were found beneath rubbish, in the vicinity of Colorado Springs, August 13 to 17.

Euryomia inda Linn.

Found flying near Bijou, August 19.

Fam. BUPRESTIDÆ.

Buprestis maculiventris Say.

Caught while flying toward a wood-pile at the entrance to Beaver Brook Gulch, August 6.

Taphrocerus gracilis Say.

Very common upon plants in damp situations in the western suburbs of Denver, August 5 to 9.

Fam. ELATERIDÆ.

Monocrepidius vespertinus Fab.

Two specimens, swept from herbage near the Cañon of the Arkansas, August 11.

Fam. LAMPYRIDÆ.

Photinus pyralis Linn.

Near Denver, August 8. Not abundant.

Fam. TELEPHORIDÆ.

Chauliognathus basalis Le C.

Common in various places on the plains. Very abundant at Colorado Springs, Cañon City, and Bijou; less so near Denver, August 8 to 19.

Telephorus bilineatus Say.

On grass and weeds near the mouth of the Cañon of the Arkansas, August 11.

Fam. MALACHIIDÆ.

Collops bipunctatus Say.

A few specimens were swept from flowering plants near Colorado Springs, August 16; also at Cañon City, August 11.

Rhopulophora longipes Say.

On weeds in the vicinity of Denver, not common, August 8.

Leptura rubrica Say.

One specimen, taken on the wing, in Beaver Brook Gulch, August 6 and another near Cañon City, August 11.

Dectes spinosus Say.

A single specimen only was taken at Cañon City, August 11; a few others were beaten from weeds near Pueblo.

Tetraopes annulatus Le C.

A few specimens were swept from the *Asclepius*, on the hills west of Denver. Although the same and other kinds of milk-weed were met with in many other places, no further specimens were seen. Evidently the season was far advanced for them, and the flowers whose colors they so well matched were generally out of bloom or drying up. They were met with early in August.

Fam. CHRYSOMELIDÆ.

Babia quadriguttata Oliv.

Swept from rank growths near Manitou and adjacent to the creek flowing west of Colorado Springs, August 12 and 13.

Euryscopa lecontei Cr.

A few specimens were beaten from oak bushes in the vicinity of Manitou, August 13.

Cryptocephalus notatus Fab.

Not common; but a few specimens were swept from weeds, in the neighborhood of Manitou, August 13. One specimen was also taken in the valley of the Arkansas, near Cañon City.

Cryptocephalus guttulatus Oliv.

One specimen from the vicinity of Cañon City, August 10.

Pachybrachys tridens Mels.

From the region of Colorado Springs, August 16. Moderately common.

Chrysomela exclamations Fab.

Taken from weeds in Clear Creek Cañon and near Denver, August 6 to 9. Not met with elsewhere.

Diabrotica tricincta Say.

Very common almost everywhere, especially where the soil was moist in the vicinity of streams and irrigating-canals.

Galerucella sp.

A few specimens somewhat related to *G. notata* Fab. were found on plants growing about the Beaver Brook, August 6.

Disonycha punctigera Le C.

Common on various plants near Colorado Springs, August 12.

Disonycha triangularis Say.

Not uncommon at Cañon City, August 11, and near Colorado Springs, August 13.

Graptodera plicipennis Mann.

Local, but quite common on a tall golden-rod growing near the stream in Beaver Brook Gulch, August 6, and also in the western part of Denver.

Graptodera punctipennis Le C.

Found abundantly at Denver, at Colorado Springs, and near Cañon City, August 8 to 13, on the willows, in wet situations.

Odontota inæqualis Web.

Common in Clear Creek Cañon and in the western suburbs of Denver, August 6 to 9.

Fam. TENEBRIONIDÆ.

Epitragus canaliculatus Say.

Found only near the mouth of the Cañon of the Arkansas, upon a species of slender, narrow-leaved *Euphorbia*, which grew upon a spot of white sand. The insects were thickly powdered with a white, mealy substance, which easily rubbed off. They loved to crawl into the axils of the flower-stems, and lay concealed there during the time of bright sunshine, but early in the morning and toward evening twilight they ran actively over the plants and pursued each other over the surface of the ground. They showed wonderful dexterity in gliding beneath the sand when I attempted to catch some of them, and they sometimes concealed themselves quite successfully by burrowing into the sand at the root of the plants. Neither the plant nor these insects were to be seen in any of the other localities that I visited.

Asida opaca Say.

Not rare, but found wide apart, scattered over the plains and lower hills, particularly in the vicinity of the Garden of the Gods. A few specimens occurred at Denver, August 18; others at Colorado Springs, and later at Bijou. Each hill west of Colorado Springs seemed to afford a variety peculiar to itself, but the whole series taken together exhibited such minute gradations that there was no reason to regard the extremes as distinct species. These variations are shown in the proportions of the thorax and elytra of the specimens, in the amount and prominence of their sculpture, and in the shape of their outline. No specimens occurred in the valley of the Arkansas, nor near its cañon.

Asida sordida Le C.

Met with only in the vicinity of Denver, August 18.

Asida elata Le C.

One specimen taken running among the grass in the evening, near Colorado Springs, August 16, and another from the vicinity of Cañon City, August 11.

Eusattus reticulatus Say.

Taken in considerable numbers on a dark sandy spot on the banks of the Arkansas River west of Cañon City, August 11. Some of them were snugly stowed away behind the loose bark around the base of a cottonwood tree, others were in the sand in holes or beneath chips, and still others were upon or around the roots of a species of *Euphorbia* growing abundantly at that spot. I could not find them in any other locality, although I searched carefully in many such places as seemed to be promising for their appearance. They hide during the bright part of the day, but run about with great activity upon the approach of evening twilight.

Eleodes tricostata Say.

This species was quite common upon the plains in the region near and west of Colorado Springs, August 10 to 16. No specimens occurred to me in any other locality. They were generally found beneath rubbish in the ground, or hid away around the roots of yuccas and other plants.

Eleodes hispilabris Say.

Not rare, but widely scattered. A large number of specimens might have been secured by searching over a large extent of surface, but it was quite rare to find more than two specimens at a single spot. It was met with at all points on the plains, from Colorado Springs to Cañon City, August 10 to 16.

Eleodes obsoleta Say.

Common on the plains, beneath cow-chips and rubbish, everywhere from Denver to Colorado Springs. I did not find it abundant south of the latter place, and it was only rarely to be seen in the vicinity of Cañon City. Found August 16 to 18.

Eleodes suturalis Say.

Met with only at Denver, August 8. But most likely the season was too far advanced for it to be found elsewhere and in the usual numbers.

Eleodes extricata Say.

Quite common beneath rubbish in the vicinity of Colorado Springs, August 13 to 16; but I failed to find a specimen of it north of this region.

Eleodes nigrina Le C.

Occurred sparingly beneath chips and rubbish in Manitou Park, August 14, but was not seen in any other locality.

Embaphion muricatum Say.

This monstrous-looking insect was found rarely, and only on the hillside near Colorado Springs, August 16.

Fam. MORDELLIDÆ.

Mordellistena arida Le C.

Common on various flowers growing near the mouth of the Cañon of the Arkansas, August 10.

Other small species were found at various points on the plains, most of them being of a black color, marked with sericeous pubescence.

No specimens of the larger forms, such as *Mordella* and *Rhipiphorus*, were found, although localities favorable to their appearance were frequently met with.

Fam. MELOIDÆ.

Epicauta ferruginea Say.

Very abundant upon the plains and in some places in Clear Creek Cañon, settling in the heads of many kinds of flowers, but especially in the various kinds of sunflowers, August 4 to 18. It was not only to be found upon the plains, but was far from uncommon in the parks of the mountains, as at Manitou Park and elsewhere, wherever sunflowers and golden-rod were in bloom.

Epicauta pensylvanica De G.

Occurred only at Bijou, chiefly on the flowers of a golden-rod, August 19.

Pyrota engelmanni Le C.

Common at Bijou, August 19, on the flowers of golden-rod, etc. Not met with in any other locality.

Cantharis nuttalli Say.

A dead specimen was picked up in Manitou Park, the only one I was able to find during the whole course of my excursion.

Cantharis biguttata Le C.

On flowers at Colorado City and also near Cañon City, August 10 to 16. Not abundant.

Zonitis atripennis Say.

Abundant at Cañon City, but rare at Colorado Springs, and only a little more common at Bijou; on sunflowers, etc.

Zonitis bilineata Say.

Rare, and found only at Cañon City, on sunflowers.

Nemognatha immaculata Say.

Common at Cañon City and at Bijou, on sunflowers, etc., August 10 to 19.

Nemognatha lurida Le C.

Found only at Cañon City, in small numbers, on flowers.

Gnathium minimum Say.

This very interesting species occurred in considerable numbers upon the heads of sunflowers, near Cañon City, August 10 and 11. It often lay bent together and buried in the mass of stamens and pollen of these

flowers. As its color agreed well with those organs, it was generally well concealed from view. It was not met with in any other locality.

Several minute forms of *Curculionidæ* were swept from various plants and flowers in the valley of the Arkansas, near Colorado Springs, and at Denver, but a larger number of specimens of them will have to be collected before the species can be determined with precision.

DIPTERA.*

Fam. TIPULIDÆ.

Dicranomyia longipennis Loew.

West of Denver, August 5.

Symplecta punctipennis St. Farg.

Observed on the plains near Denver, August 5 and later.

Ptychoptera lenis O. S.

Occurs in Clear Creek Cañon and in Beaver Brook Gulch, August 6.

Bittacomorpha clavipes Fab.

A few specimens were observed in the suburbs of Denver, flying over marshy patches of ground.

Pachyrrhina ferruginea Fab.

Captured on the plains, near Denver, August 8.

Fam. STRATIOMYIDÆ.

Nemotelus canadensis Loew.

Moderately common in the vicinity of Colorado Springs, and also in Manitou Park, August 10 and later.

Chloromyia viridis O. S.

Common in the vicinity of Denver, and also at Colorado Springs.

Odontomyia nigrirostris Loew.

Very common on sunflowers, on the heads of which they lodge and remain for hours. Colorado Springs and Denver, August 8 to 18.

Odontomyia binotata Loew.

This very beautiful species occurred at Colorado Springs August 17. It was the rarest of them all.

Two other species of *Odontomyia* were captured in the vicinity of Colorado Springs, but I am unable to cite their specific names.

All of these species were most abundant near Colorado Springs, and only one specimen of *O. nigrirostris* was found in Manitou Park.

*Kindly determined for me by Baron C. R. von Osten Sacken.

Fam. TABANIDÆ.

Pangonia incisiva Wied.—*Pangonia incisuralis* Say.

Occurred at Colorado Springs, flying over the heads of sunflower, but not common, August 17.

Chrysops fulvaster O. S.

Common in the western suburbs of Denver, among the willow trees, August 5; one specimen was captured in the pine woods on the side of the mountain adjoining Clear Creek Cañon, August 7. They have the same vicious propensities common to our species of the Atlantic region, in flying upon the unprotected face or hands of human beings, and quickly inflicting a wound, which smarts keenly.

Fam. BOMBYLIDÆ.

Exoprosopa decora Loew.

Occurs on the plains near Denver City, August 5 and later.

Exoprosopa dorcadion O. S.

This beautiful species was moderately common on the low hills west of Denver, August 8 to 18. One specimen was also found at Cañon City.

Many of the specimens of this and other *Diptera* were more or less denuded of their fur by the driving winds, loaded with fine sand, which preceded the rain-storms. Sometimes after the showers, these and other hairy insects were found lying on the ground near plants soaked with wet, and with scarcely a hair or scale of the upper surface remaining. At Cañon City, the winds, loaded with fine sand, were more intolerable than at any other place that I visited; and at that point I saw many insects destroyed and denuded by their agency. No doubt, these sand blasts lend their influence in determining the various shapes of many of the sandstone pillars with which the plains and highlands of Colorado are studded near the mountains and in the parks.

Exoprosopa titubans O. S.

In the suburbs of the city of Denver, lodging upon bare sandy spots in the midst of the patches of flowers and weeds, August 5 to 8.

Exoprosopa dodians O. S.

Two specimens, one from Manitou and the other from the hill-side near Colorado Springs, August 13 to 16.

These very attractive insects were seen at almost every locality on the plains and foot-hills, and also in Clear Creek Cañon. They balance over the bare sandy spots in the bright sunshine, and then dash suddenly and settle upon the ground with their wings fully expanded. Doubtless many other species and varieties might have been captured if my time could have been so employed.

Dipaltà serpentina O. S.

I met with it only in Clear Creek, where but a few specimens were seen flying near the road and lodging upon the rocks, August 6 and 7.

Anthrax sinuosa Wied.

Rather common in Clear Creek Cañon and Beaver Brook Gulch, August 6 and 7, but not seen in any other locality. At Denver it was replaced by another species, and at Colorado Springs and farther south still other species occurred.

Anthrax halcyon Say.

Not rare at Colorado Springs and Manitou, August 12 to 16.

Anthrax allied to *alternata* Say.

Rare in Clear Creek Cañon, August 6. A closely related, if not identical, species was common in the suburbs and vicinity of Denver, but only one dwarf specimen reached home in good condition.

Anthrax sp.

Other species were found at Colorado Springs, and one or perhaps two others were common on the highlands near and west of Denver.

Thereva sp.

Found in moderate abundance in the valley of the Arkansas near Cañon City, August 10 and 11.

Systæchus vulgaris Loew.

Extremely common on the plains from Denver to Colorado Springs, August 5 to 18; but no specimens occurred at Cañon City. It balances itself above the flowers and plants in sunny spots, and flits from place to place over short distances with such rapidity that the eye can scarcely trace its flight. It is admirably protected by the yellow flowers upon which it sometimes alights.

Lordotus gibbus Loew.

This exquisite species was rare. One specimen was captured in the act of settling on a sunflower at Colorado Springs, August 17, and another at Denver, August 18.

Sparnopolius coloradensis Grote.

One specimen from near Colorado Springs.

Phthiria sulphurea Loew.

Not uncommon in the vicinity of Colorado Springs.

Fam. ASILIDÆ.

Asilus sp.

A very large species is common on the low hills west of Denver, August 8 to 18. It and two other kinds of somewhat smaller size were seen seizing the different species of *Calopteni*, and destroying them. At Colorado Springs, one of this group was very useful in killing *Caloptenus spretus*, and, in the valley of the Arkansas, the same fact was observed on several occasions.

Species of *Mallophora*, *Stenopogon*, *Scleropogon*, *Machimus*, *Erar*, and *Diognites* were found commonly on many parts of the plains and foot-

hills, and less numerous in the cañons of the mountains. The species and forms of this group must be very numerous in Colorado, and every large locality seems to have one or more local forms.

Stenopogon allied to *trifasciatus* Say occurs in numbers on damp sands near the Arkansas River, and also in Denver, near the South Platte and its affluents.

Ospricerus cæcus Wied.

This beautiful species, so strongly resembling a *Midas*, was found near Colorado Springs and in the vicinity of Cañon City, August 11 to 16.

Fam. DOLICHOPODIDÆ.

Dolichopus sp.

This vivid green insect was very common on the weeds of damp spots in the suburbs of Denver.

Fam. SYRPHIDÆ.

Eupeodes volucris O. S.

A few specimens were taken by me at Denver and in Clear Creek Cañon, but, to my surprise, it was not met with in any other locality that I visited, August 6 to 8.

Eristalis stipator O. S.

Found singly upon the white flowers of a low plant growing in the meadow at Manitou Park, Colorado, August 14.

Syritta pipiens Linn.

Somewhat common at Denver and in Clear Creek Cañon, August 6 to 18, and less common near Colorado Springs.

Fam. TRYPETIDÆ.

Trypeta sparsa Loew.

Found in Manitou Park in very small numbers, August 14.

Trypeta alba Loew.

Common near Cañon City, August 11.

Trypeta humilis Loew.

Moderately common at Denver, August 8 and later.

Trypeta (Edicarena) persuasa O. S.

Two specimens obtained by sweeping the weeds in the valley of the Arkansas, near Cañon City, August 11. It has the same markings as seen on the wings of a group of this genus belonging to Central America, Cuba, Hayti, and Mexico, but is no doubt distinct from the species thus far described.

Trypeta sp.

Allied to *T. solaris* Loew. The specimens were taken in the vicinity of Colorado Springs.

Trypeta sp.

Allied to *T. palposa* Loew. Common at the same place as the preceding species.

Trypeta sp.

Allied to *T. aqualis* Loew. Common in the region around Cañon City, August 11.

Fam. CONOPIDÆ.

Several forms of genera, some of them new, were collected on the plains near Denver, at Colorado Springs, and at Cañon City, but their names cannot now be determined.

Fam. MUSCIDÆ.

Sarcophaga sp.

Two species were common in the region adjacent to Colorado Springs and Manitou at the time when the *Caloptenus spretus* was swarming. Both of them attacked the grasshoppers and laid eggs upon them.

Sepedon fumipennis Loew.

Very common at Denver and Colorado Springs upon plants in damp situations.

Sepedon armipes Loew.

Common in the same localities as the preceding.

Meromyza americana Fitch.

This was a very common species upon weeds in damp places near Denver, August 5 to 18.

Calobata, *Dexia*, *Miltogramma*, and *Anthomyia* of different species were found in many localities, but the species are as yet unknown to me.

HYMENOPTERA.*

Apis fasciata Lat.

A few specimens occurred on the flowers of *Malva* and on some other low plants at Cañon City, August 11.

Bombus ternarius Say.

One specimen from Beaver Brook Gulch, August 6.

Melissodes texana Cresson.

Common at Colorado Springs, August 17.

Melissodes pennsylvanica St. Farg.

Not rare near Cañon City, August 11.

Melissodes mennacus Cresson.

A few specimens were taken at Cañon City, August 11.

Melissodes new sp.

A few species occurred to me in Manitou Park, August 14. No specimens were found at any other point.

* The species of this order were kindly determined for me by Mr. E. T. Cresson.

Megachile coloradensis Cresson.

Not rare at Colorado City, August 13.

Megachile inimica Cresson.

Moderately common in the vicinity of Denver, August 5 to 9.

Megachile new sp.

A few specimens only were captured in Clear Creek Cañon, August 6.

Megachile new sp.

Three new species were found near Colorado Springs, on the flowers of the plains, August 13 and later.

Cœlioxys editha Cresson.

Not rare in the region around Colorado Springs, August 13 and later.

Anthidium zebratus Cresson.

Moderately common near Colorado Springs.

Anthidium occidentale Cresson.

Found in the same place as the preceding. Generally captured while flying upon the heads of sunflowers and other kinds of flowers.

Anthidium maculifrons Smith.

This very neat insect was found upon the flowers of *Euphorbia* in the western suburbs of Denver. It was not abundant, but seemed rather tame and easy to capture, August 8.

Panurgus new sp.

Common on the white flowers of *Euphorbia*, in and near Denver, August 5 and later.

Panurgus new sp.

Two other new species were common on flowers in the region around Colorado Springs, August 13.

Panurgus new sp.

Common on a narrow-leaved *Euphorbia* in the vicinity of Cañon City, August 10 and 11.

Panurgus æthiops Cresson.

Not rare in the western suburbs of Denver, August 5 to 13. On the heads of several kinds of flowers.

Nomada new sp.

Two new species of this genus were common on flowers in the vicinity of Colorado Springs.

Epeolus new sp.

Found near Colorado Springs, August 17. Only a few specimens seen.

Sphecodes new sp.

Common near Cañon City, August 11.

Calliopsis new sp.

A few specimens were obtained both at Cañon City and at Colorado Springs, August 11 to 17.

Agapostemon tricolor St. Farg.

Not rare in the vicinity of Colorado Springs, August 13 to 17.

Agapostemon new sp.

A few specimens were taken near the foot-hills west of Colorado Springs, August 13.

Andrena polygama Davis.

Two specimens captured at Manitou, August 13.

Halictus new sp.

Not rare in the valley of the Arkansas west of Cañon City, August 11.

Colletes consors Cresson (?).

A few specimens occurred at Cañon City on flowers, August 11.

Fam. VESPIDÆ.

Polistes aurifer Sauss.

An exceedingly abundant species on various kinds of flowers, such as *Polanisia* and golden-rod, in the vicinity of Denver, in Beaver Brook Gulch, and in Clear Creek Cañon, early in August.

Eumenes occidentalis Cresson.

Moderately common in Beaver Brook Gulch and in Clear Creek Cañon, August 6.

Odynerus new sp.

Common in the vicinity of Colorado Springs, August 13 and later.

Polybia flavitarsis Sauss.

A few specimens were flying around flowers in Beaver Brook Gulch and in Clear Creek Cañon, August 6 and 7.

Fam. CRABRONIDÆ.

Cerceris new sp.

Moderately common in Clear Creek Cañon, August 7.

Eucerceris fulvipes Cresson.

Many specimens seen and a few captured in the vicinity of Colorado Springs, August 13 and later.

Philanthus laticinctus Cresson.

A few specimens were taken in the valley of the Arkansas, near Cañon City, August 11.

Philanthus new sp.

Not uncommon on the heads of *Polanisia* and other flowers in the western suburbs of Denver, August 8 and later.

Thyreopus coloradensis Pack.

Moderately scarce in Clear Creek Cañon, August 7.

Fam. NYSSONIDÆ.

Gorytes montanus Cresson.

Found in small numbers west of Colorado Springs, August 13.

Fam. BEMBECIDÆ.

Monedula fasciata Fab.

Extremely abundant on the sandy banks of a small stream in South-western Denver, August 5 and later. They had penetrated the ground in a few places, giving the surface the appearance of having been riddled with large shot.

Fam. SPHEGIDÆ.

Ammophila pruinosa Cresson.

Common on the plains in and near Denver, August 5 and later. This interesting species was most common in localities between the rankly growing flowers and weeds. Having thus a ready means to hide, it was rather difficult to detect.

Ammophila macra Cresson.

Not very common. Occurring in Clear Creek Cañon, and also in Beaver Brook Gulch, August 6 and 7. It is fond of alighting upon the flowers of golden-rod, and of embedding itself in the abundant pollen.

Priononyx atrata St. Farg.

Moderately common on flowers in the region of Colorado Springs, August 13 and later.

Priononyx thomæ Fab.

Found on the high grounds west of Denver, but not very common, August 18.

Pelopæus cementarius Dr.

A few specimens seen, and one captured in the street of Colorado City, August 17. I did not find any of the mud cells, but doubtless they were at hand in some of the wooden sheds or houses near. Some of them were nervously jerking themselves about on the surface of the damp soil near the Fountain Creek, but I did not actually observe them in the act of making the usual mud pellets.

Fam. POMPILIDÆ.

Pompilus athiops Cresson.

Moderately common on the plains west of Colorado Springs, August 16. It struck me as remarkable that I did not find this common-looking form in other localities.

Pompilus formosus Say.

Several specimens of this very large and conspicuous wasp were found on the hill-side west of Cañon City, and two others were flying actively over and around the tall weeds and flowers in the mouth of the Grand

Cañon of the Arkansas, August 11. No specimens occurred to me in the region north of the Arkansas River; but in that valley it was to be seen singly in various places, from Pueblo westward to near the mountains.

Priocnemis flammipennis Smith.

Found singly on the highlands west of Denver, August 18.

Fam. SCOLIADÆ.

Tiphia albilabris St. Farg.

Seen in small numbers on flowers in the vicinity of Colorado Springs, August 13 and later.

Myzine hyalina Cresson.

This very slender relation of our eastern species was quite common on the flowers of golden-rod, in Clear Creek Cañon and in Beaver Brook Gulch, August 6 and 7. Two or three specimens were to be seen on each head of flowers, and they were enjoying themselves in the bright, hot sunshine by meandering through the florets and dusting their bodies with a good coating of the yellow pollen. Only males were seen.

Fam. MUTILLIDÆ.

Mutilla bioculata Cresson.

Common in and near the mouth of the Cañon of the Arkansas, August 10 and 11.

Mutilla occidentalis Drury.

One female of this large red species was found among the stones on sandy ground in the valley of the Arkansas east of Cañon City, August 10.

Fam. FORMICIDÆ.

Formica rufa Linn.

The neuters and females of my specimens correspond so closely with the descriptions and figures of *F. rufa* Linn., that I am impelled to refer them to that species. They abound on the plains in certain localities, extending all the way from near Denver to just a little distance from the valley of the Arkansas. It is the hillock-building species of the plains adjacent to the mountains, and seems to belong to most sandy situations not strictly within the limits of the alkaline soils. A closely allied, if not identical, species undermines the soil on the south bank of the Arkansas River, just inside the mouth of the Grand Cañon, and there exists in countless multitudes.

Many other kinds of the genus *Formica*, *Myrmica*, and allied genera inhabit the plains and mountains of Colorado, but it is not possible for me to give a list of their names. The houses in Denver City and Colorado Springs are infested with swarms of minute *Myrmicas*, just as we have them on the Atlantic side of the continent. In two or three places, I found it difficult to secure my collections from their insinuating propensities.

Fam. CHRYSIDIDÆ.

Chrysis new sp.

This beautiful little green-blue species occurred in small numbers at Colorado Springs, August 13.

Fam. ICHNEUMONIDÆ.

Agathis vulgaris Cresson.

Common in the vicinity of Colorado Springs, and chiefly in places near water, where the plants grew dense and tall, August 13 and later.

Microdus new sp.

Occurring singly among the tall weeds in the vicinity of Cañon City, August 11.

Ophion purgatum Say.

Rare in the western suburbs of Denver, August 8.

Campoplex laticinctus Cresson.

Taken singly beyond Colorado Springs, near the Fountain Creek, August 16.

Nototrachys reticulata Cresson.

Two specimens from Colorado Springs, August 13.

Nototrachys new sp.

Taken at Cañon City, August 11. Only two specimens seen.

Cryptus americanus Cresson.

Seen in many places on the highlands west of Denver, and also at Bijou, August 18 and 19.

Cryptus tejonensis Cresson.

Two or three specimens seen flying in Clear Creek Cañon, but only one captured, August 6.

From the above list of names, with the localities of the species, it will be readily seen that a most interesting contribution to the history of modern high types of insect life might be made by a careful and full survey of the territory of Colorado east of the mountains. Every large area yields forms peculiar to itself, and, when these shall have been all brought together, it will be possible to entertain a more adequate idea of the limits of each. We may fairly expect to find separate faunal districts north and south of the *Divide*.

NEUROPTERA.

Fam. HEMEROBINA.

Hemerobius sp.

Two or three species of this genus were swept from bushes in the Clear Creek Cañon and in the Cañon of the Arkansas.

Polystæchotes punctatus Fab.

Found flying around the city-lamps in Denver, and about the lantern at Beaver Brook station, August 6 to 18.

Chrysopa sp.

One species was common in and near Denver, and a second at Colorado Springs. Both are small, and appear to belong to the group of *Ch. nigricornis* Burm.

Myrmeleon sp.

One species allied to *M. immaculatus* De Geer was swept from the tall grass and plants west of Denver, and a specimen of the same was captured near Golden, August 6 to 18.

Myrmeleon sp.

Another species resembling *M. salvus* Hagen was common on the plains near Denver, on the highlands west of that city, at Golden, at Colorado Springs, and on the hills near the Garden of the Gods, August 8 to 19.

Fam. PHRYGANIDÆ.

Phryganea sp.

A species similar to *P. interrupta* Say was swept from a bush overhanging Beaver Brook, not far from its entrance into Clear Creek Cañon, August 6. It was to be expected that these mountain streams would furnish many varieties of this family; but my most ardent labors in beating every bush and sweeping every plant along the banks did not yield adequate results.

Setodes sp.

A pretty little insect of this genus was captured near Colorado Springs and near the Cañon of the Arkansas.

Hydropsyche sp.

One or two species of this group were common in the valley of the Arkansas, near and in the cañon, August 11.

PSEUDONEUROPTERA.

Fam. LIBELLULIDÆ.

Diplax vicina Hagen.

Two or three specimens were taken in the western suburbs of Denver, and the species also occurs at Sloan's Lake, on the highlands beyond Denver, August 8 to 18.

Diplax semicineta Say.

Very common in the western suburbs of Denver, near a marshy spot resulting from the overflow of the creek which empties into the South Platte River. Some of the specimens had only a small faint cloud of the brownish-yellow color upon the wings; while in others the deep color was quite distinct from the base to beyond the middle. A similar disparity was also observed in the size of specimens; the smallest being fully one-fourth less in expanse of wings than the largest. August 5 and later.

Diplax rubicundula Say.

Quite common in the suburbs of Kansas City, and at many points along the railroad leading through Kansas to Denver.

Mesothemis corrupta Hagen.

Moderately common near pools and streams on the plains in and beyond Denver, August 5 and 8. It seemed to have disappeared by the 18th of the month, as I then failed to see it in the same or similar localities.

Mesothemis longipennis Burm.

Observed in many places in Kansas, and one specimen seen in the valley of the Arkansas, near Pueblo.

Libellula pulchella Drury.

One specimen observed in the suburbs of Denver, August 5. It kept out of the reach of my net, and I was unable to secure it, although it flew sometimes within three or four feet of the point where I stood.

Libellula luctuosa Burm.

This species was very common all along the railroad through Kansas; but no specimens were to be seen at a distance from the streams and pools of water on the plains of Colorado.

Libellula forensis Hagen.

One specimen of this fine insect was met with on the road leading from Denver to Golden, and at a distance of about six miles from the former city. I obtained a full view of it, but could not get near enough to capture it.

Cordulia sp.

One, if not more, of the brilliant green species of *Cordulina* was seen in localities near the South Platte River; but none were in places where I could capture them. A similar insect was seen near buffalo-pools at several of the stopping-places along the line of the Kansas Pacific Railroad, within the limits of Colorado.

Æschna constricta Say.

Observed in many places in Kansas and Colorado, along the line of the Kansas Pacific Railroad, generally flying over pools of water. In Clear Creek Cañon, it was seen at intervals of every few rods flying over the creek or lodging on the rocks of the open spaces and around the openings of the gulches, August 6.

Æschna sp.

A larger species than the preceding was flying about near the mouth of Clear Creek Cañon, but it was beyond the reach of my net.

Anax junius Drury.

Very common along the Kansas Pacific Railroad, through Kansas and into Colorado. It was always seen on the wing, flying over the railroad ditches or pools.

Ophiogomphus severus Hagen.

Occurred singly, flying actively over Clear Creek in the cañon, or in Beaver Brook Gulch, August 6 and 7. It was seen at many intervals along the latter brook, even up toward the high levels, nearly 8,000 feet above the sea. Its color when living is a clear pea-green, with dark purplish-brown markings on the thorax and abdomen. The stripes of the legs are fuscous. Like many others of this group, it flies rapidly backward and forward for the distance of a few yards over the running water, and then lodges for a moment on a rock or projecting bush. Being very wary, it is quite difficult to capture.

Agrion hastatum Say.

A few specimens were captured in the western suburbs of Denver August 5.

Agrion saucium Burm.

One female taken at the same place.

Agrion civile Hagen.

A few specimens were seen on the highlands west of Denver, in the vicinity of Sloan's Lake, August 8 and 18.

Agrion sp.

A species closely allied to, if not identical with, *A. doubledayi* Selys, was very common around damp spots in the western suburbs of Denver, August 18.

Fam. PERLIDÆ.

Perla sp.

A small species was found upon tall weeds and plants in the mouth of the Grand Cañon of the Arkansas, August 10.

Chloroperla sp.

A beautiful little green species occurred at the same place as the preceding.

Fam. EPHEMERIDÆ.

Baetis sp.

One small species was common in Clear Creek Cañon, and two or more smaller species were abundant near the cañon of the Arkansas.

Fam. TERMITIDÆ.

Termes sp.

An insect closely related to *T. flavipes* Hagen, and of about the same size, was common under stones near Colorado Springs, and beneath chips and logs west of Cañon City, August 10 to 16.

ORTHOPTERA.

Fam. MANTIDÆ.

Mantis sp.

The nymph of a narrow, small species was found stowed away at the base of a yucca on the hill-side near Colorado Springs. It had taken refuge there from the heavy storm in company with other insects. A smaller specimen was swept from a sunflower at the same place.

Fam. GRYLLIDÆ.

Gryllus sp.

The larva of a black cricket was taken beneath stones and rubbish near Colorado Springs. A similar form occurred near Denver and in the entrance to the Grand Cañon of the Arkansas. Only one adult specimen was met with anywhere, and the young specimens were not common in either of the above-mentioned places.

Æcanthus niveus Serv.

One specimen was seen at Denver; but the species was comparatively common around Colorado City and in the valley of the Arkansas River.

Fam. LOCUSTIDÆ.

Ceuthophilus sp.

A form closely related to *C. maculatus* Harris was found beneath a decaying pine log and chips high up the mountain-side, beyond Beaver Brook, August 7. Young specimens of a similar species were detected beneath stones on the hill-side near Colorado Springs.

Phylloptera sp.

The young nymphs of this genus were not uncommon among the grape-vines and rank weeds in the valley of the Arkansas and near Colorado City.

Orchelimum sp.

A fine large species occurred among the grass and weeds in the valley of the Arkansas River, a mile or more east of Cañon City.

Xiphidium sp.

A species similar to *X. fasciatum* Serv. was common in Beaver Brook Gulch, also in Denver and beyond that city, on the farms, and in the entrance to the Grand Cañon of the Arkansas.

Fam. ACRIDIDÆ.

Stenobothrus lætus new sp.

Ground-color above bright apple-green, including the upper part of the face; cheeks and labrum paler green, or tinged with rosy-testaceous. Antennæ longer than the head and prothorax united, dusky greenish, paler at base, flattened, tapering at tip. Wing-covers deeper green, narrow, the costal margin curved, a little expanded beyond the base; the discoidal area wide, having numerous quadrate areoles, and with about four black spots, the two intermediate of which are round and larger; costal and cubital fields dusky, the second with a series of about four irregular black dots; posterior field brown, with the bases of the thick veins black and the margin green. Head thick, convex on the sides, the sutures between the genæ and front black, and a triangular black spot behind each eye; the margins of the fastigium brown, and the ridge above the eye fuscous. Face oblique, but curved, the vertex

higher above the eyes than before or behind, lowest behind; fastigium of medium width, forming an equilateral triangle with the tip blunted; facial ridge narrow above, tapering toward the fastigium, sulcated from thence to below the middle, expanding toward the epistoma. Lateral foveolæ substituted by a flat, sunken continuation of the eye-sockets; above each eye is a lunate fovea, bounded exteriorly by a thickened, prominent margin. Prothorax curvedly contracted each side, the central carina distinct and prominent, the lateral ones arcuated and less distinct; all three embrowned, and exterior to the latter is a broad, black stripe expanded posteriorly; disk of the side-flaps with two or three cuneiform black marks, the middle ones placed on indented lines. Abdomen greenish-testaceous, with a dorsal row of small black spots, a row of somewhat larger ones each side, and with a series of still larger, cuneiform, transverse ones above the longitudinal sutures; the superior terminal segment submarginued with black, and with a median black stripe. Anterior femora infuscated at tip superiorly; middle ones with two or three patches of fuscous dots on the upper sides, and posterior ones greenish, with three fuscous clouds on the inner face, the upper edge, an oblique band, and a cloud at each end of the outer face; the knees black; the tibiæ bright red and with yellow spines, which are widely terminated with black. Wing-covers a very little shorter than the body. ♂.

Length to tip of genital segments 15^{mm}; of antennæ 8^{mm}; of tegmina 9^{mm}; of hind femora 10^{mm}.

Occurring singly on bare sandy spots between Cañon City and the mouth of the Grand Cañon of the Arkansas. The colors decidedly change after death, some of the more delicate green parts becoming dull testaceous or pale brownish-yellow.

Stenobothrus sp.

Closely allied to *S. maculipennis* Scudder, and perhaps the same species; but I have no specimens now at hand to enable me to make a comparison. Not rare in the vicinity of Cañon City, August 11.

Stenobothrus sp.

Having somewhat the appearance of *S. curtipennis* Scud., but with arcuated lateral carinæ, and with tegmina nearly as long as the body. Common in Manitou Park, August 14.

Stenobothrus sp.

Allied to the preceding, but differing in details of marking. Colorado Springs, on the hill-sides west of the city, August 16.

Stenobothrus sp.

Same group as the foregoing two species, but more robust, and with shorter antennæ. Found on August 6 in Beaver Brook Gulch. Not common there.

Acrolophita hirtipes Say.

Inhabits the hilly country west of Colorado Springs. It was only found singly, and at remote intervals, in places where the grass was moderately thick and tall, August 16.

Tropidolophus formosus Say.

On the plains, in the tall grass, near Bijou, August 19. It was seen only one at a time, and at remote intervals, a few rods from the Bijou Creek.

Ædipoda carolina Linn.

Extends across the continent, from the Atlantic coast to the foot-hills near the Rocky Mountains. It was not frequently seen on the great treeless plains, except near the water-courses, or where vegetation was luxuriant. At Denver, and all along the railroad as far as Cañon City, it was often to be seen flying in the air. Near Colorado Springs, it was common everywhere, and a single specimen was seen in the entrance to Clear Creek Cañon.

Ædipoda carlingiana Thomas.

The black base of the wings of this species makes it quite conspicuous when flying. It is very wild, and found singly in the vicinity of Colorado Springs, August 16.

Arphia carinata Scudder.

Found singly at Colorado Springs, and westward to the Garden of the Gods, August 12 to 16. It occurs in single specimens at remote intervals.

Trimerotropis aequalis Say.

Common in most parts of Eastern Colorado, on the plains and foot-hills, as also in Clear Creek Cañon, and in the gulches near Manitou, August 6 to 18.

Psinidia eucerata Harris.

Exceedingly common south of Colorado City and in the vicinity of Cañon City. It is variable in colors and markings, just as we find it to be in Maryland and New Jersey. Specimens found on the white sands are very pale-colored, almost white, with wings varying from pale yellow to pale red-lead. Those of the dark soils and loams are dark-colored, fuscous or grayish brown, with darker mottlings on the tegmina, and with deep-red wings. August 10 to 17.

Near the cañon of the Arkansas, an allied species occurred, with more prominent eyes and somewhat shorter antennæ, but having the same peculiarities of coloring as the preceding. It is probably undescribed.

Circotettix undulata Thomas.

Somewhat uncommon at Colorado Springs and near Cañon City, August 10 to 17.

Hadrotettix trifasciata Say.

Very common in many places near Colorado Springs, in the valley of the Arkansas, from Pueblo as far west as to the mouth of the Grand Cañon, but not in it; also at Bijou, August 19. Around Cañon City it is extremely variable and very beautiful. On the pale sands at that place it is sometimes of a rosy yellowish, with narrow and very conspicuous brown bands on the wing-covers, while on the wet and dark soils it is pale fuscous, with dark fuscous markings. The face and sides of the prothorax inferiorly are sometimes white, occasionally bright ochreous, or dull dark gray.

Tomonotus tenebrosus Scudder.

A few specimens were seen between Cañon City and the mountains, August 11.

Dissosteira longipennis Scudder.

Found in the region west of Colorado Springs, but in very few individuals. The purplish-black color of the wings is very showy in the bright sunlight, and more brilliant than in the other species, which have a dark base to their wings. August 12 to 16.

Hesperotettix viridis Thomas.

This exquisitely beautiful little Acridioid occurred in Beaver Brook Gulch and near the mouth of the Grand Cañon of the Arkansas. It is also not uncommon in the cranberry-fields of Atlantic County, New Jersey. August 6 to 11.

When living, the stripes of the prothorax, the costal area of the tegmina, and the stripes and clouds upon the femora are of a coral red color, exceedingly clear and vivid. Varieties occur which are destitute of the red, and which have a very pale green line along the middle of the prothorax.

Specimens from Texas and Mexico have also passed through my hands.

Dactylotum bicolor Charp.—*Pezotettix picta* Thomas.

Large numbers of specimens of this most beautiful of all the *Calopteni* have passed through my hands. They were from Mexico, Texas, New Mexico, Arizona, Indian Territory, and Kansas. Specimens from Mexico were of both patterns of color, either with the bright red spots and bands between the greenish-black bands, or with the red color absent and replaced by yellow or greenish-yellow. The latter is the color figured by Charpentier, and is only a condition of the other. On the plains west of Colorado Springs I found great numbers of them in the tall grass, and in the damper situations they were of both styles in the same places. At Colorado Springs, they are chiefly of the red color, and only rarely did I meet with a pale one. There are no structural differences to separate the two varieties. It seems to me that the pale color is only a condition of the brighter-colored one, and that if we kept them under favorable conditions they would all remain dull-colored. At least, this was the case with some specimens of *Brachystola magna* which I kept for a

few days in a box at the hotel in Colorado Springs, and similar to my experience with *Phrynosoma cornutum*, kept in like manner. Two individuals of the latter, taken on the red soil near Manitou, were rust-red, but upon keeping them in a box of gray sand they became pale, and never returned to their original color.

Caloptenus bivittatus Say.

Common near Colorado Springs and in the valley of the Arkansas.

Caloptenus spretus Thomas.

Eastern Colorado, in many places; Denver, Clear Creek Cañon, Colorado Springs, Cañon City, and near Pueblo. Quite variable in color and structure.

Pezotettix dodgei Thomas.

On the mountain-sides in Clear Creek Cañon, August 6.

Brachystola magna Scudder.

Very common west of Colorado Springs, and near Manitou, and at Bijou, August 12 to 19. Both styles of color occurred together, and sometimes both were united sexually. They vary very much in length and thickness.

Batrachidea sp.

Common at Denver and near Cañon City, August 5 to 11.

The *Orthoptera* enumerated here are, I am sure, but a tithe of the great catalogue of forms which are distributed throughout the plains and mountains of Colorado. Wherever vegetation was growing, the numbers of kinds set in motion by the sweeping of my net filled me with surprise. My time was too limited to permit me to secure them, and a rich harvest in this field may yet be secured by the industrious collector who remains long enough in that interesting country.

A P P E N D I X .

BY A. R. GROTE.

A collection made by Mr. Uhler has been submitted to me containing the following species :—

Mamestra discalis n. s.

Allied to the eastern *Mamestra nimbose*, of the same gray color and large size. It differs by the space between the stigmata being clouded with black, and by the reniform being wider inferiorly, much indented, and narrower superiorly. The transverse posterior line is dentate and not very distinct. The color is more purely bluish-gray, and the insect looks in this respect more like the European *nebulosa*, but also differs by the above characters. Claviform spot outlined in black. Hind wings clear fuscous-gray, pale, with terminal black broken line, beneath whitish, with faint median line, discal mark, and a distinct black terminal line. On primaries, above, the black terminal points are smaller, more cuneiform than in *nebulosa*.

Length of primary 25^{mm}. One specimen. Clear Creek Cañon.

Mamestra olivacea Morr., var.

A single specimen with the median space black, abdomen blackish, hind wings fuscous, from Beaver Brook. Though darker, it is evidently the same species as specimens sent me from Vancouver Island under the No. 5579, and that I cannot separate except by their darker color from eastern examples of *olivacea*.

Mamestra sp.

A single specimen from Clear Creek Cañon indicates a species distinct from *illaudabilis* Grote. Owing to the difficulty of the group, I am dissuaded from drawing up a description on this material.

Mamestra (Dianthæcia) meditata Grote.

Two specimens, Colorado Springs.

Hadena arctica (Boisd.).

One specimen, Clear Creek Cañon.

Stibadium spumosum Grote.

One specimen, Bijou.

RHODODIPSA VOLUPTA (Fitch).

In *Rhodophora florida* Guen., the fore tibiæ are provided with an outer claw and two inner spines; the joint is also furnished with

spinules. In *Rhododipsa*, the joint wants the spinules; there is an outer claw and two spines on the inside followed by a third paler colored and more slender, but nearly as long, much longer than the ordinary spinules. At the location of this third spine in *Rhodophora* is a spinule not noticeably longer than the rest, and not as long as one which follows the outer claw, and commences a series which is wanting in *Rhododipsa volupia*. The hind and middle tibiæ are armed. Eyes naked; palpi a little longer and less lengthily scaled than in *Rhodophora*. The lower half of the clypeus is shortly scaled. The specimen differs from Dr. Fitch's description in having the abdomen above ochre-yellow like the thorax, and the hind wings entirely crimson. The lines on the fore wings are also not pure "white", and are confusingly described by Dr. Fitch, who does not mention the pale and narrow terminal space. But I have no doubt of my determination of this species, which is smaller and more gaily colored than *florida*. One specimen. Colorado Spa.

Porrina sanguinea Geyer.

The fore tibiæ have an outer claw followed by two unequal slender spines; on the inside there is a series of four stout, rather short spines, of which the first two from the base of the joint are less thick. The middle and hind tibiæ are spinose, while there are no spinules on the fore tibiæ. The clypeus bulges and is mossily scaled. The eyes are naked. The palpi slender, oblique, less prominent than in allied genera and shortly scaled. The moth is whitish, with the basal and subterminal spaces dusty wine-color; the inner line arcuate; the median shade blackish, diffuse. The ovipositor is exerted. One specimen, Colorado Spa.

Euleucyptera cimatilis Grote.

The median lines vary in position in two specimens from Clear Creek Cañon. In another from Beaver Brook, the transverse posterior line is outwardly rounded opposite the cell, without the usual dentation at the middle.

Lygranthœcia jaguarina Guenée.

One specimen, Bijou.

Lygranthœcia packardi Grote.

Two specimens, Bijou. One from Colorado Spa has the secondaries suffused with black. In my "Check List of North American Noctuidæ", I have regarded *nobilis* and *mortua* as forms of this species, for which I have retained the above name, under which the usual form was described. I have as yet seen no larger material than that brought by Mr. James Ridings from Colorado, and a series is needed to decide whether my course in regard to *nobilis* and *mortua* is correct.

Grotella septempunctata Harvey.

One specimen, Manitou. This easily recognized species was originally described from Texas.

Bleptina caradrinalis Guenée.

One specimen, Clear Creek Cañon. The form in which the reniform is filled in with black.

Botis volupialis n. s.

Allied to *vinulenta*; of the same small size with the other species of the group *Rhodaria*. Vinous purple. Primaries with the median lines pale yellow, broad. Inner line dentate; outer line oblique, even, unbroken. Hind wings pale fuscous, subpellucid, with dusky borders. Beneath fuscous, slightly rosy, with darker borders and a yellow transverse line on primaries. The specific characters appear in the oblique, even, outer line, differing in shape from *vinulenta*, *diffissa*, etc. It is, though broad, much narrower than in *laticlavata* G. & R. One specimen, hills west of Denver.

Botis coloradensis G. & R.

One specimen, Colorado-Spa.

Zophodia dentata n. s.

Allied to the Texan *Zophodia bollii* Zeller, but much stouter, larger and darker-colored. Blackish-gray; the costal whitish shading inconspicuous. The inner line with a median tooth twice more prominent than in its ally. The line is obsoletely geminate, the inner line appearing to run across the mouth of the tooth. The discal mark is obliterate. Costa ashen. The outer line is fine, black, joining an apical black shade. The line is exceedingly deeply dentate, a succession of deep waves, and differs at once from the same line in *bollii* by this character. A series of black terminal points; fringes dark. Primaries blackish fuscous beneath. Secondaries whitish hyaline, with smoky border; beneath the costal edge is blackish. Legs and breast ashen; tarsi blackish. One fresh specimen, Clear Creek Cañon. Length of primary 22^{mm}. Wings wider than in its Texan congener.

The following species of *Eepantheria* was collected by Prof. F. H. Snow in Colorado:—

Eepantheria reducta n. s.

♀.—A small form of the size of *Spilosoma*, differing by the shorter palpi and closely scaled body-parts. Head white; orbits of eyes and palpi blackish. Thorax white; collar with two central black spots; tegulae with a basal smaller and outer larger black spot; disk with a central black line emanating from an anterior spot. Abdomen white, yellowish at the sides; and with the terminal segments blackish above; beneath with a series of brown spots; laterally with brown dots. Antennae white

above, blackish beneath. Legs brownish inwardly, white exteriorly; extremity of the tibiæ dotted with whitish. Fore wings white, crossed by five series of black spots, outwardly bent along the centre of the wing. A terminal series of irregularly sized spots. Hind wings white, subpellucid, with a faded brown discal mark and series of terminal marks discontinued inferiorly. Beneath the markings repeated in brownish; on fore wings the spots about the discal cross-vein are larger, and form the usual mark; on hind wings the costal marks are more evident. Expanse 43^{mm}. Prof. Glover has figured a moth from Southern California which I think is this species.

Tortrix sp.

Allied to *algidana*, but larger and stouter, with pale lemon-yellow fore wings and thorax. Primaries with an oblique, broad, abbreviated, brown bar beyond the middle, over the median nervules, and a brown spot on submedian interspace centrally. Hind wings fuscous. Beneath fore wings fuscous; hind wings yellow white. Abdomen whitish fuscous. Length of primary 13^{mm}.

Oncocnemis homogena n. s.

At first sight, this species recalls the species of *Homohadena*. Yellowish-gray. Median space narrow. Interior line thick, black, preceded by a yellowish stain; a trace of the claviform is seen in a thickening of the line at this point. Median space darker, more mixed with blackish scales. Orbicular, round, rather large, gray, with black annulus. Median shade inconspicuous. Reniform gray, of the usual kidney-shape, with black annulus, a little stained with yellowish. Exterior line pale, yellowish-gray, commencing on costa with a preceding black spot, as do the median shade and interior line. The t. p. line is exerted opposite the cell, obsoletely dentate. Subterminal line irregular broadly preceded by a blackish diffuse shade. A terminal black interrupted line; fringes grayish, cut by an indistinct dark line. Hind wings pale fuscous, with dark fuscous borders; beneath white, with discal dot, distinct fuscous borders and traces of a mesial line. Collar discolorous, pale brown, with a black line at base. Thorax fuscous-gray. Expanse of fore wing 17^{mm}. Manitou, Colo., August 19, Baron Osten Sacken (No. 7). A single specimen, in fine condition.

Arsilonche absidum Harvey.

Webber Lake, Cal., July 22 (Osten Sacken, No. 5).

Agrotis sierræ Harvey.

Webber Lake, Cal., July 22 (Osten Sacken, No. 3).

Plusia sackenii n. s.

This fine species belongs to the group with yellow hind wings. It may be quickly distinguished from either *divergens* or *alticola* by the course of

the t. p. line, which is widely inwardly angulated. Inner line with a bright golden costal patch; the line itself is rounded and gilded below median vein. Median space rich dark brown (like *ampla*) below the median vein; above grayish, washed with pinkish over the faintly outlined orbicular. Reniform narrow, upright, with a fine gilded interior annulus. Metallic mark pale golden, somewhat as in *U-aureum*, with an elongated detached spot beyond it. Exterior or t. p. line running inwardly to median vein, thence outwardly again to near internal angle, where it is followed by a rusty spot; the line is narrow, geminate, gilded inferiorly. Subterminal line denticulate; terminal space lighter gray than subterminal. Fringes dark, cut with paler. Hind wings yellow, with rather broad black borders, dusky at base, with narrow, faint, discal lunule. Beneath hind wings yellowish, with costa purplish, border repeated; fore wings obscure, washed with yellowish, with discal lunule and exterior line less angulated than on upper surface. Body fuscous with purplish hairs. Expanse 36^{mm}.

Idaho Springs, Colo., August 15, Baron Osten Sacken, to whom the species is dedicated. It is the most beautiful of its group.

The Lepidopterous material hitherto collected by the different Government surveys has proved of high scientific interest, It is therefore hoped that it will be found convenient to afford facilities to entomologists to accompany the expeditions, or to attach one or more permanently in employ.

ART. XXXII.—DESCRIPTION OF CAMBARUS COUESI, A NEW SPECIES OF CRAWFISH FROM DAKOTA.

BY THOS. H. STREETS, M. D., U. S. N.

A small collection of Crustacea made by Dr. Coues in Dakota in 1873 contains the following new species:—

CRUSTACEA MACRURA.

Family ASTACIDÆ.

CAMBARUS COUESI, *n. sp.*

Rostrum broad; twice as long as broad; deeply excavated above; margins nearly parallel, slightly converging anteriorly; sides grooved; anterior portion in advance of the lateral teeth much produced, narrow, longer than the transverse measurement at the base between the lateral teeth; point and lateral teeth acute, prominent; tips corneous. The ridge on the upper surface of the carapace at the base of the rostrum on either side sulcate; externally spine at the anterior extremity prominent. Carapace subcylindrical; superior surface smooth, punctate; sides roughly granular; lateral spine long, acute; a minute spine on anterior edge of the carapace below the termination of the lateral fissure; areola narrow widening posteriorly. External antennæ nearly as long as the body; spine externally on first and second basal articles, that on the second article small and acute; lamina longer than the rostrum, broad; apex spinous; a long, acute spine on the under surface of the basal article of the internal antennæ, situated above the middle on the inner edge, hooked forward. Epistome broader than long; apex truncated or concave; sides oblique; margin straight or sinuous. External maxillipeds hairy below and internally. Abdomen smooth, sparsely punctate slightly longer than the cephalo-thorax.

Anterior feet long and slender; hands long, punctate externally, smooth, and sparsely punctate internally, spiny tuberculate above; tubercles arranged in a double row; fingers long, slender, compressed, more than half the length of the hand, internally and externally punctate, smooth, externally grooved. Movable finger spiny tuberculate on the superior edge; cutting edges closely approximated, toothed, tips curved, and corneous; immovable finger bearded at the base of the cutting edge internally. Carpus longer than broad, sulcate above; a row of tubercles on the inner edge of the sulcus; a stout spine on the middle of the inner surface, a smaller one more posteriorly; two spines on the under surface; the spines all long and acute; two small, acute spines on the superior surface of the arm, just behind the anterior

margin; a double row of spines on the under surface; the anterior ones and those on the outer row are the largest, those on the inner row smaller and of a greater number.

Third pair of legs hooked. First pair of abdominal legs long, deeply bifid; external part longer, and tapering to an acute point; internal part broadly compressed.

Closely allied to *Cambarus virilis* Hagen, but presents the following points of difference, which were observed to hold good in all the twenty-two specimens collected from one locality when compared with twenty-three specimens of *C. virilis* from the Souris or Mouse River:—Body more cylindrical, less depressed; sides less inflated; in fact, the general appearance of the species, in all its parts, is more slender and less robust than *C. virilis*. Rostrum narrower, longer, more deeply excavated above; anterior portion of the rostrum in advance of the lateral teeth narrower and more produced, longer than its transverse measurement at the base. In *C. virilis* the anterior portion of the rostrum is not longer than broad at its base between lateral teeth. Point of the rostrum, lateral teeth, the spines on the ridge at the base of the rostrum, and those on the sides of the carapace, are long, acute, and more prominent than in *C. virilis*; in the latter, the spines in these situations, except on sides of carapace, are short and obtuse. Finally, the hands of the anterior pair are longer and more slender, and the internal part of the first abdominal legs is more broadly compressed.

Length of body 2.7 inches; external antennæ 2.4 inches; anterior pair of legs 2.1 inches.

Locality, Red River of the North. Obtained from the stomach of a Pelican shot in May, 1873, on the Red River near Pembina. The bird was sick and unable to fly; the Crawfish must, therefore, have been secured in this locality. Collected by Dr. Elliott Coues, U. S. A., then Surgeon and Naturalist of the United States Northern Boundary Survey, to whom the species is dedicated.

A second species of the same genus was also taken by Dr. Coues in Dakota:—

CAMBARUS VIRILIS, Hagen.

Cambarus virilis, Hagen, Illustr. Catal. Mus. Comp. Zoölogy, No. 3; Monograph of the North American Astacidæ, p. 63, pl. 1, figs. 23-23; pl. 2, figs. 128-132; pl. 3, fig. 155; pl. 8.

Locality, Souris or Mouse River, Dakota.

The following observations on the color of this Crawfish were furnished by Dr. Coues:—"In bed of stream among stones, in shallow water, very abundant. Carapace variegated with lighter and darker shades of brown: tail segment darker and more uniform brown, with large symmetrical dark brown spots, one on each side. Claws green, speckled with darker, with the protuberances yellow and reddish; other legs paler greenish. Below, including under side of the claws, greenish-white, the claws speckled with dark spots. Antennæ rich brown."

ART. XXXIII.—ON A CARNIVOROUS DINOSAURIAN FROM THE
DAKOTA BEDS OF COLORADO.

BY E. D. COPE.

The vertebrate fauna of the Dakota epoch of the regions west of the Mississippi having been heretofore unknown, it is satisfactory to be able to state that I have recently received, from a new locality, evidence of the existence of some colossal species of *Dinosauria* during this period. This is derived from a skeleton discovered near to the town of Canyon City, on the Arkansas River, near the point where the latter issues from the cañon through the Greenhorn Range of the Rocky Mountains.

At present, I only describe a portion of the right dentary bone, which supports eight teeth, and contains a cavity at the anterior extremity, from which one tooth was probably shed. The dentition is of the carnivorous type, and does not differ from that of the species of the genus *Laelaps*, to which have been referred numerous species from Cretaceous Nos. 5 and 6. The crowns exhibit the gradual modification of form in the succession from rear to front which I have already described in the *Laelaps incrassatus*.* There are subordinate characters exhibited by the present animal which show that it is quite distinct from any of the species heretofore known.

Five successional and two functional teeth exhibit crowns complete, or nearly so. The posterior exhibit a nearly straight posterior edge and an anterior one curved backward to a subacute erect apex. Both are denticulated, but the denticles of the anterior edge do not descend so near to the base of the crown as those of the posterior. The anterior series turns inward toward the base. The section of the crown is here (at the ninth tooth from before) not quite symmetrical, the internal face being the more convex near the apex. Soon the greater convexity of the outer side of the crown near the base becomes apparent, and as the inward curvature of the anterior denticulate edge increases, the convexity becomes more pronounced. On the second tooth, which is the first one preserved, the posterior edge is median; the anterior edge is on the inner side of a gently convex anterior face, which passes into the external face by an abrupt convexity. The long axis of the section of the crown does not connect the cutting edges, but passes from the posterior edge to the extero-anterior convexity mentioned, and parallel to the symphysis mandibuli. The enamel is smooth and with a fine silky luster. Two stages of succession are evident in these teeth. Successional crowns

* See Proceedings Academy Phila., January, 1877.

ART. XXXIV.—A CONTRIBUTION TO THE KNOWLEDGE OF THE
ICHTHYOLOGICAL FAUNA OF THE GREEN RIVER SHALES.

BY E. D. COPE.

The railroad-cut through the bluff on the west side of Green River, Wyoming, at Green River City, has been known for some years for the numerous fishes preserved in the shales through which it is excavated. An investigation into the ichthyology of this horizon and locality was undertaken by the writer, and a report published in the Annual Report of the United States Geological Survey of the Territories for 1870. Eight species of fishes were there described. Subsequently, in my expedition of 1872, I discovered a second locality, sixty miles north of the "Fish-cut", near the mouth of Labarge Creek, from which several species of fishes and insects were obtained. A third locality, nearer the main line of the Wasatch Mountains, has been more recently found, and a very fine collection of fishes procured and forwarded to me by my friend, H. Schoemaker. The specimens are mostly in a fine state of preservation, and are preserved on slabs of a calcareous shale, with leaves and insects. The mineral is of softer consistence than the slate of Green River, and thus permits of a more complete exposure of the bony structure of the fishes. In the following pages, sixteen species from this locality are described, all of which are new to science. Many of them are nearly allied to the species already known from the cut at Green River, belonging to the same genera, but none of them are identical. Three genera not previously represented in the fauna are added. General remarks follow the descriptions.

DAPEDOGLOSSUS TESTIS, Cope, *gen. et sp. nov.*

Char. gen.—Family *Osteoglossidae*. A single row of elongate acute teeth on the premaxillary, maxillary, and dentary bones; vomer, tongue, and (?) basihyal bones closely studded with short conic grinding teeth. Mouth rather short. Pectoral fin with the anterior ray elongated; dorsal fin not elongate, with the anal well separated from the caudal. No beards.

This interesting genus presents the characters of the family to which I refer it in its segmented scales, posterior dorsal fin, etc., and does not differ widely in essentials from *Osteoglossum*. The principal differences

between the two genera are the small mouth in *Dapedoglossus*, the absence of barbels, and the generally abbreviated form. From *Arapama*, it differs in proportions, and in the abundance of teeth on the bones of the roof and floor of the mouth. To this genus is no doubt to be referred the fish found in the Green River Shales which I called* *Osteoglossum encaustum*, so that the name of that species will stand *Dapedoglossus encaustus*.

Char. specif.—Form oval, contracting subequally to the muzzle and caudal peduncle. The front is gently convex and the mouth is terminal. The depth is little less than half the length minus the caudal fin, and the length of the head enters the same 3.4 times. The dorsal fin is shorter than the anal, and its first ray stands over the sixth of the latter. The ventrals are small, and extend about one-half the distance from their base to the first anal ray, which equals the distance to the base of the pectoral. The latter is elongate, especially the first ray, which, although jointed, as in *Osteoglossum bicirrhosum*, reaches nearly to the end of the ventral. Radii: D. 22-23; A. 27-30. The caudal fin is slightly concave. Scales five or six series above the vertebral column and seven below it. Their exposed surface is rather wide, and is minutely granulated and without grooves. The cells are invisible except when this surface is removed, and they are rather large. Vertebrae: 21 dorsal; 25 caudal.

The orbit is rather large, and is reached by the end of the maxillary bone. The suborbital bones are not much enlarged, as is the case in the recent genera. Preoperculum entire; suboperculum very narrow. Branchiostegals slender, rather numerous; coracoid wide, forming a vertical keel, which is not produced. Length of the longest specimen 0^m.230; of the shortest, 0^m.165.

The five specimens of this fish which I possess do not differ widely in size, and are one-third and less of the dimensions of the *D. encaustus*. A scale of this or of another large species occurs in the present collection.

DIPLOMYSTUS DENTATUS, *gen. et sp. nov.*

Char. gen.—Family *Clupeidae*, and nearly related to the genus *Clupea*. It differs from *Clupea* in the presence of a series of dorsal scuta, which extend from the supraoccipital region to the base of the dorsal fin, corresponding in position with those of the ventral surface. Unlike these, they have no costal processes. The dorsal fin originates in front of the anal. In the typical forms, teeth are well developed in a single series on the dentary, premaxillary, and maxillary bones; but, in the small forms, they are invisible. Mouth moderate.

There are two sections of this genus, the species of which differ in the form of the dorsal scuta. In section I, these shields are transverse, and their posterior borders are pectinate, a median tooth being especially

* Annual Report U. S. Geol. Surv. Terr., 1870, p. 430.

prominent. In section II, the scuta are not wider than long, and have but one, a median tooth, which is the extremity of a median longitudinal carina. The species of section I are *D. dentatus*, *D. analis*, and *D. pectorosus*; those of section II are *D. humilis* and *D. altus*.

Char. specif.—Fin-radii: D. I—13; A. I. 35. Vertebræ: dorsal, 18; caudal, 21. The greatest depth enters the length without the caudal fin two and a half times, and the head enters the same nearly three and one-third times. The eye is large, its horizontal diameter a little exceeding the length from its border to the inferior edge of the premaxillary bone, and a little greater than one-fourth the length of the head. The premaxillary and dentary bones are short and deep, the latter with a deep notch on the anterior border; both are directed upward. The maxillary bone is long and narrow, and curved backward at its lower end, which reaches a point below the anterior border of the orbit. The profile behind the premaxillary bone is nearly horizontal; above the posterior part of the orbit, it rises, and a compressed supraoccipital crest carries it to the gently convex dorsal line. The abdomen is convex, and is about as long as the caudal region. The last dorsal ray rises above a point anterior to the first anal ray. The caudal is deeply forked. The ventrals originate at a point barely in advance of a vertical line from the first dorsal ray. The pectoral fins are short. The scuta of the inferior median line are large and acute. The scales are rather small, and are delicately grooved; twenty rows may be counted between the vertebral column and the dorsal fin.

Measurements.

	M.
Total length.....	0.365
Length of head.....	0.083
Length (axial) to below first dorsal ray.....	0.145
Length to above first anal ray.....	0.185
Length to base of external caudal rays.....	0.285
Depth at orbit.....	0.055
Depth at occiput.....	0.093
Depth at first dorsal ray.....	0.118
Depth at middle anal ray.....	0.050
Depth at base of caudal fin.....	0.030

This species is represented by a single specimen of the size of a small Shad and exceeding the Herring. It is in fine preservation.

DIPLOMYSTUS ANALIS, Cope, *sp. nov.*

Radial formula: D. I. 11; A. I. 40. Vertebræ: dorsal, 17-18; caudal, 23-24. This species is more elongate in proportion to its depth than either of the other species, the length being three times the greatest depth. The anal portion of the body is considerably longer than the abdomen, and the anal fin is long and with short rays. The ventral fin commences well in front of the dorsal, whose last ray is considerably in advance of the first anal ray. The pectoral fin reaches the ventral, and

contains thirteen rays. The greatest depth is at the pectoral region, the outlines contracting to the base of the anal fin. The dorsal outline is convex. The profile descends gently. The muzzle is half as long as the diameter of the orbit, which enters the length of the head three times. The latter enters the length without the caudal fin three and three-fourths times. There is a row of short, conical teeth along the middle line of the mouth, which is not on the vomer, but is on the parasphenoid or axial hygal bones. Similar teeth exist in the mouth of *D. dentatus*. The jaws may be furnished with minute teeth, or they may be wanting. The scales are thin and difficult to count; there are fifteen rows between the vertebral column and the anterior anal rays.

Measurements.

	M.
Total length.....	0.195
Length of head.....	0.040
Axial length to below first dorsal ray.....	0.073
Axial length to above first anal ray.....	0.092
Axial length to base of external caudal rays.....	0.149
Depth at orbit.....	0.030
Depth at occiput.....	0.044
Depth at first dorsal ray.....	9.047
Depth at middle anal ray.....	0.027
Depth at base of caudal fin.....	0.016

This Herring is represented by a great number of well-preserved specimens, and was, next to the *D. humilis*, the most abundant fish of the waters of the ancient Green River lake-basin. It is distinguished from the *D. dentatus* by the larger number of anal and smaller number of dorsal radii, and by the shorter head and relatively more slender body. The specimen measured represents the average size; the largest obtained is half as large again, and much smaller than the type of *D. dentatus*.

DIPLOMYSTUS PECTOROSUS, Cope, *sp. nov.*

This Clupeoid is represented by small specimens of a deeper form than that seen in the two preceding species. It is also characterized by a smaller number of dorsal radii than either of them. Formula: D. I. 8-9; A. I. 40-44. Vertebrae: dorsal, 16-17; caudal, 22. The greatest depth is in the pectoral region, and enters the length minus the caudal fin a little less than three times. The outlines contract from the ventral fins, and the anal region is longer than the abdominal. The eye is a little more than one-fourth the length of the head, and the latter enters the total minus the caudal fin three and a half times. The ventral fins are small, and commence well in advance of the line of the dorsal. The last dorsal ray is nearly above the first anal; the caudal is deeply forked. As in the two preceding species, the neural spines in front of the interneurals present a laminar antero-posterior expansion. The

dorsal scuta are furnished in the *D. pectorosus* with an especially prominent median keel.

Measurements.

	M.
Total length.....	0.040
Length (axial) to below D. I.....	0.038
Length (axial) to above A. I.....	0.043
Length (axial) to base of caudal fin.....	0.070
Length of head.....	0.022
Depth at orbit.....	0.017
Depth at pectoral fin.....	0.026
Depth at dorsal fin.....	0.024
Depth at caudal peduncle.....	0.008

This species is represented by several specimens.

DIPLOMYSTUS HUMILIS, Leidy.

Clupea humilis, Leidy, Final Report U. S. Geol. Surv. Terr. i, p. 195, pl. xvii, fig. 1.

This and the following species, already referred to a distinct section of the genus *Diplomystus*, differ from those above described in several points. They have a much shorter anal fin, and the caudal part of the vertebral column is thus shorter. The anterior neural spines do not present the antero-posterior laminar expansion. The ventral fin commences a little behind the origin of the dorsal. The formulæ for the *D. humilis* are as follows:—Radii: D. I—11; A. I—14. Vertebrae: D. 21; C. 13. Depth to length as 3 : 8.5. The *Diplomystus theta* (*Clupea theta* Cope, Ann. Rep. U. S. Geol. Surv. Terr. 1873, p. 461) is intermediate between the species of the two sections in the structure of its anal fin, which includes twenty-six rays.

As at the Green River locality, so at this one, this Herring is the most abundant species. One-third the entire number of specimens are referable to it.

DIPLOMYSTUS ALTUS, Leidy.

Clupea alta, Leidy, loc. cit. p. 196, pl. xvii, fig. 2.

Also abundant. Formulæ:—Radii: D. I. 11; A. 1. 13–15. Vertebrae: D. 22; C. 12. Depth to length (without caudal fin) as 4:8.

ERISMATOPTERUS ENDLICHII, sp. nov.

This fish displays the characters of the genus to which it is referred, and of which a description will be found in the Annual Report of the United States Geological Survey of the Territories for 1870, p. 427. The ventral fins are neither abdominal nor pectoral, but intermediate, and the dorsal fin is above the abdomen. Both it and the anal are short, and are supported in front by two or three strong appressed spines. The vertebrae are hourglass-shaped, and the scales cycloid. The ventral rays are seven in number in *E. endlichi* and *E. rickseckeri*.

The radial formula in this fish is: D. III—11; C. 6—19—6; A. III—7. V. 7. The vertebræ are: D. 13; C. 17. Centra between the lines of the first interneural and first interhæmal spines, 10. Ten rows of small scales visible above the vertebral column.

The general form of the fish is stout, and the caudal peduncle is deep. The top of the head is convex, and the eye large. The front descends abruptly to the rather projecting muzzle in the specimen, but whether this is a distortion or not is uncertain. The coracoid is wide and well produced backward, while the clavicle is, as usual, directed forward. The femur* is slender, and connected with its fellow by a posterior transverse bar. The greatest depth is a little less than one-fourth the length without the caudal fin. The diameter of the eye is one-fourth the length of the head. The origin of the ventral fin is in advance of the first dorsal ray; the origin of the anal is below the penultimate dorsal ray. The caudal fin is openly forked.

Measurements.

	M.
Total length.....	0.061
Length of head.....	0.016
Length to line of ventral fin	0.020
Length to line of dorsal fin.....	0.022
Length to line of anal fin	0.031
Length to base of caudal fin.....	0.048
Depth at caudal peduncle.....	0.008
Depth at dorsal spine.....	0.011

The more numerous rays of the dorsal fin and more numerous scales are among the characters which distinguish this species from the two heretofore known. It is dedicated to Dr. Frederick M. Endlich, geologist in charge of one of the parties of the United States Geological Survey of the Territories under Dr. F. V. Hayden.

AMPHIPLAGA BRACHYPTERA, Cope, *gen. et sp. nov.*

Char. gen.—Generally as in *Erismatopterus*, but with strongly ctenoid scales. The dorsal fin is over the abdomen, and is supported by a few strong, adherent spines in front, which rest on stout interneurals; the soft rays have no interneurals, either in this fin or the anal. They are present in *Erismatopterus*. The ventrals originate a little in advance of the line of the dorsal, and the caudal fin is deeply forked. This genus approximates *Aphrodedirus*.

Char. specif.—Radii: D. II—8; A. III—4. Vertebræ of the caudal series 15. Scales: transverse row, 22; longitudinal row behind first interneural bone, 40. The only specimen I possess lacks the head, so that various characters cannot be ascertained. The depth of the body at the first dorsal spine enters the length from that point to the base of the caudal fin two and a half times, giving a general form of medium proportions.

*Before the homologies of these bones were studied, authors frequently called them *pubes*.

Caudal peduncle stout. The vertebrae are contracted medially, and not shortened; they have two or three longitudinal keels, which are somewhat irregular in their connections. This species is larger than any of the *Erismatopteri* yet known.

Measurements.

	M.
Length from first dorsal spine	0.073
Length from first anal spine.....	0.051
Length of anal fin	0.023
Length of second dorsal spine.....	0.015
Length of third anal spine.....	0.012
Depth at first anal spine	0.018

ASINEOPS PAUCIRADIATUS, Cope, *sp. nov.*

This Perch is represented by a single specimen, which is larger than any of those of the *A. squamifrons*, which have yet been found, and which is of more robust proportions. It differs materially in the radial and vertebral formulæ, and in the greater relative shortness of the dorsal spines. I observe at the base of these a series of short subhorizontal basilar interneural bones.

Formulæ:—Radii: D. IX—12; A. II. 7. Vertebrae: D. 9; C. 13. One or two vertebrae may be concealed behind the epiclavicle, but these, as in the description of *A. squamifrons*, are uncounted. The depth enters the length 2.25 times, the caudal fin being omitted. The length of the head is little less than the depth. The dorsal spines are not very robust, and are (excepting the first) of subequal length. The longest equals only half the depth of the body at the middle of the second dorsal fin. The caudal is rounded, and the ventrals are below the pectorals. The origin of the latter is a little in advance of that of the first dorsal spine. Its base is attached to four short basilar bones, of which the inferior two are stout in proportions. There are about ten rows of cycloid scales below the vertebral column. Scales extend on the top of the head as far as the orbits. The mouth is terminal. The total length of the type-specimen is 0^m.243, of which the head constitutes 0^m.075. The longest (ninth) dorsal spine measures 0^m.027, and the second anal spine 0^m.024.

MIOPLOSUS ABBREVIATUS, Cope, *gen. et sp. nov.*

Char. gen.—Allied to *Labrax* and *Perca*. Branchiostegal rays, 7 or 8; ventral rays, I. 5.; scales ctenoid. Two dorsal fins slightly connected at base; only two anal spines. Operculum rounded, without spines or emargination. Preoperculum without spine, and smooth on the posterior border; inferior border with teeth. Premaxillary and dentary with small uniform teeth in a narrow series. Clavicle unarmed. Vertebrae with two lateral fossæ. Caudal fin emarginate.

The discovery of this genus in the Green River Shales is of no small importance to fossil ichthyology, proving the existence, at that early

period, of the type, which is one of the highest among the true fishes. It probably belongs to the *Percidae*, although I have not ascertained the presence of teeth on the vomer, and there may be eight branchiostegal rays. As compared with the genera, recent and extinct, which are allied to *Perca*, it differs in the unarmed operculum and the preoperculum with teeth only on the lower limb, and in the presence of but two anal spines. It is therefore a weaker form than they, and, though of a higher type, less strongly protected by spines than the cotemporary *Asineops*. *Mioplosus* embraces the largest Physoclystous fishes yet known from this formation, and specimens are not rare at the locality from which they have been procured. They are often in a state of excellent preservation. The type of the genus is the *M. labracoides*.

Char. spec.—The *M. abbreviatus* is represented by but one specimen, from which the muzzle has been broken away. It is the stout species of the genus, and the others succeed it in this enumeration in the order of their greater elongation of form. The depth at the first dorsal fin enters the total length (including caudal fin) three and a half times; and the depth at the first anal ray enters the length of the vertebral column two and eight-tenths times. Vertebrae visible behind clavicle: D. 9; C. 14. Radii: D. IX—I, 11; A. II—11; P. 14. Ventral with a very weak spine. The last dorsal spines, as in all the other species, are very short, the anterior ones slender and moderately long; in this species, they are curved. The anal spines are short and slender, the first a rudiment. There are six rows of scales above and six below the vertebral column on the caudal peduncle.

Measurements.

	M.
Length of vertebral column.....	0.125
Length of third dorsal spine.....	0.025
Length of ninth dorsal spine.....	0.007
Depth at middle of first dorsal fin.....	0.060
Depth of caudal peduncle.....	0.025

MIOPLOSUS LABRACOIDES, *sp. nov.*

This Perch is represented by five specimens, mostly in good preservation. They have much the proportions of the Rock-fish. The origins of the pectoral and ventral are in nearly the same vertical line, and that of the first dorsal is not far behind them. That of the first ray of the anal is below the second or third ray of the second dorsal. The rays of none of the fins are prolonged; the dorsal spines are slender and nearly straight, the longest (third), when depressed, reaches but four-tenths the distance to the first ray of the second dorsal. The last dorsal spine is very short. The soft dorsal rays are rather longer than the spinous. Formulæ:—Rays: D. IX—I, 12; C. 8—17—8; A. II—14; V. I. 5. Vertebrae: D. 10; C. 15.

The depth at the first dorsal fin enters the total four times; the depth at the first anal ray enters the length of the vertebral column three times.

The length of the head enters the total four times, and that of the orbit enters the head 4.66 times, and into the length of the muzzle one and one-third times. The profile of the top of the head is slightly convex, and the dorsal line is also slightly convex. The mouth opens somewhat obliquely upward. The end of the maxillary bone reaches a point below the middle of the orbit. The teeth of the inferior border of the preoperculum are strong, and are directed forward; they number five. The angle of the lower jaw is not produced, but the inferior edge of the ramus is laminar and acute; the symphysis is shortly truncate. The superior edge of the maxillary bears a supernumerary bone at its distal portion. There are six branchiostegal rays preserved, with impressions of two others: the anterior three are slender; the others wide, as in allied genera. There is a low supraoccipital crest. The abdomen bears fourteen rows of scales below the vertebral column, and six rows may be counted above it; on the caudal peduncle I count 5—5.

Measurements.

	M.
Total length	0.280
Axial length of head	0.070
Axial length to line of first dorsal spine	0.085
Axial length to line of first ray of second dorsal	0.143
Axial length to line of first anal spine	0.152
Axial length to base of caudal	0.232
Depth at orbit	0.051
Depth at first anal ray	0.055
Depth of caudal peduncle	0.030
Length of third dorsal spine	0.030
Length of second anal spine	0.016

Mioplosus longus, *sp. nov.*

I have questioned the right of the form to which the above name is given to be maintained as a species distinct from the *M. labracoides*. It is represented by two individuals of much smaller size than those of the latter, and which are of a more elongate form. They have also two anal radii fewer.

The formulæ are:—D. IX—12; A. II. 12. Vertebrae: D. 10; C. 15. The depth at the first dorsal fin enters the total length five times, and the depth at the first anal ray three and one-half to three and eight-tenths times. The dorsal spines are straight and slender, the posterior ones very short. The caudal is forked. The teeth of the inferior border of the preoperculum are strong and acute; there are three large and two small ones.

Measurements.

	M.
Total length	0.175
Length of head	0.042
Length to line of first dorsal	0.054
Length to line of second dorsal	0.035
Length to line of anal	0.091

Length to caudal.....	0.140
Depth at orbit	0.025
Depth at first dorsal.....	0.037
Depth at second dorsal	0.034
Depth of caudal peduncle	(?)0.020

The scales are similar to those of the *M. labracoides*.

MIOPLSUS BEANI, *sp. nov.*

The most slender species of the genus is represented by one specimen, which is the smallest obtained, which is referable to this genus. The depth enters the total length six times, and the depth at the first anal spine enters the length of the vertebral column a little more than four times. Radii: D. IX—I. 13; A. II—12; P. 13. Vertebrae: D. 10; C. 15. The general characters are as in *M. labracoides*, but the scales are not preserved. The form of the head is that of a younger fish, but its proportions as compared with the body are not those of immaturity. The length enters the total 4.2 times, and the orbit enters it 4.5 times. The profile of the front is descending. The teeth of the inferior limb of the preopercle are obtuse and not well defined. There are impressions of seven branchiostegals preserved.

This perch is named in honor of my friend Dr. T. H. Bean, of the United States Fish Commission.

Measurements.

	M.
Total length	0.131
Length of head	0.031
Length to line of first dorsal.....	0.040
Length to line of second dorsal	0.064
Length to line of anal fin.....	0.070
Length to line of caudal fin	0.109
Depth at orbit	0.020
Depth at first dorsal ray.....	0.023
Depth at first anal ray	0.019
Depth of caudal peduncle	0.011

PRISACARA SERRATA, *gen. et sp. nov.*, *Chromididid* vel *Pomacentridis* *affinis*.

Char. gen.—This type might be included in the *Pomacentridae*, but it differs from the genera now known in the possession of vomerine teeth, and apparently in having eight branchiostegal rays.

In general, *Prisacara* may be characterized as *Pharyngognathi*, with ctenoid scales and well-developed spinous rays. The preoperculum is, in the typical species, sharply serrate on both borders. There are three anal spines, and the lateral line is well developed, not extending near the dorsal line. The caudal fin is rounded. The jaws are toothless. The pharyngeal bones, both superior and inferior, are closely studded with short, sessile, conical, teeth; a row of small ones stands on the external border of the inferior pharyngeal. One dorsal fin.

Char. specif.—Form a regular wide oval, with a subequal contraction at both extremities. The spinous dorsal rays become longer than the

soft ones, but the posterior spines are shorter than the anterior soft rays, so as to produce a wide emargination in the superior outline. The spines are very robust, especially those of the pectoral and anal fins. The first anal spine is near two-thirds the length of the second. The pectoral fin does not extend to the anal, and the soft parts of the anal and dorsal, which are equal, do not overlap the base of the caudal. Radii: D. X—11; A. III—10; C. ?—17—?. Vertebrae: D. 9; C. 14. The centra have a strong median lateral ridge, which separates two fossae.

The greatest depth is at the base of the ventral fins, or the third dorsal spine; it enters the total length (with caudal fin) two and four-tenths times. The length of the head enters the same three and four-tenths times. The orbit is large, its diameter exceeding the muzzle and entering the length of the head a little over four times. The mouth is terminal, and the premaxillary extends obliquely downward and backward; the maxillary reaches the line of the anterior border of the orbit.

The scales are longer than deep, and the rough surface has but a small extent, and is finely granulated. The remainder of the scale is marked with strong concentric grooves. Those on the gular region are small. On the belly, there are seventeen rows (about) below the vertebral column. A row of scales extends along the postero-inferior edge of the operculum. This part is well preserved in only one of the three specimens which represent the species.

Measurements.

	M.
Total length	0.217
Length of head	0.064
Length to line of first spine of first dorsal	0.070
Length to line of first spine of second dorsal	0.121
Length to line of anal	0.122
Length to base of caudal	0.173
Depth at first dorsal spine	0.093
Depth at first dorsal soft ray	0.070
Depth of caudal peduncle	0.027
Length of fourth dorsal spine	0.030
Length of second anal spine	0.027

This species is about the size of the Crappie, *Pomoxys annularis*.

PRISCACARA CYPHA, *sp. nov.*

This species is nearly related to the last, but presents a number of differences which require its separate consideration. These are:—(1) The more arched or convex dorsal outline; (2) The relatively longer head; (3) The presence of an additional dorsal spine; (4) The entire covering of the operculum with scales. There is also probably a smaller number of dorsal vertebrae, but this is not certain, as that region has been somewhat disturbed. Formulae:—Rays: D. XI—10—11; A. III—9; P. 15. Vertebrae, 6—14.

The greatest depth enters the total length 2.6 times; the length of the head enters the same 3.3 times. The spines are more robust, and the serrature of the preopercle more produced in the individual now described than in any of those of the *P. serrata* in my possession. The size is about the same as that of the latter species.

PRISCACARA LIOPS, sp. nov.

A smaller fish than either of the preceding is referred to this genus, although it differs in one feature, regarded as important among the *Pomacentridæ*, *i. e.*, the preopercular border is entire. It conforms closely to the *P. serrata* in other respects, as the form of the dorsal fin, three anal spines, form of caudal fin, character of scales and lateral line, edentulous jaws, and, indeed, in form to such an extent as to lead me to suspect that in this genus, as in *Lepomis*, etc., the serration of the preopercle is not of much systematic value. One character by which the *P. liops* may be distinguished from *P. serrata*, in addition to the smooth preoperculum and small size, is the constantly larger number of rays in the second dorsal fin.

Formulæ:—Rays: D. X—13—14; C. 5—19—6; A. III. 10—11. Vertebrae: D. 9; C. 13. The form is characterized by the downward production of the muzzle, or a descending slope of the front. One specimen does not present this character, perhaps on account of distortion. The pectorals originate below the first dorsal spine, and the ventrals a little behind it. The spines are moderately stout, and the emargination of the dorsal fin is not deep. There are twenty-five rows of ctenoid scales traversed by a vertical line from the middle of the spinous dorsal, and smaller scales cover the operculum and more or less of the preoperculum.

Measurements.

	M.
Total length	0.113
Length of head	0.032
Length to first dorsal spine	0.034
Length to first dorsal soft ray	0.057
Length to first anal spine	0.057
Length to base of caudal	0.086
Depth at orbit	0.030
Depth at first dorsal spine	0.043
Depth at first dorsal soft ray	0.035
Depth of caudal peduncle	0.014

Five specimens of this fish have been received.

GENERAL OBSERVATIONS.

The species of this locality are distributed as follows, in their respective genera. A corresponding list of all the species known from the Green River Shale is also given:—

	Number of species.	
	This locality.	Entire formation.
Dapedoglossus	1	2
Diplomystus	5	7
Erismatopterus.....	1	3
Amphiplaga.....	1	1
Asineops	1	3
Mioplosus	4	4
Priscacara.....	3	3
	16	23

The Herring (*Diplomystus*) exceed all others in number of species and individuals. One of the species (*D. humilis*) is more abundant than all the other species of all genera put together. Long after these come, in point of numbers, the more typical spinous-rayed species, which doubtless preyed upon them. The following species are represented by but one individual each:—*Diplomystus dentatus*, *Erismatopterus endlichii*, *Amphiplaga brachyptera*, *Asineops pauciradiatus*, *Mioplosus abbreviatus*, *M. beanii*, and *Priscacara cypha*.

A consideration of the fauna with the additional light derived from this accession of new material is of some value in connection with the question of the relation of this formation to the oceans and lakes of the Eocene period. I have heretofore expressed the opinion that the Green River water-area in which the shales were deposited may have had, like the Wasatch Lake of New Mexico, connection with the sea, and pointed out the broad distinction between its fish-fauna and that of the undoubtedly land-locked lakes of the South Park of Colorado and of Elko, Nev. The fishes of the latter formation are nearly related to fresh-water types only, and to those at present inhabiting North America. On the other hand, the Green River Shales contain two striking representatives of families which do not now exist in North America, and very rarely in any of the northern realms of the earth. These are the *Osteoglossidae*, whose genera are all fresh-water, and the *Pharyngognathi*, with ctenoid scales. Some of these are marine (*Pomacentridæ*), and others are fresh-water (*Chromididæ*). The Green River genus *Priscacara* is, in some respects, more nearly allied to the latter than the former family, but not entirely so.

The remaining genera (excepting *Asineops*) correspond to existing North American genera, viz:—*Diplomystus*, to *Clupea*; *Erismatopterus* and *Amphiplaga*, to *Aphredodirus*; and *Mioplosus*, to *Labrax*. The first and last-named recent genera are anadromous, and *Aphredodirus* exists in tide-water; it has also been found near the Great Lakes. We look for further material to throw light on the question of possible marine communication with the Green River lake.

ART. XXXV.—ON THE GENUS ERISICHTHE.

BY E. D. COPE.

Erisichthe is a genus of fishes which was described by the writer in 1873, and subsequently referred to the *Saurodontida*. In the Final Report of the United States Geological Survey of the Territories,* the typical species, *E. nitida*, was again described, and also figured, so far as the material permitted, and the existence of a second species, *E. angulata*,† was pointed out. Subsequent accumulation of material enables me to add to the knowledge of the structure of the genus and to increase the number of known species.

The *E. nitida* Cope was originally represented by a few portions of the skull; among other pieces, the premaxillary and dentary bones being present. The latter element was correctly determined, but the premaxillary was called maxillary in my description. A fine specimen of this species, obtained the present season from the Niobrara Cretaceous of Kansas, by Charles H. Sternberg, includes the greater part of the cranium. From this and other specimens I discover that the anterior portion of the skull, probably the ethmoid bone, is produced into a long beak, in general form similar to the sword-like snout of the Sword-fishes of modern seas. I had already been in receipt of fragments of these beaks, associated with loose teeth of the genus *Erisichthe*, but it was Prof. B. F. Mudge who first pointed out that both belong to one and the same genus.‡ The specimen above mentioned includes also the maxillary bones, so that their true character is now clear. A remarkable feature of the genus is displayed in the mandibles. Each of these is compound in the region usually composed of the simple dentary bone. It there consists of three parallel elements, an internal and an external embracing a median element. The inner bears a band of teeth *en brosse* on its inner and superior aspect, and the external a few teeth of similar character on its superior edge. The large lancet shaped teeth are borne by the middle element, excepting some of the largest near the symphysis. Two of these on the inner side of the ramus originate in the internal bone. The maxillary bone forms the greater part of the arcade of the mouth, and has no superior articulation with the facial part of the skull. It is attached by a simple sutural articulation with the premaxillary, so

* Vol. ii, 1875, p. 217, pl. xlvi, figs. 3-8.

† *Portheus angulatus*, Geol. Survey N. Carolina, by W. C. Kerr, p. 32.

‡ Bulletin U. S. Geol. Survey Terrs.

as to permit some lateral motion. The premaxillary also has no superior condyle articulating with the cranium, but the entire length of its superior margin is applied in a groove of the ethmoid bone, so as to be immovable. Anterior to the premaxillary bones, on the inferior aspect of the ?ethmoid, is situated a pair of large, compressed, double-edged teeth, whose alveoli are close together. Only one of these teeth is in functional service at a time. In the *Erisichthe penetrans*, the superior surface of the skull is swollen above the fundus of this alveolus, while no such enlargement marks the position of its young companion.

The compound character of the mandible, and the peculiar mode of articulation of the premaxillary and maxillary bones, entitle this genus to recognition as the type of a family distinct from the *Sauroidontide*, which may accordingly be called the *Erisichtheide*. It is allied to the *Sauroidontide* in the mode of implantation of its teeth and in the relative extent of the bones of the maxillary arch.

Three species are represented by the specimens received. They are readily distinguished by the forms of the beaks. In the *E. nitida*, this weapon is distinguished by the flat superior surface of its distal half. The section in this region is semicircular, a strong angle on each side bounding the superior plane, while at the base the section is a transverse oval. The flat surface is only finely rugose, while the remainder is closely marked with raised ridges, which are generally parallel, but which send off many lateral free or inosculating branchlets. This beak is stout, and contracts abruptly at the tip. It is also recurved, and the form does not appear to be due to distortion. Length from the inferior pair of large basal teeth 0^m.155; transverse diameter at base 0^m.025; depth at base 0^m.021.

The second species, which I call *Erisichthe penetrans*, has a snout of uniformly oval section at all points. The long diameter of the section is transverse. The axis is straight and the form acuminate, the contraction being uniform and gradual to acute apex. Thus it follows that a beak of greater diameter at the base than one of the *E. nitida* has a more slender shaft. The teeth of the inferior basal pair are, in the specimen described, of large size, and, as in other species, smooth, compressed, and with opposite fore and aft cutting edges. The surface of the beak is thrown into numerous sharply defined longitudinal ridges, which more or less inosculate with each. There is no difference between the superior and inferior surfaces in this respect. Length of beak from basal teeth 0^m.150; transverse diameter at base 0^m.035; vertical diameter at the same point 0^m.020; width at middle of the fossæ for the premaxillary bone 0^m.060.

The third species of *Erisichthe* is represented by a muzzle of an old individual, which has lost a good deal of its apex by attrition. Its surface lacks the sculpture of the other species; but whether this smoothness is due to attrition or not is uncertain. The alveolæ for the basilar teeth are empty and almost filled up with bone. The form of the muzzle

is quite peculiar. Its shaft is depressed, with a strongly convex inferior surface and a slightly convex superior surface, the two separated by an obtuse angular border. Behind the alveolæ, the inferior surface is narrowed by a strong lateral contraction, in which the superior surface shares in a slight degree. The latter is continued in a prominent border. The inferior surface is divided by an angular depression, the apex of which is directed forward. It is perhaps the articular face for the extremity of the vomer. As compared with the other species, this one is characterized by the lateral longitudinal concavity at the base, which appears to be an anterior prolongation of the grooves for the premaxillary bones. The small size and anterior position of the alveolæ of the basal pair of teeth is also a marked character. The superior surface of the skull at the base of the beak is apparently unworn; it is smooth. In *E. nitida*, it is sculptured with ridges. Length preserved, anterior to dental alveolæ, 0^m.045; transverse diameter in front of alveoli 0^m.025; vertical diameter 0^m.020. This species may be called *E. ziphioides*, from the *Ziphius*-like form of the beak.

A fourth species has been found in England, and figured by Dixon in the "Geology of Sussex". The portions represented in this work are the mandibles, which resemble those of the *E. nitida*, and which were supposed at that time to belong to a species of *Saurocephalus*. A muzzle, perhaps of the same species, was regarded as a Sword-fish, which was called *Xiphias dixonii* by Agassiz. It should be now termed *Erisichthe dixonii*.

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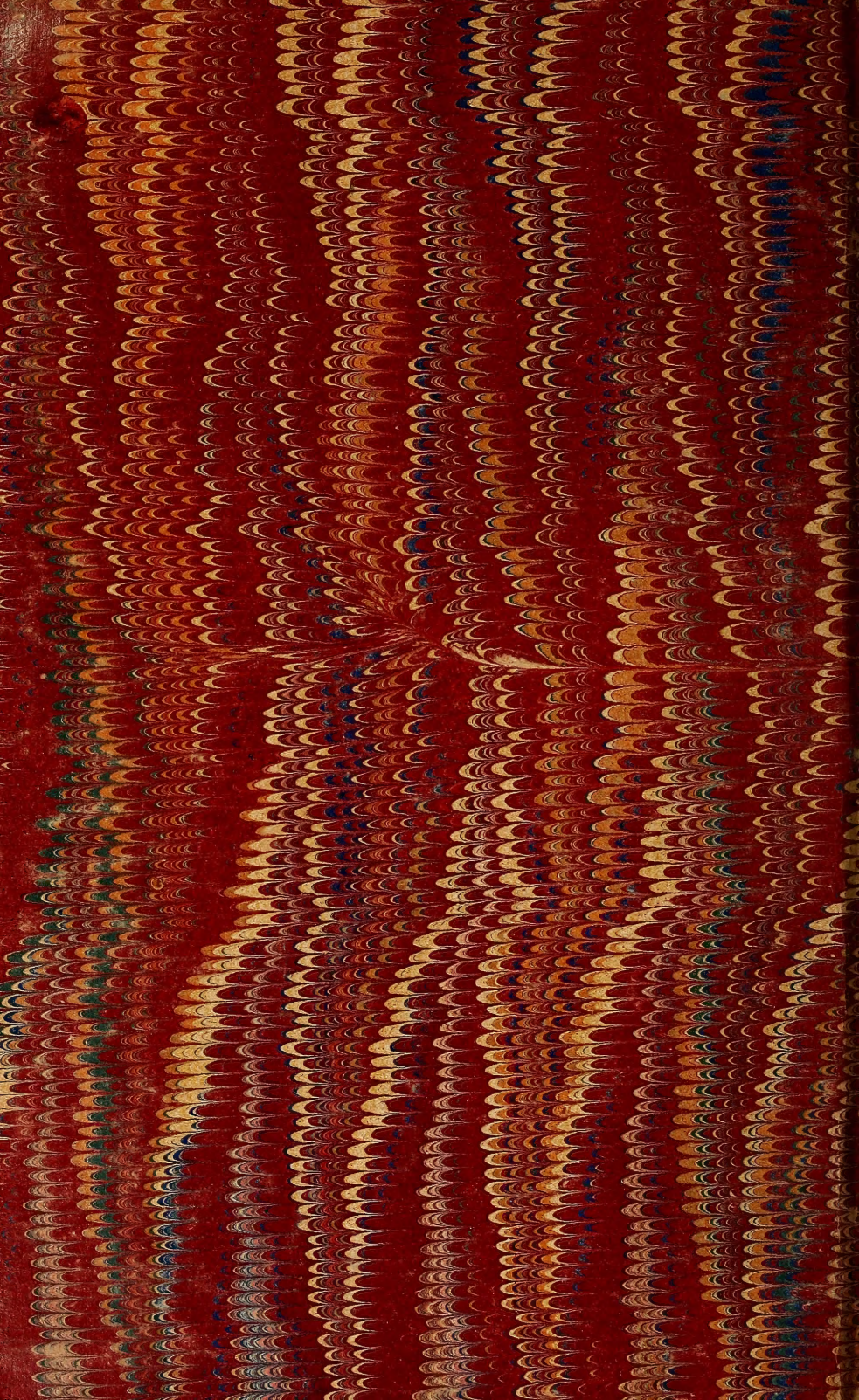
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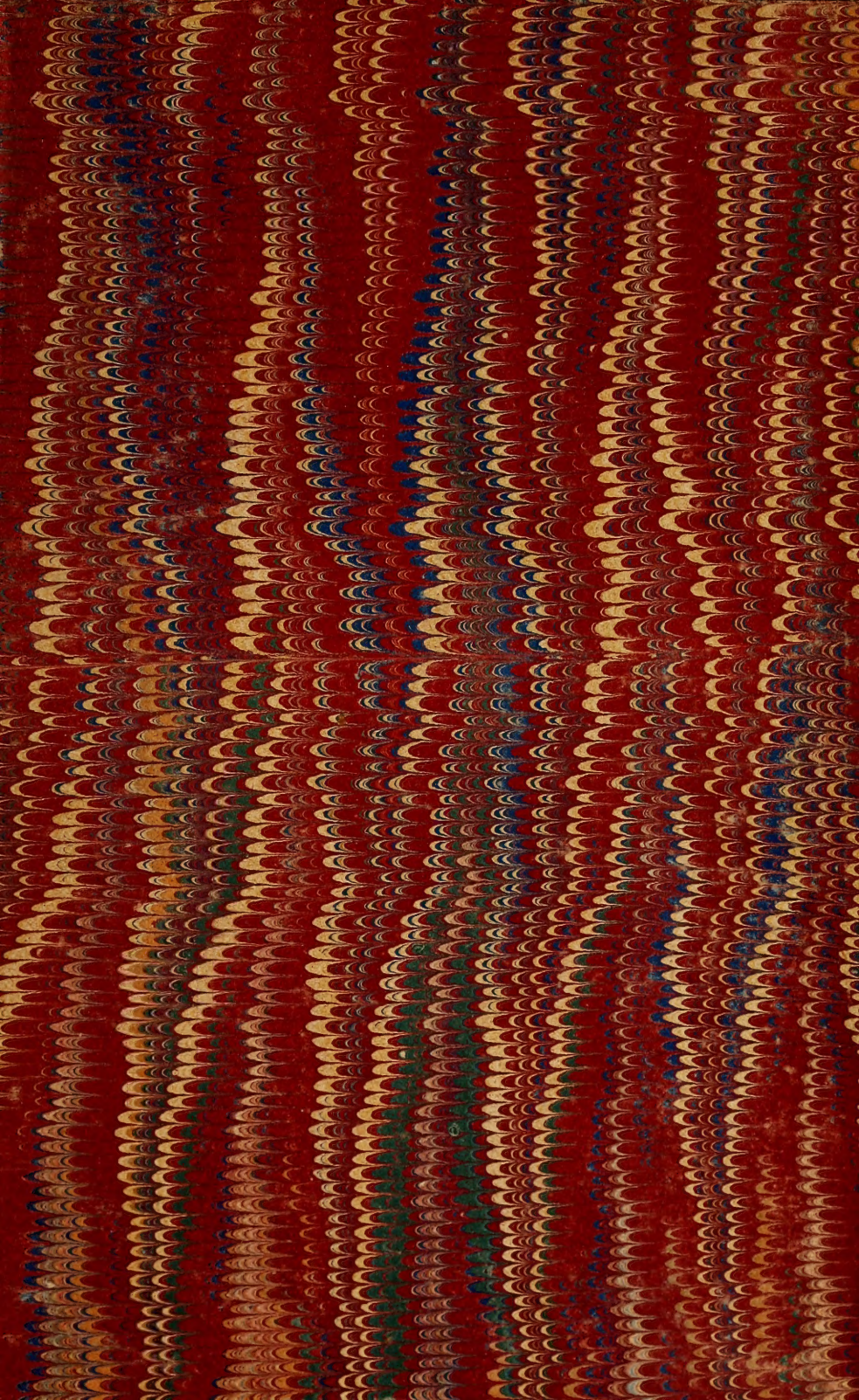
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