

were placed at his disposal by Messrs. Chance Brothers, of Birmingham, the question may perhaps be considered as settled. After some preliminary trials, a piece of glass free from striae was prepared of titanate of potash mixed with the ordinary ingredients of a crown glass. As the object of the experiment was merely to determine in the first instance whether titanic acid did or did not confer on the glass the universal property of separating the colours at the blue end of the spectrum materially more, and at the red end materially less, than corresponds to a similar dispersive power in ordinary glasses, it was not thought necessary to employ pure titanic acid; and rutile fused with carbonate of potash was used as titanate of potash. The glass contained about seven per cent. of rutile, and as none was lost, the percentage of titanic acid cannot have been much less. The glass was naturally greenish from iron contained in the rutile; but this did not affect the observations, and the quantity of iron would be too minute sensibly to affect the irrationality.

Out of this glass two prisms were cut. One of these was examined as to irrationality by Prof. Stokes, by his method of compensating prisms; the other by Mr. Hopkinson, by accurate measures of the refractive indices for several definite points in the spectrum. These two perfectly distinct methods led to the same result, viz., that the glass spaces out the more as compared with the less refrangible part of the spectrum no more than an ordinary glass of similar dispersive power. As in the phosphatic series, the titanium asserts its presence by a considerable increase of dispersive power; but, unlike what was observed in that series, it produces no sensible effect on the irrationality. The hopes therefore that had been entertained of its utility in silicic glasses prepared for optical purposes appear doomed to disappointment.

A paper was read by Mr. J. A. Fleming, *On the Decomposition of an Electrolyte by Magneto-electric Induction*. When a solid conductor is moved in a magnetic field induced currents are created in it. In a solid these expend themselves partly or wholly in producing heat in the conductor. The paper was occupied with an examination of the effect produced on electrolytes under the same circumstances, viz., when made to flow or move in a magnetic field: experiments were described to show first that induced currents are produced under these conditions in electrolytes, and then that the electrolyte is to some extent decomposed by these currents.

Dr. Moffat, in his paper *On the apparent connection between Sunspots, Atmospheric Ozone, Rain, and Force of Wind*, stated that in discussing ozone observations from 1850 to 1869, he had observed that the maxima and minima of atmospheric ozone occurred in cycles of years, and that he had compared the number of new groups of sunspots in each year of these cycles with the quantity of ozone, and the results showed that in each cycle of maxima of ozone there is an increase in the number of new groups of sunspots, and in each cycle of minima a decrease. He also gave a table to show that the years of maximum ozone and number of sunspots were generally distinguished by an increase in the quantity of rain and the force of the wind.

Sir W. Thomson's paper *On the effects of Stress upon the Magnetism of Soft Iron* was a continuation of two that had been read before the Royal Society. In the physical laboratory at Glasgow University he had stretched steel and soft iron wire about twenty feet long from the roof. An electro-magnetic helix was placed round a few inches of the wire, so that the latter could be magnetised when an electric current was passed through the former; the induced current thus produced in a second helix outside the first being indicated by a reflecting galvanometer. When steel wire was used, the magnetism diminished when weights were attached to the wire, and increased when they were taken off; but when specially made soft iron wire (wire almost as soft as lead), the magnetism was increased when weights were put on, and diminished when they were taken off. Afterwards he discarded the electrical apparatus, and by suspending a piece of soft iron wire near a magnetometer consisting of a needle, a small fraction of a grain in weight, with a reflecting mirror attached, the wire was magnetised inductively simply by the magnetism of the earth, and changes in its magnetism were made by applying weights and strains, the changes being then indicated by the magnetometer.

Prof. W. F. Barrett read a paper *On effects of Heat on the molecular structure of Steel Wires and Rods*, in the course of

which he said he found that if steel of any thickness be heated by any means, at a certain temperature the wire ceases to expand, although the heat be continuously poured in. During this period also the wire does not increase in temperature. The length of time during which this abnormal condition lasts varies with the thickness of the wire and the rapidity with which it can be heated through. It ceases to expand, and no further change takes place till the heat is cut off. When this is done the wire begins to cool down regularly till it has reached the critical point at which the change took place on heating. Here a second and reverse change occurs. At the moment that the expansion occurs, an actual increase in temperature takes place sufficiently large to cause the wire to glow again with a red-hot heat. It is curious that this after-glow had not been noticed long ago, for it is a very conspicuous object in steel wires that have been raised to a white heat and allowed to cool.

Mr. Brahm exhibited some experiments on magnetised rings, plates, and discs of hardened steel, and also experiments on air, hydrogen and oxygen.

SECTION D.

BIOLOGY.

OPENING ADDRESS BY DR. P. L. SCLATER, M.A., F.R.S.,
F.L.S., PRESIDENT.

On the Present State of our Knowledge of Geographical Zoology.

In the office, which I have now held for more than sixteen years, of Secretary to the Zoological Society of London, I have been not unfrequently requested by our members and correspondents in various parts of the world to furnish them with information as to the best works to be consulted on the zoology of the countries in which they are respectively resident, or which they are about to visit. With the well-furnished library of the Zoological Society at my command this is not usually a very difficult task, so far as publications are actually in existence to supply the desired information. I am also frequently asked to point out the principal deficiencies in our knowledge of the animals of particular countries. This is also a not very difficult request to reply to, although it is somewhat embarrassing on account of the very imperfect information which we still possess of geographical zoology generally, and the largeness of the claims I am therefore constrained to put forward for the attention of those who make such inquiries. Great, however, has been the progress made of late years towards a more complete knowledge of the faunas of the various parts of the world's surface. Expeditions have been sent out into countries not previously explored; collections have been formed in districts hitherto little known; and many general works have been published, combining the results of previous fragmentary knowledge on this class of subjects. Under these circumstances I have thought that such an account as I might be able to give of the general progress that has been recently made towards a better knowledge of the zoology of the various parts of the earth's surface, accompanied by a series of remarks upon the best available authorities to be consulted upon such subjects, might supply a want which, as above mentioned, I know by personal experience is often felt, and at the same time would form a not inappropriate address from the chair which I have now the honour to occupy.

I must premise, however, that my observations must be restricted mainly to the terrestrial members of the sub-kingdom Vertebrata. To review the recent progress of our knowledge of the various sections of invertebrate animals in different countries would be beyond my powers, and would indifferently enlarge my subject. Besides, it is certain that the higher classes of animals have occupied the principal attention of recent writers on geographical zoology, and it is with their distribution that we are best acquainted.

Taking, therefore, the seven great regions into which the earth's surface may be most conveniently divided for zoological purposes one after another, I will endeavour to point out our leading authorities on the Mammals, Birds, Reptiles, Batrachians, and Fishes of each of them, and their main constituent parts. At the same time, I will endeavour to indicate the principal deficiencies in our knowledge of these subjects, and may perhaps be able to add a few suggestions as to how some of these deficiencies might be best overcome.

In these remarks I will take the divisions of the earth's surface

ment of the rate of wave progress. His apparatus consisted of three deep troughs, two circular and one rectangular, and the steadiness of the motion in each was remarkable; he compared the velocities of the waves with the times of vibrations of pendulums, and verified that in different sized troughs the rate varied inversely as the square root of the diameter. The experiments excited a good deal of interest.

The Rev. S. J. Perry, of Stonyhurst College (one of the members of the expedition to Kerguelen to observe the Transit of Venus), read a paper on that event. Father Perry illustrated his remarks by diagrams of the sun and the planet, as seen from various stations, and gave a very interesting explanation which was attentively listened to. He said that although much prominence had not been given to the idea, he believed that a very important reason why so much expense was gone into the expedition was that the distance of the earth from the sun entered into the calculation of lunar tables. The observations were not of any striking nature; they were simply to watch a black spot pass across the sun. There was nothing exciting about it, except that when the observations had to be taken they had to be very careful about the precise time, and they had to observe the spot during the whole time of its passage. Having pointed out with reference to his diagrams the reason why the different stations were chosen, he denied the assertions that had been made that Sir George Airy neglected Halley's method of observation for Delille's; the truth was he had rightly decided in favour of Delille, but he had not neglected Halley. With regard to the (Halleyan) stations in the extreme north, they were left to the care of the Russians, and the English, French, Americans, Germans and others occupied in the southern hemisphere. As it was mid-winter, the sun was very nearly on the line of the southern tropics and nearly vertical at ingress over the eastern border of Australia. There were primarily five English Government expeditions, but as these were subdivided, there were, including private observers and those of India and the Colonies, about twenty English stations of observation. His station was Kerguelen, to the south-west of Australia, and after arriving there they found that the Americans had taken the station recommended by the members of the *Challenger* Expedition, but in spite of that they had plenty of time to look about the island (which was a very barren place, about ninety miles by forty-five), and they were fortunate enough to get a much better position than the Americans, after all, by going a little to the south-west. They had been told before they went out that there was always a mist over the island, but, though that might be the case in the north of the island, which had been chiefly visited before, it did not apply to the south while they were there, and they had not more mist than there would have been in London. On the morning of the transit, which they expected to begin at 6:30, they rose at four, and at once made preparations for the day's work. They were divided into three parties, and were so placed that, with the Americans, they formed four parties, about eight miles distant from each other. They saw the sun very well until after six o'clock, at the first (his own) station, until almost the time that Venus was coming on to the sun's disc, and they had the external contact as well as could be expected, for there never could be absolute certainty with regard to such a point. They continued very well until they had taken the bisection by the planet of the sun's disc, but then there was just one little cloud that came and placed itself right over the planet and remained till ten minutes after the commencement of the transit. At the other stations they were able to make observations of the ingress. At his station they were able to get observations of the internal and external contact at egress, and a few photographs. Father Perry added particulars of the result of observations at the other stations as far as could be ascertained, and narrated his experience of a cyclone in the Indian Ocean on the homeward passage. He added that during their stay on the island they not only made astronomical observations, but also a series of magnetic and meteorological observations; and the Rev. A. E. Eaton was sent by the Royal Society to study the botany of the island.

In answer to a gentleman, Father Perry said if they got the results of the observations in seven years' time they would be very lucky, as they had first to determine their longitude, and that occupied a very long time.

Prof. Osborne Reynolds read a paper *On the Refraction of Sound by the Atmosphere*, in which he remarked that in previous papers he had pointed out that the upward diminution of temperature in the atmosphere (known to exist under certain

circumstances by Mr. Glaisher's balloon a cent) must refract and give an upward direction to the rays of sound which would otherwise proceed horizontally, and it was suggested that this might be the cause of the observed difference of the distinctness with which similar sounds were heard on different occasions, particularly of the very marked advantage that the night has over the day in this respect. On this subject he had made a series of experiments. He mentioned a case in which at sea, when leaving a yacht in a small boat, for the purpose of making experiments on sound, those in the yacht and the boat were able to call to one another, and he heard at a distance of three-and-a-half miles, and that the hiss and report of a rocket sent up from the yacht was heard at a distance of five miles. Also on the same occasion the barking of a dog on shore, which was eight miles distant, was heard, and the paddles of a steamer which must have been fifteen miles off were distinctly audible. Prof. Reynolds remarked that the distinctness with which sounds of such comparatively low intensity could be heard was perhaps beyond anything definitely on record, although remarkable instances of sounds heard a long way off were occasionally heard. As the result of a series of experiments made by means of an electric bell, Prof. Reynolds found that when the sky was cloudy and there was no dew, the sound could invariably be heard much further than against the wind; but when the sky was clear, and there was a heavy dew, the sound could be heard as far against a light wind as with it. On one occasion in which the wind was very light and the thermometer showed 39° at one foot above the grass, and 47° at eight feet, the sound was heard 400 yards against the wind and only 270 yards with it.

The paper by Prof. G. G. Stokes and Dr. J. Hopkinson, *On the Optical Properties of a Titanio-silicic Glass*, we give in extenso on account of its importance. At the meeting of the Association at Edinburgh in 1871, Prof. Stokes gave a preliminary account of a long series of experiments in which the late Mr. Vernon Harcourt had been engaged, on the optical properties of glasses of a great variety of compositions, and in which since 1862 Prof. Stokes had co-operated with him.* One object of the research was to obtain, if possible, two glasses which should achromatize each other without leaving a secondary spectrum, or a glass which should form with two others a triple combination; an objective composed of which should be free from defects of irrationality without requiring undue curvature in the individual lenses. Among phosphatic glasses, the series in which Mr. Harcourt's experiments were for the most part carried on, the best solution of this problem was offered by glasses in which a portion of the phosphoric was replaced by titanic acid. It was found, in fact, that the substitution of titanic for phosphoric acid, while raising, it is true, the dispersive power, at the same time produces a separation of the colours at the blue, as compared with those at the red end of the spectrum, which ordinarily belongs only to glasses of a much higher dispersive power. A telescope made of discs of glass prepared by Mr. Harcourt, was, after his death, constructed for Mrs. Harcourt by Mr. Howard Grubb, and was exhibited to the Mathematical Section of the late meeting in Belfast; this telescope, which is briefly described in the Report,† was found fully to answer the expectations that had been formed of it as to destruction of secondary dispersion.

Several considerations seemed to make it probable that the substitution of titanic acid for a portion of the silica, in an ordinary crown glass, would have an effect similar to that which had been observed in the phosphatic series of glasses. Phosphatic glasses are too soft for convenient employment in optical instruments, but should titano-silicic glasses prove to be so silicic what titano-phosphatic glasses have been found to be to phosphatic, it would be possible, without encountering any extravagant curvatures, to construct perfectly accurate combinations out of glasses having the hardness and permanence of silicic glasses; in fact, the chief obstacle at present existing to the perfection of the achromatic telescope would be removed, though naturally not without some increase to the cost of the instrument. But it would be beyond the researches of the laboratory to work with silicic glasses on such a scale as to obtain them free from striae, or even sufficiently free to permit of a trustworthy determination of such a delicate matter as the irrationality of dispersion.

When the subject was brought to the notice of Mr. Hopkinson, he warmly entered into the investigation, and thanks to the liberality with which the means of conducting the experiments

* Report for 1871. Transactions of the Sections, p. 38.

† Ditto for 1874. Transactions of the Sections, p. 26.

in the same order as I have generally used in my lectures on zoological geography, namely,

- | | |
|---------------------------|------------------------|
| I.—Palearctic Region | } <i>Arctogaea.</i> |
| II.—Ethiopian Region | |
| IIIa.—Lemurian Sub-region | |
| III.—Indian Region | |
| IV.—Nearctic Region | } <i>Dendrogea.</i> |
| V.—Neotropical Region | |
| Va.—Antillean Sub-region | } <i>Antarctogaea.</i> |
| VI.—Australian Region | |
| VII.—Pacific Region | |

I.—THE PALEARCTIC REGION.

The Palearctic Region I shall consider for convenience sake in the following seven sub-regions:—

1. The *Cisatlantean Sub-region*, embracing all that part of the Palearctic Region lying south of the Mediterranean Sea.
2. The Atlantic Islands.
3. The *European Sub-region*.
4. The *Siberian Sub-region*, embracing the whole of Northern Asia.
5. The *Mantchurian Sub-region*, containing Northern China and the adjoining part of Mongolia.
6. The *Japanese Sub-region*, embracing the Japanese Islands.
7. The *Tartarian Sub-region*, containing the great desert-region of Central Asia.
8. The *Persian Sub-region*, embracing Persia, Asia Minor, and Syria.

I. THE CISATLANTEAN SUB-REGION.

As regards the zoology of the main western portion of this district (Tunis and Algeria) our knowledge may be now said to be pretty far advanced. The standard work on the subject is the "Exploration Scientifique de l'Algérie" published by the French Government, in which are treatises on the Mammals and Birds of Algeria by Loche, and on the Reptiles and Fishes by Geichenot. This work was commenced in parts in 1840, and the portions relating to the Mammals and Birds were, I believe, intended to have been written by M. Vaillant, the artist of the Commission; but only the plates were issued, and the text by Captain Loche was not completed until 1867. A smaller and more convenient work for travellers is the last-named author's catalogue of the Mammals and Birds of Algeria, published in 1858.

As regards the herpetology of Algeria, an excellent memoir on this subject by Dr. Alexander Strauch will be found in the fourth volume of the new memoir of the Academy of St. Petersburg. Those who penetrate beyond the Atlas will find the lists of the vertebrate animals appended to Canon Tristram's "Great Sahara" very useful. Many interesting details about the birds of Tunis and Algeria will likewise be found in the papers communicated to the "Ibis," by Messrs. Salvin, Tristram, and J. H. Gurney, jun.

Of Morocco and the extreme western portion of the Atlas, our knowledge is as yet by no means so perfect. As regards the birds of Tangier and its vicinity, we have Colonel Irby's lately published volume on the Ornithology of the Straits of Gibraltar, in which the "observations on the Moorish birds are in a great measure culled from the MSS. of the late M. Favier—a collector long resident in Tangier." But in the south of Morocco, in the Western Atlas and surrounding district, there is certainly a considerable *terra incognita* within easy reach of England, which has hitherto been almost inaccessible to naturalists, though the short expedition of Dr. Hooker, Mr. Maw, and Mr. Ball in 1871 (of which a notice only has been published, but a complete scientific account is, I believe, in preparation), shows that it may be penetrated if proper precautions are taken.

1a. The Atlantic Islands.

The Atlantean island-groups of the Canaries, Madeira, and the Azores, may perhaps be most naturally appended to this division of the Palearctic Region. Our knowledge of the fauna of each of these three groups is tolerable, although there is of course much to be done in working up details. As regards the Canaries, the standard work is Webb and Berthelot's "Histoire Naturelle des Îles Canaries," published at Paris under the auspices of the Minister of Public Instruction. Dr. Carl Bolle has visited the group more recently, and written several excellent articles in Cabanis's Journal on their ornithology.

Madiera has had the advantage of the residence of several

first-class English naturalists—I need only mention the names of Lowe, Vernon, Wollaston, and Johnson, to establish this point. More than twenty years ago Mr. E. W. Harcourt, in his "Sketch of Madeira," and in contributions to the "Proceedings of the Zoological Society," and "Annals of Practical History," gave us a good account of the ornithology of Madeira. Mr. F. Godman has recently published an excellent article on the Birds of Madeira and the Canaries in the "Ibis" for 1872, in which a complete *résumé* is given of the whole of our previous knowledge of this subject, together with the information obtained by the author himself during his expedition to these islands in 1871.

As regards the fishes of Madeira, they have formed a subject of study of several excellent ichthyologists. The Rev. R. T. Lowe made numerous communications to the Zoological Society of London upon them in the early days of the Society, and published in their "Transactions" a *Synopsis of Madeiran Fishes*, to which divers supplements were afterwards added. Subsequently Mr. J. Y. Johnson took up the subject and made numerous additions to Mr. Lowe's experiences, which were mostly published by the same Society. Dr. Günther has likewise contributed to our knowledge of Madeiran fishes, so that on the whole there is, perhaps, hardly any locality out of Europe with the ichthyology of which we have a better general acquaintance.

For our knowledge of the higher animals of the third island-groups above spoken of, that of the Azores, we are mainly indebted to the energy of Mr. F. D. Godman, who made a special expedition to those islands in 1865, with the object of studying their fauna. The results are embodied in his volume on the Azores, published by Van Voorst in 1870. Morelet's work on the Azores, previously published, is mainly devoted to the Land-shell. Mr. Godman is almost the only authority upon the Mammals, Birds, and other Vertebrates.

2. THE EUROPEAN SUB-REGION.

To discuss, or even to give the titles of, all the works that have been published on the Vertebrates of Europe would extend this address to far beyond its proper limits. I must content myself with a few words on the principal works which have appeared of late years—first, upon the Zoology of Europe generally, and secondly, upon the Faunas of its chief political divisions.

A. Mammals of Europe.

To begin with the Mammals, our standard authority upon the European members of this class is Blasius's "Naturgeschichte der Säugethiere Deutschlands und der angrenzenden Länder," and an excellent work it is. Unfortunately, however, it does not extend into Southern Europe, where alone many of the more interesting forms of European Mammal-life make their appearance. A work founded on Blasius's volume and embracing the additional species of Mammals to be met with in Spain, Italy, and Turkey is very desirable, and it is with great pleasure that I have been informed that an energetic member of this Association has already set some such undertaking before him. The only work of reference of this extent that I am at present acquainted with is Lord Clermont's useful "Guide to the Quadrupeds and Reptiles of Europe," published in 1859. As regards the constituent countries of the European Sub-region, there are but few recommendable works devoted to the illustration of their Mammal-fauna. In England we have Bell's "British Quadrupeds," belonging to Mr. Van Voorst's excellent series. This remained long out of print, until its recent re-issue in 1874 by the author, with the assistance of Mr. R. F. Tomes and Mr. Alston. For France, M. Gervais's "Zoologie et Paléontologie Française" enumerates both recent and fossil Mammals, though most regard is paid to the extinct fauna. As regards Spanish Mammals, almost the only authority I am acquainted with is Rosenhauer's "Thiere Andalusien's" which is, however, very defective, the author having devoted himself principally to the study of the Invertebrates. Captain Cork (afterwards Widdrington) was the original discoverer of several of the rarer Mammals of Spain; but the account of them in his "Sketches" is very meagre. A bare list of the Mammals of Portugal is given by Prof. Barboza de Bocage in the "Revue Zoologique" for 1863. Passing over to Italy, Bonaparte's "Fauna Italica" and Costa's "Fauna del Regno di Napoli" must be mentioned, though both are somewhat out of date. But the former work is still the only authority on certain of the rarer Italian species and local forms.

A recent summary of Italian Mammals has been given by Prof. Cornalia in "Italia;" but on the whole it must be allowed that a good work upon the Mammals of the Italian peninsula is still a desideratum. Of the Mammals of Switzerland, on the other hand, we have an excellent recent work by Dr. Fatio, forming the first volume of his "Faune des Vertébrés de la Suisse," in which special attention is devoted to the difficult groups of Rodents and Insectivores. No student of the European Mammal-fauna should omit to consult it.

Passing to Eastern Europe, we find our state of exact knowledge as to the Mammals very defective. As regards Greece, we may refer to the French "Expedition Scientifique en Morée," in which there is a memoir on the Mammals by Geoffroy St. Hilaire, and Erhard's "Fauna der Cycladen," which gives some details on the Mammals of the Greek Archipelago. Of Turkey we find very little information, and there is certainly still much to be done as regards the smaller Mammals of this part of Europe. In Russia we have Ménétriés's "Catalogue of the Animals of the Caucasus," and P. Demidoff's "Voyage dans la Russie Méridionale," and perhaps other works in the language of the country, which I am not acquainted with. But there can be no doubt that it is in South-eastern Europe that our knowledge of the Mammal-fauna of this continent is exceedingly defective, and that much remains to be done in order to complete our acquaintance with this branch of European Zoology.

In Northern Europe, which we now turn to, the case is quite different. The highly cultivated and laborious naturalists of Scandinavia have for many years paid great attention to this as to every other part of their fauna. The first volume of Nilsson's "Scandinavian Fauna," published at Lund in 1874, has long been a standard book of reference on this branch of zoology. Much, however, has been done since that period; and in Prof. Lilljeborg's lately issued work on the Mammals of Sweden and Norway, we have an exhaustive account of the present state of our knowledge of this subject.

As regards the few Mammals of Spitzbergen, reference should be made to the second volume of Heuglin's "Reisen nach dem Nordpolarmeer," where that energetic naturalist has put together an account of the nineteen species of Mammals that penetrate so far north.

B. Birds of Europe.

(a.) *Europe generally.*—There can be no question, I suppose, that the attractive class of Birds has received much more attention than its sister-classes of Vertebrates in Europe as generally elsewhere. Of late years especially a considerable number of naturalists in almost every part of this continent have devoted their principal attention to ornithology. Two journals are devoted solely to this science—in which the larger number of articles treat of the birds of some portion or other of Europe. The mass of literature on the subject is large, and I must therefore be rather concise in my notices of the principal modern authorities that should be referred to by an inquirer on the subject of European Ornithology.

First, as to the avifauna of the whole continent, Temminck's "Manual"—long the acknowledged authority on this subject—was superseded in 1849 by the issue of Degland's "Ornithologie Européenne." The new edition of this work, issued by the author and Gerbe jointly in 1867, is perhaps now the most complete book of its kind. But it has great faults and imperfections, particularly as regards its indications of the distribution of the species. This branch of the subject had never been properly worked until the recent issue of Mr. Dresser's (formerly Sharpe and Dresser's) "Birds of Europe," which contains, so far as it has hitherto progressed, by far the most exhaustive account of the European birds yet attempted. Its large size and numerous illustrations, however, render it rather cumbersome as a manual; but a handbook based on it when completed, and containing a judicious abridgment of its information (which I hope Mr. Dresser will not fail to prepare), will, I am sure, form a most valuable work.

Fritsch's "Naturgeschichte der Vögel Europas," lately published at Prague, is a cheap and useful manual for those who understand German; while Gould's "Birds of Europe," though out of date, will be always referred to for its illustrations.

(b.) *Birds of Great Britain.*—For many years the standard book of reference on the ornithology of these islands has been Yarrell's "British Birds," and its several Supplements. The new edition of this work, commenced in June 1871 by Prof. Newton, is familiar, no doubt, to most of the mem-

bers of Section D. As to its merits there can be no question; I think it is seldom indeed that a task is entrusted to one so thoroughly competent to perform it, or so careful in the execution of what he undertakes. But the slow progress of the work is appalling. After four years only one of the promised four volumes has been completed. As amongst the best of numerous local works on the birds of this country recently issued should also be mentioned Gray's "Birds of the West of Scotland," and Hancock's memoir on those of Northumberland and Durham. A very useful work of reference for ornithologists is also Mr. Harting's "Hand-book of British Birds," in which the exact dates and places of occurrence of all the rarer visitants are recorded. Those who love licensed illustrations, and have full purses, will not fail to acquire (provided a copy is left) Mr. Gould's splendid work on the "Birds of Great Britain," now complete in five volumes. After this enumeration it will be almost needless to remark that Ornithology has no reason to complain of want of support in this country.

(c.) *Birds of France.*—In France less attention has been devoted to the native birds of late years; and besides the new edition of Degland's "Ornithologie Européenne" already spoken of, I have only to mention Bailly's "Ornithologie de la Savrie," and Jaubert and Barthélemy-Lapommeraye's "Richesse Ornithologique de la Midi de la France," in each of which will be found much information about the rarer birds of the districts respectively treated of.

(d.) *Birds of Spain and Portugal.*—Much attention has been paid to the avifauna of Southern Spain of late years, but rather by visitors from the north than by native naturalists. Lord Lilford and Mr. Howard Saunders have both given us some excellent articles in the "Ibis" on this subject, and have made a variety of interesting discoveries, amongst which are actually several new species,* or at all events well-marked local forms. Dr. A. E. Brehm, long resident at Madrid, has also devoted much attention to Spanish ornithology, and written a complete list of Spanish Birds, which should be consulted. To Colonel Irbý's work on the Straits of Gibraltar I have already alluded; as regards the southern extremity of the peninsula he is our best and most recent authority. For information on the birds of Portugal we must again go to an English source.—Mr. Alfred Charles Smith, "Narrative of his Spring Tour" being the best authority which I am acquainted with on this subject.

(e.) *Birds of Italy.*—Savi's "Ornithologia Toscana," published as long ago as 1827, was for long almost our only authority on Italian ornithology. Bonaparte's "Iconographia," already alluded to, gave some additional information as to rarer species. Salvadori's memoir on the birds, forming the second volume of the recently published "Fauna d'Italia," is the best and most recent authority on this subject, and contains an excellent "Bibliografia Ornithologica Italiana." A large illustrated work on the birds of Lombardy has been recently published at Milan by Bettoni. We must also call attention to the persevering way in which Mr. C. A. Wright has worked up the Avifauna of Malta, and to Mr. A. B. Brooke's recently published notes on the Ornithology of Sardinia.

(f.) *Birds of Turkey and Greece.*—Dr. Krüper, a well-known German naturalist, has been long resident in various parts of the Levant, and has contributed numerous articles upon the birds met with to various periodicals. These have been recently put together and edited by Dr. Hartlaub, and published as a number of Mommsen's "Griechische Jahrezzeiten," which thus contains a summary of all our principal information on the birds of Greece and its islands. Before that our best authority on Grecian birds was Linder-mayer's "Vogel Griechenlands." As regards European Turkey, Messrs. Elwes and Buckley have lately published a good paper in the "Ibis" on its birds; and MM. Alphonse and Vian have written several articles in the "Revue Zoologique" on the ornithology of the neighbourhood of Constantinople. But there is certainly still much to be done as regards birds in this part of the continent, as likewise amongst the islands of the Greek Archipelago, many of which are almost unexplored by the naturalist.

(g.) *Birds of Southern Russia and the Caucasus.*—Though many notices of the birds of Southern Russia have appeared in the "Bulletin" of the Society of Naturalists of Moscow, I am not aware of any complete account of them having been issued. Demidoff, in the third volume of his "Voyage dans la Russie Méridionale," gives a list of the birds of what he calls the

* *Cecusus Sharpii*, P.Z.S. 1873, p. 153, and *Calendrella botica*, Dresser, "Birds of Europe," pt. 21.

"Faune Pontique," but his original observations are somewhat meagre. Eichwald's "Fauna Caspio-Caucasica" and Méndric's Catalogue of the Zoology of the Caucasus, should also be consulted, although both are rather out of date. An excellent zoologist, Hr. Gustav Radde, is now resident at Tiflis; but I do not think he has yet prepared any general account of the birds of the Caucasus, where there must be certainly much of interest, as is proved by the discovery of the remarkable Grouse, allied to our Black Grouse, which has just been described by M. Taczanowski.

(h.) *Birds of Germany and Central Europe.*—Local lists of the birds of the various States of Central Europe, and their principal divisions, are very numerous; and there are also many manuals and memoirs on the same subject. But J. A. Naumann's excellent "Vögel Deutschlands," commenced in 1822, with its supplements, is still, I believe, quite unsurpassed as a standard book of reference on Central European Ornithology. It was generally understood that Prof. Blasius, at the time of his lamented death, had a work on the birds of his native country in preparation; but unfortunately this was never finished, or it would have proved to be, no doubt, of first-rate excellence. In no other country, however, except our own, is ornithology so much cultivated as in Germany. Two societies emulate each other in their pursuit of this science, and a special journal is devoted to its progress. There is no lack, therefore, of recent information upon the birds of every part of Germany, although this has to be fished out of journals and periodicals of different sorts, instead of being put together, as we should rather wish to see it, in some general work.

(i.) *Birds of Scandinavia and North Europe.*—In Scandinavia also there is no dearth of diligent observers of birds as of every other class of animals. The bird-volume of Nilsson's Scandinavian Fauna was published in 1858, and is still worthy of careful study. But the more recent works of Collett upon the Birds of Norway, in German and in English, should be consulted, as also Sundevall's "Svenska Foglarna," unfortunately not quite finished at the time of his decease, and Von Wright and Palmén's "Finland's Foglar." Many memoirs have also recently appeared upon the birds of the extreme north, which have always attracted great interest among ornithologists. Amongst these special attention may be called to v. Heuglin's account of the birds of Nova Zembla, first published in Cabanis's Journal for 1872, and afterwards enlarged and revised in the second volume of his "Reisen in dem Nordpolarmeer;" to Prof. Newton's essay on the birds of Iceland in Mr. Baring-Gould's "Iceland, its Scenes and Sagas;" and lastly, to Messrs. Alston and Brown's narrative of their adventures among the birds of Archangel—a little explored district, and one of much promise, to which one of these active explorers has returned this year.

C. European Herpetology.

In this field of research there is not so much of recent work to record as among the birds; but Dr. E. Schrieber's "Herpetologia Europea," which has just appeared, marks an important epoch in this branch of science, since there was previously no good work of reference upon the Reptiles and Batrachians of Europe. Dr. Schrieber's work is drawn up upon the same plan as Blasius's well-known "Säugethiere Europas," and forms a most convenient handbook. The list of published works and memoirs on the same subject prefaced to it renders it unnecessary for me to refer to the previous authorities on European herpetology in detail. I observe, however, that Lord Clermont's very useful "Guide to the Quadrupeds and Reptiles of Europe" is not referred to in the list, and it would appear that Dr. Schrieber is not acquainted with it. I must also call special attention to Dr. Strauch's excellent memoir on the Serpents of the Russian Empire, recently published in the Memoirs of the Imperial Academy of St. Petersburg, which is as important for the European as for the Asiatic part of the Russian dominion. As regards our native Herpetological Fauna also, I may point out that the last edition of Bell's "British Reptiles," published in 1839, requires considerable revision to bring it up to our present standard of knowledge, and that it is much to be desired that a new edition should be undertaken. Let me venture to suggest that Mr. Van Voorst should communicate with Dr. Günther upon this subject.

D. European Ichthyology.

I am not aware of the existence of any special work on European Ichthyology, but C. Th. v. Siebold published in 1863 a

volume on the Fresh-water Fishes of Central Europe, which forms a useful guide to the Pisci-fauna of the principal European river-basins. For the fishes of the Atlantic which visit the British coasts we have the third edition of Yarrell's "British Fishes," edited by the late Sir John Richardson, which was published in 1859. Now that Dr. Günther's great general work on Fishes has been completed, this portion of Mr. Van Voorst's excellent series would be also much benefited by revision and rearrangement according to Dr. Günther's modern system and nomenclature. As a cheaper and more popular work we may also refer to Conch's "British Fishes" in four volumes, in which the figures are coloured.

Prof. Blanchard issued in 1866 a volume of the Freshwater Fishes of France, which, however, does not bear so high a character as Siebold's work above referred to. For our knowledge of the fishes of Spain and Portugal we are chiefly indebted to Steindachner's memoirs in the Sitzungsberichte of the Vienna Academy, and to F. de Brito Capello's papers in the *Journal of Sciences of Lisbon*. Of those of Italy, Prof. Canestrini has lately published a revised list with short specific characters, as a portion of the work called "Italia" already referred to. Those interested in the fishes of the Black Sea and adjoining river-basins should consult the ichthyological portion of Demidoff's "Voyage dans la Russie Méridionale," entitled "Pisces Faune Pontica." I am not acquainted with any other important recent memoirs on the ichthyological faunas of the different European States which it is necessary to refer to until we come to Scandinavia, where Malmgren published in 1863 an excellent essay upon the Fishes of Finland, which was subsequently translated into German. As regards the fishes of Spitzbergen and Nova Zembla, Heuglin's Synopsis of them in the second volume of his already quoted "Reisen nach dem Nordpolarmeer" is the most recent authority, though it is principally founded upon the labours of Lovén and Thorell, and of the naturalists of the Swedish expeditions of 1861 and 1864.

3. THE SIBERIAN SUB-REGION.

When I call to mind the numerous scientific expeditions sent by the Russians into different parts of their recent acquisition in Northern Asia, and turn over the pages of the excellent and instructive work in which the results of these expeditions have been given to the world, I must own to a feeling of indignation at the manner in which such matters are usually dealt with by the Government of this country. In the first place, in order to get such an expedition sent out at all, great exertions and special influence is necessary. The Treasury must be memorialised, the Chancellor of the Exchequer besought, and the Admiralty petitioned, before any grant of money can be sanctioned for the purpose, and even then it is too often bestowed in a niggardly and grudging way. When the expedition returns, similar applications have to be made in order to get the results worked out and properly published, and these are in some cases altogether rejected, so that the money already spent upon collecting becomes virtually thrown away. In Russia, although the nation may be less awake to the claims of science than in this country, the Government is certainly more so; and it is to the scientific men attached to the Government expeditions that we are indebted for nearly all the knowledge we possess of the fauna of Northern Asia. Of the more important reports of the more recent of these expeditions I will say a few words.

Middendorff's "Sibirische Reise," published in 1851, gives an account of the fauna of the extreme north and east of Siberia. The second volume of the zoological portion is entirely devoted to the Mammals, Birds, and Reptiles, and gives full details concerning the structure and habits of the species met with. Of Von Schrenck's "Amur-reise," a volume published in 1859, contains a complete memoir on the Mammals and Birds of the newly acquired district traversed by the Amoor, lying to the south of that investigated by Hr. v. Middendorff. Lastly, two volumes of Radde's "Reisen in dem Süden v. Ost-Sibirien," published in 1862 and 1863, render more perfect our knowledge of the Mammals and Birds of South-eastern Siberia. Hr. Radde's chief observations were made in Transbaikalia, but he incorporates the knowledge accumulated by his predecessors in the surrounding districts, and goes deeply into general results.

Dr. A. v. Middendorff's "Isleipitseen Russlands" should also be consulted by those who wish to understand the migration of birds in Siberia, or indeed throughout the Russian dominions.

* *Tetrax melochirovici*, Tacz., P.Z.S., 1875.

4. THE MANTCHURIAN SUB-REGION.

Of this district, which embraces the country lying south of the Amoor and the greater part of Northern China, down perhaps to the great river Yang-tze, we have, besides the Russian works lastly spoken of, two principal sources of information. The first of these consists in the researches of Mr. Robert Swinhoe, of H.M. Chinese Consular Service, one of the most industrious and successful exploring naturalists that have ever lived, as is well known to many of my brother members here present. Mr. Swinhoe's memoirs and papers on Chinese Zoology are very numerous, but his last revised list of the birds of China will be found in the Zoological Society's "Proceedings" for 1871. Père Armand David, a worthy rival of our Consul, has likewise contributed in no small degree to our knowledge of the fauna of Northern China. His journals, containing numerous remarks full of interest, have lately been published in the "Nouvelle Archives du Muséum d'Histoire Naturelle de Paris;" and M. Alphonse Milne-Edwards's recently completed "Recherches sur les Mammifères" contains a section specially devoted to the Mammals of Northern China, which is mainly based on Père David's researches. I shall, however, have again occasion to mention the discoveries of both Mr. Swinhoe and M. David in a subsequent portion of this address.

5. THE JAPANESE SUB-REGION.

Temminck and Schlegel's "Fauna Japonica" have long been our standard authority upon the zoology of Japan, and not much has been done of late years to perfect it, except as regards the birds. On this branch of our subject some very good articles have been published in the "Ibis" by Capt. Blackiston, based upon his researches in Hakodadi; by Mr. Whitely, who was for some time resident along with Capt. Blackiston at the same port; and by Mr. Swinhoe. Reference should also be made to the second volume of Commodore Perry's "Narrative of the U.S. Expedition to Japan in 1852-54," wherein will be found articles on the birds collected by Cassin, and on the fishes by Brevoort.

6. THE TARTARIAN SUB-REGION.

Into the great desert-region of Central Asia, hitherto almost unknown, except from Eversmann's "Reise nach Buchara," which contains a short natural-history appendix, excursions have recently been made from two opposite quarters. The advancing tide of Russian conquest from the north, accompanied, as usual, by its scientific corps, has already made us well acquainted with the zoology of Turkestan. Mr. Severtzoff has unfortunately yielded to the unphilosophical spirit of nationality, which has of late years attained such a monstrous development, and published his "Turkestanische Jevotnik," or review of the distribution of animal life in Turkestan, in his native Russian. But a translation and reproduction of the portion relating to the birds has already appeared in German, and an abstract of it in English is now being given to the world by Mr. Dresser in the "Ibis."

From the south, the peaceful embassies of this country to Yarkand have led naturalists into the fringe of the same zoological district. Of the first of these expeditions we have an excellent account as regards the birds by Mr. A. O. Hume, forming the second part of Henderson's "Lahore to Yarkand." Sir D. Forsyth's second expedition to Yarkand and Kashgar was accompanied by Dr. Ferdinand Stollitzska, one of the most accomplished and energetic members of the staff of the Indian Geological Survey, whose life was miserably sacrificed to the hardships encountered on the return. Of this last expedition we have as yet only incomplete accounts,* but may, I trust, look forward to the publication of an equally interesting volume on the zoological results. The ichthyological part of the collections has, I believe, been entrusted to Dr. F. Day to work out in this country.

7. THE PERSIAN SUB-REGION.

Of the Persian or "Mediterraneo-persic" Sub-region, as Mr. Elwes prefers to call it,† which may be held to embrace European Turkey, Palestine, and Persia, our knowledge was until recently very limited, and even up to the present day remains very imperfect, considering the proximity of the district to Europe, and the many interesting features which it presents. As regards Palestine, Canon Tristram's energetic researches have done much to remove what has long been a scandal to biblical scholars as well

as to naturalists. His long-promised "Synopsis of the Flora and Fauna of Palestine" is, however, not yet issued by the Royal Society, and may be consequently content with Mr. Tristram's papers on the Birds of the Holy Land in the "Ibis" and Dr. Günther's article upon the Reptiles and Fishes in the Zoological Society's "Proceedings," until the finished work appears. Of Asia Minor and Armenia it may be said that we are miserably ignorant, Tchihatzeff's desultory account of its natural history in his "Asie Mineure" being almost the only authority we have to refer to—Thirty years ago the Zoological Society had two excellent correspondents at Erzeroum—Messrs. Dickson and Ross; and it is a great misfortune that no continuous account was ever prepared of the fine collection which they sent home.*

As regards Persia, we may hope very shortly to be much more favourably situated. Mr. W. T. Blanford and Major St. John have recently made large zoological collections in various parts of that country, particularly of birds, and it is generally understood that the report of the Persian Boundary Expedition will contain a complete account of the zoology of Persia from Mr. Blanford's accomplished pen. Hitherto we have had to rely on De Filippi's "Viaggio in Persie," and other fragmentary sources of information.

II.—ETHIOPIAN REGION.

This region I shall speak of, for convenience sake, under the following six sub-divisions:—

1. *Western Africa*, from the Senegal to the Congo.
2. *South-western Africa*, or Angola and Benguela.
3. *South Africa*.
4. *South-eastern Africa*, from the Portuguese possessions up to the Somali coast.
5. *North-eastern Africa*, including Abyssinia, Nubia, and Egypt.
6. *Arabia*.

I. WESTERN AFRICA.

The Mammals of Western Africa are certainly not so well known as they should be; and there is no one work which gives an account of them except Temminck's "Esquisses Zoologiques sur la côte de Guinée," which is devoted to the collections transmitted to Leyden by Pel, a most energetic and successful Dutch explorer. On the Mammals of Gaboon, Pucheran's article in the French "Archives du Muséum," and Du Chaillu's travels and the literature connected therewith, should be consulted.

The birds of Western Africa, on the contrary, have attracted much attention from European naturalists since the time when Swainson published his "Birds of West Africa." This work, however, has been quite superseded by Hartlaub's classical "System der Ornithologie West-Afrikas," published in 1857. Since that period many memoirs and papers have appeared on the birds of various parts of this district, principally by Cassin, of Philadelphia, Dr. Finsch, of Bremen, and Mr. R. B. Sharpe, of the British Museum, who has paid special attention to the African Ornithology, and is understood to be preparing a general work on the subject.

For information on the Reptiles and Fishes of West Africa we must refer to Aug. Duméril's memoir in the tenth volume of the "Archives du Muséum et Histoire Naturelle," founded on the collections in the Paris Museum.

2. SOUTH-WESTERN AFRICA.

The Portuguese colonies of Angola and Benguela, which seem to belong to a zoological sub-region, distinct from both that of West Africa and that of the Cape, were until recently almost unexplored. Within these last few years, however, Prof. Barboza du Bocage has acquired extensive series of specimens in nearly every department of natural history from these countries for the Lisbon Museum, and has published several important memoirs on the subject, which he will probably ultimately incorporate into a general work. Mr. J. J. Monteiro has also sent to this country collections of Mammals and Birds which have formed the subject of several papers in the Zoological Society's "Proceedings."

3. SOUTHERN AFRICA.

Sir Andrew Smith's "Illustrations of the Zoology of South Africa" constitute four solid octavo volumes, devoted to the new and rare vertebrates met with during that energetic traveller's many explorations of the Cape Colony and the

* See Hume, "Sraz Feathers," il. p. 513 and ill. p. 215.

† Cf. P.Z.S. 1873, p. 647.

* See notices, P.Z.S. 1839, 1840, and 1844.

adjoining districts. But there is no perfect list of the Cape fauna given in Sir Andrew Smith's work, and Mr. Layard's "Birds of South Africa," though not very completely elaborated, was, therefore, a most acceptable and convenient work to the ornithologist. Still more agreeable will it be to witness the completion of the new and enlarged edition of Mr. Lyall's little volume, which Mr. Sharpe has undertaken, and of which he has just issued the first part. Mr. Sharpe will, however, I trust, pardon me for remarking that he has cut the synonymy of the species rather short in his pages. It is hard to expect every South-African colonist to have at his side the British Museum Catalogue of Birds, to which he always refers us. Another modern and much-to-be-recommended bird-book belonging to this sub-region is Mr. J. H. Gurney's "Birds of Damara-land" founded on the extensive collection of the late C. J. Anderson. No less than 428 species of birds were obtained by this indefatigable collector, and the task of editing his field-notes has been well performed by Mr. Gurney.

4. SOUTH-EASTERN AFRICA.

Our knowledge of the fauna of Mozambique is chiefly due to the scientific visit made to that country by Dr. W. Peters, of Berlin, in 1842 and the following years. The volume of this distinguished naturalist, "Naturwissenschaftliche Reise nach Mozambique," on the Mammals was published in 1852, that on the Fishes in 1864. The delay in the issue of the portions relating to the Reptiles and Birds is much to be regretted, more especially when we consider the high standard of the work, although diagnoses of the new species discovered in these groups have been long since published; and I am sure I am expressing the sentiments of naturalists in general when I say that I hope to see the series shortly completed. Proceeding further north along the African coast, we come to Zanzibar, where an excellent ichthyologist, Consul Playfair, was lately resident. The "Fishes of Zanzibar," by Günther and Playfair, founded on the extensive collections here made, was published in 1866, and gives an account of above 500 species, and many excellent figures.

The ornithology of the whole East-African coast, from Cape Gardafui to Mozambique, has been elaborately worked out by Drs. Finsch and Hartlaub. The results are contained in these authors' "Vogel Ost-Afrikans," forming the fourth volume of the unfortunate Baron Carl Claus von der Decken's "Reisen in Ost-Afrika." Full details as to older authorities on the subject are given in this excellent work, so that it is not necessary to refer to them.

As regards the Mammals of this part of Africa, however, it is necessary to say a few words. Our knowledge of this class of animals is, as regards the coast opposite Zanzibar and the country surrounding the great lakes of the interior, mainly comprised in the fragmentary collections of Speke and Grant (of which an account has been published in the Zoological Society's "Proceedings," and in the few specimens transmitted by Dr. Kirk from Zanzibar. There is no doubt, however, that much remains to be done here, and I believe there is at the present moment no finer field for zoological discovery available than this district, where we know that animal life in every variety is still abundant, and excellent sport can be obtained to add a zest to scientific investigation. The fishes of the great lake of Tanganyika and the Victoria and Albert Nyanza are likewise utterly unknown, and their investigation would be a subject of the greatest interest. Of those of the more southern Nyassa Lake, a few specimens have been obtained by Dr. Kirk.

5. NORTH-EAST AFRICA.

For many years Rüppell's "Atlas" and "Neue Wirbelthiere," and, as regards birds, his "Systematische Uebersicht," remained our standard works of reference upon the zoology of North-eastern Africa. The recent completion of Th. von Heuglin's "Ornithologie Nordost-Afrikas" has superseded Rüppell's volumes for general use; and no more valuable piece of work for ornithologists has been accomplished of late years than the reduction of the multitudinous observations and records of this well-known traveller and naturalist into a uniform series. V. Heuglin's work, however, concerns mainly Upper Nubia, Abyssinia, and the wide territory drained by the confluents of the Upper Nile. For Egypt and the Lower Nile a more handy volume is Capt. Shelley's "Birds of Egypt," published in 1872, which will be found specially acceptable

to the tourist on the Nile. Nor must I forget to mention Mr. Blanford's interesting volume on the Geology and Zoology of Abyssinia, which contains an account of the specimens of Vertebrates collected and observed during his companionship with the Abyssinian Expedition. Mr. Jesse's birds, collected on the same occasion, were examined by Dr. Finsch, and the result given to the world in a memoir published in the Zoological Society's "Transactions."

A good revision of the Mammal-fauna of North-east Africa is much to be desired. Meanwhile Fitzinger's list of v. Heuglin's collection, and the latter author's own account of them in his Travels on the White Nile may be consulted.

6. ARABIA.

Of Arabia, as might have been expected, we know but little, zoologically or otherwise. But little, it may be said, can be expected to be found there, looking to the general aspect of the country. Still it would be of interest to know what that little is. At present the only district that has been visited by naturalists is the peninsula of Sinai, and of this our knowledge is by no means complete. Hemprich and Ehrenberg's unfinished "Symbolæ Physicæ" was for many years our sole authority. More recently Mr. Wyatt has published an article in the "Ibis" upon the birds of the Sinaitic peninsula. Let me suggest to some of the officers who are stationed idle at Aden that an account of the animals to be met with in that part of Arabia would be of great value, and would give them much useful and interesting occupation. I have been more than once told that there is nothing whatever to be found there. But this I am slow to believe. Anyone with a good pair of eyes and a taste for collecting might certainly do much good to science by passing a few months at Aden, and making excursions into that part of "Arabia Felix."

IIa.—LEMURIAN SUB-REGION.

This aberrant appendage of the Ethiopian Fauna I will speak of under two heads, namely:—

1. Madagascar.
2. Mascarene Islands.

I. MADAGASCAR.

To our knowledge of the extraordinary fauna of "Lemuria," as I have elsewhere proposed to call Madagascar and its islands,* great additions have been recently made, but it is manifest that Madagascar is by no means yet worked out.† Dr. Hartlaub's "Ornithologischer Beitrag zur Fauna Madagascars" was the first attempt at a *résumé* of the remarkable avifauna of this part of the world. Since its issue two Dutch naturalists, Pollen and Van Dam, have visited Madagascar, and forwarded rich collections to the Leyden Museum. Of these the Mammals and Birds have been worked out by Professor Schlegel and Mr. Pollen, and the results published in a well-illustrated volume entitled "Recherches sur la Faune de Madagascar." This has been since followed by an accompanying account of the Fishes, and treatise on the Fisheries, by Messrs. Bleeker and Pollen. Following upon the footsteps of these naturalists, a French explorer, Alfred Grandidier, has since visited the interior of Madagascar, and in his turn has reaped a grand harvest, of which some of the results have already been given to the public. But we are promised to have these discoveries in a much more extended and complete form, in a work now in progress, in which M. Grandidier has obtained the efficient assistance of M. Alphonse Milne-Edwards. There still remain to be spoken of the discoveries recently made by an English collector in Madagascar, Mr. A. Crossley. Mr. Crossley's birds have been worked out by Mr. Sharpe in several papers published from time to time by the Zoological Society, while Dr. Günther has described several new and remarkable Mammals from the same source.

2. THE MASCARENE ISLANDS.

The fauna of the islands of Bourbon, Mauritius, and Rodriguez forms an appendage to that of Madagascar, and merits careful study. Our knowledge of these islands, since the recent investigation of Rodriguez by the naturalists sent out with the Venus Expedition, is tolerably complete, but requires to be put together, as it consists of fragments dispersed over various

* Quart. Journ. of Science, 1864, p. 213.

† Witness the Mammal-forms, *Brachyotaryx* and *Mixacelus*, lately described by Dr. Günther and Dr. Peters, and the new genus of birds, *Neodrepanis*, recently characterised by Mr. Sharpe.

journals and periodicals. I trust that Mr. Edward Newton, who has had so many opportunities of acquiring information on this subject during his Colonial Secretaryship at Mauritius, and has so well used these opportunities, may shortly have leisure to devote to this task. His labours to recover the skeleton of *Pezophaps*, in which, I am pleased to think, he was aided by a grant from this Association, are well known, as is likewise the excellent memoir by himself and Prof. Newton, in which the result of his labours was given to the world. Nor must I omit to mention Prof. Owen's dissertations on the extinct fellow-bird of Mauritius, recently published by the Zoological Society.

As regards the recent ornithology of these islands, we have nothing later to refer to than Hartlaub's little work on Madagascar, noticed above, which includes what was then known of the avifauna of the Mascarenes.

The neighbouring group of the Seychelles was visited by Mr. Edward Newton in 1867, and several new and most interesting species of birds obtained there. A complete account of the ornithology of these islands was given by Mr. Newton in the "Ibis" for 1867. Since that period Dr. E. P. Wright, formerly an active member of this Association, has made a scientific excursion to the Seychelles, with a view, as was generally understood, of preparing a complete monograph of the fauna and flora of these interesting islands. It is much to be regretted that this very desirable plan has not yet been accomplished.

III.—INDIAN REGION.

Of the extensive and varied Indian Region I will now proceed to say something under the subjoined heads:—

1. *British India.*
2. *Central and Southern China.*
3. *Burma, Siam, and Cochin.*
4. *Malay Peninsula.*
- 4a. *Andaman and Nicobar Islands.*
5. *East-Indian Islands.*
6. *Philippine Archipelago.*

I. BRITISH INDIA.

For British India Dr. Jerdon's well-known series of zoological handbooks was intended to supply a long-standing want; and it is a great misfortune that his untimely death has interfered with their completion. The three volumes on Birds were finished in 1866, and one on Mammals in 1867. Of the volume on the Reptiles and Batrachians a portion, I believe, was actually in type at the time of his decease; but of the Fishes no part, as far as I know, was so much advanced. For the Reptiles, therefore, we must for the present refer to Dr. Günther's "Reptiles of British India," published by the Ray Society in 1864. Indeed, as regards India, any future account of these animals must, in any case, be founded upon the basis of that excellent and conscientious work. For the Indian fishes generally there is at present no one authority, though Dr. Day, author of the "Fishes of Malabar" and of numerous other papers, is understood to have in preparation a general work on this subject, which his office of Inspector-General of Indian Fisheries has given him excellent opportunities of studying. Complete lists of both the freshwater and marine species of India are given in the appendices to Dr. Day's two "Reports on the Fisheries of India and Burma," published in India in 1873.

But although our wants as regards the Indian Vertebrates will probably be supplied in this way, it would be much more satisfactory if the Indian Government would select a successor to Dr. Jerdon, and place under his control the necessary means for the preparation of a series of zoological handbooks for India. There is no reason why botany should be more favoured than zoology in this matter; and I believe it is only the greater energy of the botanist [that in this, as in other cases, has given them the start. New editions of Dr. Jerdon's Mammals and Birds are both necessary to bring our knowledge up to date, and the original editions are long out of print. There can be no question as to the great impetus to the study of natural history in India that has already followed on the publication of these handbooks; and it will be a great misfortune to science if our Indian rulers fail to continue the good work. They have only to select a competent editor for the series, and to place the necessary funds temporarily at his disposal. The sale of the works would in the end recoup all the necessary expenses.

Amongst more recent contributions to our knowledge of Indian ornithology, which, under the influence above referred to, have been especially numerous, I can now only stop to call

attention to a few. Mr. Allan Hume, C.B., has been specially active, and has published numerous papers in his queerly-titled periodical "Stray Feathers," which is exclusively devoted to Indian Ornithology. Amongst them the articles on the birds of Scinde and those of Upper Pegu are of special interest. Mr. Holdsworth's most useful "Synopsis of the Birds of Ceylon," lately published in the "Proceedings of the Zoological Society," is also of great value, more especially as Ceylon was omitted from the scope of Dr. Jerdon's work. Nor must I omit to mention Major Godwin-Austen's series of papers on the ornithology of the newly-explored districts on the north-eastern frontier, which contains so much of novelty and instruction.

As regards the Testudinata of India, we may shortly expect a complete account of them from Dr. John Anderson, who has devoted much time and toil to their study. His magnificent series of drawings of these animals, from living specimens, I have had the pleasure of inspecting; and I trust sincerely that some means may be found of reproducing them for publication. Such a work would vastly increase our knowledge of this very difficult group of animals.

2. CENTRAL AND SOUTHERN CHINA.

In speaking of Northern China I have introduced the names of the two great modern zoological discoverers in China, Mr. Robert Swinhoe and M. le Père David. Mr. Swinhoe's article on the "Mammals of China," recently published in the Zoological Society's "Proceedings" gives a complete list of the species known to him to occur south of the Yang-tze. It includes those of the great island of Formosa, which is essentially part of China, although it possesses some endemic species, and which was a complete *terra incognita* to naturalists before Mr. Swinhoe's happy selection as the first British Vice-Consul in 1861. Mr. Swinhoe's last revised catalogue of the Birds of China, published in 1871, has been already referred to. He is now at home, unfortunately in ill health, but is by no means idle on his bed of sickness, and has in contemplation, and I may say, in actual preparation, a complete work on Chinese Ornithology, for which he has secured the co-operation of one of our most competent naturalists.

The still more remarkable discoveries of Père David have revealed to us the existence on the western outskirts of China, or on the border-lands between China and Tibet, of a fauna hitherto quite unknown to us, and apparently a pendant of the Sub-Himalayan Hill-fauna first investigated by Hodgson. In his recently completed "Recherches sur les Mammifères," already referred to, M. Alphonse Milne-Edwards has given us a complete account of M. David's wonderful discoveries among the Mammals of this district. M. David's birds were worked out by the late Jules Verreaux, and the novelties described in the "Nouvelle Archives," but no complete list of them has yet been issued. In herpetology, I believe, M. David has also made some remarkable discoveries, amongst which, not the least assuredly, is the discovery of a second species of gigantic Salamander* in the mountain-streams of Moapin.

3. BURMAH, SIAM, AND COCHIN.

I speak of these ancient kingdoms, which occupy the main part of the great peninsula of South-eastern Asia, principally to express my surprise at how little we yet know of them. There are several good correspondents of the Jardin des Plantes in the French colony of Saigou, who have, I believe, transmitted a considerable number of specimens to the Muséum d'Histoire Naturelle, but beyond the descriptions of a certain number of novelties we have as yet received no account of them. The two philosophic Kings of Siam appear not yet to have turned their attention to biological discovery, although there is certainly much to be done in the interior of that State, with which the late M. Moutou, had his life been spared, would certainly have made us better acquainted. As it happens we have only one or two published memoirs upon the results which this unfortunate naturalist achieved.

Lower Burma now forms part of British India, and will be doubtless well explored. As regards Burma proper and the Shan-States, our Indian legislators appointed a most efficient naturalist to accompany the Yucan Expedition of 1868; but when he returned, refused or neglected to provide him with the facilities to work out and publish his results. I rejoice, however, to learn that this error has been to a certain extent remedied,

* *Sibboldia Davidiana*, Blanchard.

and that Dr. Anderson has now in preparation a connected account of his Yucan discoveries, which is to be issued by the Linnean Society in their "Transactions." A separate publication of these results would have involved much additional expense, and would have been more worthy of the Government which sent out the expedition.

4. MALAY PENINSULA.

The Malay peninsula belongs unquestionably to the same Sub-fauna as Sumatra. Its zoology is tolerably well known to us from numerous collectors that have reached this country, but a modern revision of all the classes of Vertebrates is much to be desired. About twenty years ago, Dr. Cantor, of the East Indian Medical Service, published catalogues of the Mammals, Reptiles, and Fishes of Malacca in the Journal of the Asiatic Society of Bengal. To obtain a knowledge of its birds we must refer to the papers of Eyton, Wallace, and various other ornithological writers.

4a. ANDAMAN AND NICOBAR ISLANDS.

The two groups of islands in the Bay of Bengal have of late years attracted considerable attention from naturalists. Port Blair, in the Andaman Islands, having become the seat of an Indian penal settlement, has received visits from several excellent Indian workers who have made extensive collections, especially in ornithology. The most recent authorities upon the birds of the Andaman Islands are Lord Walden, who has worked out the series forwarded to him by Lieut. Wardlaw Ramsay, and Mr. Vincent Ball, who has published in "Stray Feathers" a complete list of all the birds known to occur in the Andaman and Nicobar groups.

5. EAST INDIAN ISLANDS.

Up to a recent period the standard authority on the fauna of the East Indian Islands was the great Dutch work on the Zoology of the foreign possessions of the Netherlands Government, based upon the vast collections formed by Macklot, Müller, and other naturalists, and transmitted to the Leyden Museum. This has been supplemented of late years by several works and memoirs of Dr. Schlegel, the eminent director of that establishment, and in particular by his "Musée des Pays Bas," which contains an account of that magnificent collection drawn up in a series of monographic catalogues. Up to this time, however, Dr. Schlegel has only treated of the class of birds, though at the present moment, I believe, he is engaged on a revision of Quadrumana. To the class of fishes, and especially to the fishes of the Dutch Islands and Seas in the East Indies, another naturalist, Dr. P. P. Bleeker, has for many years devoted great attention. His memoirs and papers on the Ichthyology and Herpetology of the various islands and settlements are far too numerous to mention. But his "Atlas Ichthyologique," his principal work on the Fishes of the Indian Seas, is one of great importance, and claims a special record as embracing the results of the life-work of one of the most energetic and laborious of living naturalists.

The travels of our countryman, Mr. Wallace, in the Malay Archipelago are well known to the general public from his instructive and entertaining narrative, and to zoologists from the large collections which he made in every branch of natural history. It is a misfortune that no general account of them has ever been prepared. But special articles on the birds of the Sula group to the east of Celebes or those of Bourou, and on those of the islands of Timor, Flores, and Lombok, will be found in the Zoological Society's "Proceedings," besides other ornithological papers referring more or less to this district.

Of the island of Celebes we have acquired more intimate knowledge from the researches of Dr. A. B. Meyer, and from two excellent memoirs on its Ornithology, prepared by Lord Walden. The adjacent territory of Borneo has likewise not escaped the attention of recent writers, an accomplished Italian author, Dr. Salvadori, having made it the subject of a special ornithological essay. For the animals of Java and Sumatra, we have unfortunately no such recent authority, but must refer primarily in the one case to Horsfield's Zoological Researches, and in the other to Sir Stamford Raffles' Catalogue, supplementing in each case the deficiency by reference to various more recent books and memoirs. The fact is that before we can attain precise notions as to the real zoological relations of these great islands, we require a much more complete acquaintance with their different faunas, and special monographic essays upon them. So

there is certainly no lack of work remaining for the zoologist in this quarter.

6. PHILIPPINE ARCHIPELAGO.

In spite of the visits of Cuming, and more recently of Semper and Jagor, there has been until very lately great lack of a work for reference on the Vertebrates of the Philippine Archipelago. This deficiency has been partly supplied by the excellent essay published by Lord Walden in the "Transactions" of the Zoological Society, upon the Birds of the Philippines. Although based upon the collections of Dr. A. B. Meyer, this memoir contains a résumé of all that is yet known upon the subject. It likewise points out the deficiencies in our present information, which, I need hardly add, are many and numerous.

That the knowledge of our Mammal-fauna of the Philippines is also by no means perfect, will be sufficiently manifest when I recall to my hearers the fact that there is now living in the Zoological Society's Gardens a very distinct species of *Deer*, quite unknown to all our Museums, which is undoubtedly endemic in one of the Philippine Islands. There is much want of more information on this subject, as also on the Reptiles and Fishes, although Dr. Peters has lately made us acquainted with many novelties from Jagor's researches in these branches.

IV.—NEARCTIC REGION.

This part of my subject will be most conveniently treated of under two heads:—

1. *North America down to Mexico,*
2. *Greenland,*

leaving Mexico to be spoken of as a whole under the Neotropical Region, although part of it undoubtedly belongs to the Nearctic.

I. NORTH AMERICA.

(a.) *Mammals.*—The latest revision of the Mammals of North America is still that of Prof. Baird, contained in the Reports on the Zoology of the Pacific Railway Routes, published by the War Department of the U.S. in 1857. I understand, however, that Dr. Coues is now engaged on the more perfect work on the same subject, which will embrace the results of the large additions since made to our knowledge of this region. The marine Mammals are not included in Prof. Baird's subject; and under this head I may notice two important works recently issued, Mr. Allen's memoir on the Eared Seals, which, especially treats of the North-Pacific species, and Capt. Scammon's volume on the marine Mammals of the North-western coasts of North America, which contains a mass of information relative to the little-known Cetaceans of the North Pacific.

Prior to them Audubon and Bachman's Quadrupeds of North America, published at New York in 1852, was the best book of reference.

(b.) *Birds of North America.*—The American ornithologists have been specially active of late years. Up to about twenty years ago, the recognised authorities upon the Birds of the United States were Wilson, Audubon, Bonaparte, and Nuttall. In 1856 Cassin's "Illustrations," chiefly devoted to the species then recently discovered in Texas, California, and Oregon, appeared. In 1858 the joint work of Messrs. Baird, Cassin, and Lawrence, on the Birds of North America, forming part of the "Pacific Railway Routes," was issued. This was republished with additions as a separate work in 1860 in two volumes, and still forms an excellent work for reference on American ornithology. The List of Authorities given at the end of the letterpress will be found extremely useful for those who require a guide to the literature of American ornithology. But even this bids fair to be superseded by the more recent publications of our energetic fellow naturalists. In the first place, three volumes of a "History of North-American Birds," illustrated by plates and numerous woodcuts, by Messrs. Baird, Brewer, and Ridgway (were issued last year, and two more volumes to complete the work will soon be ready. Then for those who require a handy book for reference nothing can be more convenient than Dr. Coues' "Key," in one volume, published in 1872. The same energetic naturalist has also lately issued a "Handbook of the Ornithology of the North-west," containing an account of the birds met with in the region drained by the Missouri and its tributaries, amongst which he has had such long personal experience. Nor must I conclude the list without mentioning Mr. D. G. Elliot's "Birds of North America," which contains life-sized illustrations of many rare

and previously unfigured species, and Cooper's "Birds of California," devoted to an account of the birds of the Pacific coast-region, which has been edited by Prof. Baird from the late Mr. Cooper's MSS. Of the last-named work, however, only the first volume is yet published. It will be thus seen that we have ample means of acquiring the most recent information on the birds of the Nearctic Region, and in fact in no part of the world, except Europe itself, is our knowledge of the endemic avifauna so nearly approaching towards completion.

(c.) *Reptiles and Batrachians of North America.*—Holbrook's "North American," in five quarto volumes, published at Philadelphia in 1843-4, contains coloured figures of all the North American Reptiles and Batrachians known to the author, and is a reliable work. A large amount of information has been acquired since that period and published in the various "Railway Reports" and periodicals by Hallowell, Baird, Cope, and others. In 1853 Messrs. Baird and Girard published a catalogue of North American Serpents, and Prof. Agassiz devoted the first volume of his "Contributions" mainly to the Testudinata of North America. Prof. Baird tells me that Prof. Cope is now engaged in printing a new catalogue of the Reptiles and Batrachians of North America, which will contain an enumeration of all the species and an account of their geographical distribution.

(d.) *Fishes of North America.*—Of the fishes of North America there is up to the present time no one authority, and the inquirer must refer to the various works of De Kay, Agassiz, and Girard for information. This, aided by the copious references in Dr. Günther's masterly Catalogue, he will have little difficulty in obtaining, so far as it is available. But the "History of American Fishes" is still to be written, and I have no doubt that our energetic brethren of the United States will before long bring it to pass.

2. GREENLAND.

Of Greenland, which is undoubtedly part of the Nearctic Region, I have made a separate section in order to call special attention to the "Manual" for the use of the Arctic Expedition of 1875, prepared under the direction of the Arctic Committee of the Royal Society. A résumé of all that is yet known of the biology of Greenland is included in this volume. I may call special attention to the article on the Birds by Prof. Newton, and on the Fishes by Dr. Lütken, both prepared specially for this work. I am sure you will all join with me in thanking the present Government for sending out this new expedition so fully prepared in every way, and in hoping that large additions may be made to the store of information already accumulated in the "Manual."

(To be continued.)

Department of Anthropology.

ADDRESS BY GEORGE ROLLESTON, M.D., F.R.S., F.S.A.,
PRESIDENT OF THE DEPARTMENT.

Dr. Rolleston began his address by referring to a few of the principal papers which were to be brought before the department. He referred in congratulatory terms to the work in the Pacific Islands brought out this year by Dr. Carl E. Meinicke, and to an article by the Rev. S. J. Whitmee in the *Contemporary Review* for February as the most important recent contribution to the ethnology of Polynesia. He then spoke in high terms of the services rendered to the native Polynesians by the missionaries, quoting to the same effect from Gerland's continuation of Wurtz's "Anthropologie." He also referred critically to Mr. Bagehot's statement that savages did not formerly waste away before the classical nations, as they do now before the modern civilised nations. He then went on to say—

I come now to the consideration of the subject of craniology and craniography. Of the value of the entirety of the physical history of a race there is no question; but two very widely opposed views exist as to the value of skull-measuring to the ethnographer. According to the views of one school, craniography and ethnography are all but convertible terms; another set of teachers insist upon the great width of the limits within which normal human crania from one and the same race may oscillate, and upon the small value which, under such circumstances, we can attach to differences expressed in tenths of inches or even of centimetres. As usual, the truth will not be found to be in either extreme view. For the proper performance of a craniographic estimation, two very different processes are necessary: one is the carrying out and recording a number of

measurements; the other is the artistic appreciation of the general impressions as to contour and type which the survey of a series of skulls produce upon one. I have often thought that the work of conducting an examination for a scholarship or fellowship is very similarly dependent, when it is properly carried out, upon the employment of two methods—one being the system of marking, the other that of getting a general impression as to the power of the several candidates; and I would wish to be understood to mean by this illustration not only that the lines of inquiry are both dependent upon the combination and counter-checking of two different methods, but also that their results, like the results of some other human investigations, must not be always, even though they may be sometimes, considered to be free from all and any need for qualification. Persons like M. Broca and Prof. Aeby, who have carried out the most extensive series of measurements, are not the persons who express themselves in the strongest language as to craniography being the universal solvent in ethnography or anthropology. Aeby, for example, in his "Schädelformen der Menschen und der Affen," 1867, p. 61, says:—"Aus dem gesagt geht hervor dass die Stellung der Anthropologie gegenüber den Schädelformen eine ausserordentlich schwierige ist;" and the perpetual contradiction of the results of the skull-measurements carried out by others, which his paper (published in last year's "Archiv für Anthropologie," pp. 12, 14, 20) abounds in, furnishes a practical commentary upon the just quoted words. And Broca's words are especially worth quoting, from the "Bulletin de la Société d'Anthropologie de Paris," Nov. 6, 1873, p. 824:—"Dans l'état actuel de nos connaissances la craniologie ne peut avoir la prétention de voler de ses propres ailes, et de substituer ses diagnostics aux notions fournies par l'ethnologie et par l'archéologie."

I would venture to say that the way in which a person with the command of a considerable number of skulls procured from one district in modern times, or from some one kind of tumulus or sepulchre in prehistoric times, would naturally address himself to the work of arranging them in a museum, furnishes us with a concrete illustration of the true limits of craniography. I say, "a person with the command of a considerable number of skulls," for, valuable as a single skull may be, and often is, as furnishing the missing link in a gradational series, one or two skulls by themselves do not justify us (except in rare instances, which I will hereinafter specify) in predicating anything as to their nationality. Greater rashness has never been shown, even in a realm of science from which rashness has only recently been proceeded against under an Alien Act, than in certain speculations as to the immigration of races into various corners of the world, based upon the casual discovery in such places of single skulls, which skulls were identified on the ground of their individual characters as having belonged to races shown on no other evidence to have ever set foot there.

It is, of course, possible enough for a skilled craniographer to be right in referring even a single skull to some particular nationality; an Australian or an Eskimo, or an Andamanese might be so referred with some confidence; but all such successes should be recorded with the reservation suggested by the words, *ubi coram qui perierunt?* and by the English line, "The many fall, the one succeeds." They are the shots which have hit and have been recorded. But if it is unsafe to base any ethnographic conclusions upon the examination of one or two skulls, it is not so when we can examine about ten times as many—ten, that is to say, or twenty, the locality and the dates of which are known as certain quantities. A craniographer thus fortunate casts his eye over the entire series, and selects from it one or more which correspond to one of the great types based by Retzius not merely upon consideration of proportionate lengths and breadths, but also upon the artistic considerations of type, curve, and contour. He measures the skulls thus selected, and so furnishes himself with a check which even the most practised eye cannot safely dispense with. He then proceeds to satisfy himself as to whether the entire series is referable to one alone of the two great typical forms of Brachycephaly or Dolichocephaly, or whether both types are represented in it, and if so, in what proportions and with what admixture of intermediate forms. With a number of Peruvian, or, indeed, of Western American skulls generally, of Australian, of Tasmanian, of Eskimo, of Vedda, of Andamanese crania before him, the craniographer would nearly always, setting aside a few abnormally aberrant (which are frequently morbid) specimens, refer them all to one single type.*

* It is not by any means entirely correct to say that there is no variety observable among races living in isolated savage unity. The good people of

south, and the greater denudation of the pre-Devonian land of the north. The Permian he wished to abolish as a separate formation, as it was a group made up of some stained carboniferous rocks and some of Sedgwick's previously described Magnesian Limestone and New Red. He thought that the continental area on whose submerged surface the New Red was deposited sunk unequally, and that conglomerates, where there was material to furnish them, were formed along the receding shore line, but at different dates as different parts of the land got down below the waves. He challenged anyone to show a section in which a greater break could be seen between the Trias and so-called Permian than several which occur amongst various members of the Upper New Red itself—and commented upon the unsatisfactory character of the palaeontological evidence and of the stratigraphical evidence derived from tracing lines through a district where the rock was seldom seen.

Prof. Hull commented upon the difficulty of introducing any material changes in a nomenclature now so widely accepted. Prof. Harkness stated that he was in favour of adopting the classification of Silurian rocks given in Lyell's "Student's Manual." In reply, Prof. Hughes maintained his original claims with much humour and energy.

Prof. Hébert's very interesting communication on Undulations in the chalk of the North of France had special reference to the strata likely to be encountered in the drift-way of the Channel Tunnel. The Professor considered that observations of dips established the existence of two series of folds, one transverse to the other, which by their intersection produce bosses, or geological hills. The lower rocks, and notably the Greensand, may thus come to the surface in the Channel, and admit the sea-water through their porous substance. Sir John Hawkshaw was present, and combated the geological difficulties with great success. A course of no fewer than five hundred borings, made by a plunger from the side of a vessel, had satisfied him of the substantial accuracy of the geological map of the Straits constructed from shore observations, and the information yielded by these borings was in his opinion adequate to prove that the tunnel will run through Lower Chalk in its whole extent. A small irregularity, bringing in some less compact rock, may be successfully and easily encountered by the engineer. In answer to a suggestion that the shallow holes made by the plunger might be deceptive, owing to a superficial detritus along the floor of the Straits, Sir John Hawkshaw explained that the strong wash of the Channel produced a perfectly clean floor. All along the Straits the instrument had brought up chalk where chalk was expected, and gault where gault was expected, and these formations had a perfectly definite boundary upon the floor of the sea.

A paper by Mr. Sanders described some large bones from the Rhaetic beds of Aust Cliff. The dimensions of these fragments are so great as to suggest a large Dinosaurian, but the absence of any medullary cavity seems to imply that the body was habitually submerged. The articular ends, which might be expected to yield useful characters, are not preserved. A communication from Mr. Brodie opened the question of the extent and classification of the Rhaetic beds. The interesting discovery of these deposits at Leicester formed the chief and most novel feature of the discussion. Confident statement was on the whole more conspicuous than matured reasoning in this part of the proceedings of the Section, and much evidently remains to be done to elucidate the palaeontological and physical relations of the deposits in question. For the moment the preponderance, at least of authority, rests with those who affirm the universal spread of a Rhaetic age, and look in every quarter of the globe for a bone-bed with *Ceratodus* and an *Avicularia-convoluta* zone.

A large audience assembled to hear Dr. Carpenter's paper on the red clay found by the *Challenger*. The substance of his remarks has already appeared in the Proceedings of the Royal Society.

The greater part of Tuesday's sitting was occupied by papers and discussion upon the Glacial Period. By this time the easily observable glacial phenomena have been co-ordinated, and there is not quite so much room as formerly for supposition and unconnected facts. The discussion elicited a few curious points, and was interesting, if not particularly instructive. Most readers of such modern summaries as are given in Lyell's "Principles" or Geikie's "Ice Age" would demur to the too sweeping language in which the Chairman summed up the argument. Dr. Wright's opinion that no man living knows anything of the Glacial Period may possibly be just, but it is not sufficiently incontestable to be enunciated *ex cathedra*. The most novel points of Dr. Carpenter's

communication upon the "Sea Bottom of the North Pacific" were the low temperature of the water at great depths, and the supposed existence of coral reefs, drowned by too rapid submergence, upon all the submarine summits. The species are believed to be recent, and the submergence comparatively modern. Some notice was taken of the results obtained by the *Valerous*, and of Mr. Gwyn Jeffrey's view that the Arctic shells of the Sicilian Tertiaries were derived from polar areas by migration through a marine gap not far distant from the present canal of Languedoc. Mr. Thomson's views as to some new genera of fossil corals, which met heavy criticism at the Geological Society, were brought up once more here, but gained no support of consequence. The method of investigation is curious, but it has hitherto proved somewhat barren of results.

Among other good papers may be cited Prof. A. H. Green's account of the Millstone Grit of North Derbyshire and South Yorkshire. This was a highly-condensed statement of the stratigraphical relations of an extensive group of very interesting rocks. The variations in thickness of the different grits were referred to inequalities of the old sea-floor upon which they were accumulated, hollows permitting a greater thickness to form. Had discussion been allowed, it would have been interesting to notice the remarks thrown out by those classifiers of strata who regard the formation of every rock as a definite and almost universal event in the earth's history. Rarely has a better example been given than this of the local conditions, often quite trivial in themselves, which regulate the extent, divisions, and thickness, as well as the mineral and fossil characters of a large formation.

SECTION D.

BIOLOGY.

OPENING ADDRESS BY DR. P. L. SCLATER, M.A., F.R.S., F.L.S., PRESIDENT.*

V.—NEOTROPICAL REGION.

The Neotropical Region is, I suppose, on the whole the richest in animal life of any of the principal divisions of the earth's surface. Much work has been done in it as regards every branch of zoology of late years, and I must confine myself to noticing the most recent and most important of the contributions to this branch of knowledge.

I believe the following† to be altogether the most natural sub-divisions of the Neotropical Region, which are nearly as they are set forth in Hr. v. Pezeln's "Ornithology of Brazil."

1. *Central American Sub-region*, from Southern Mexico to Panama.
 2. *Andean or Columbian Sub-region*, from Trinidad and Venezuela, along the chain of the Andes, through Columbia, Equador, and Peru, down to Bolivia.
 3. *Amazonian Sub-region*, embracing the whole watershed of the Orinoco and Amazonas up to the hills, and including also the highlands of Guiana.
 4. *The South Brazilian Sub-region*, containing the wood-land of S.E. Brazil and Paraguay and adjoining districts.
 5. *The Patagonian Sub-region*, containing Chili, La Plata, Patagonia, and the Falklands.
- Besides these we have:—
6. *The Galapagos*, which, whether or not they can be assigned to any other sub-region, must be spoken of separately.

I. THE CENTRAL AMERICAN SUB-REGION

was, up to twenty years ago, very little known, but has recently been explored in nearly every part, and is perhaps now more nearly worked out than any other of the above-mentioned sub-regions. There is as yet no complete work on the zoology of any portion of it, and the discoveries of Sallé, Boucard, de Saussure, and Sumichrast in Mexico, of Salvin in Guatemala, of v. Frantzius and Hoffman in Costa Rica, of Bridges and Arcé and Veragua, and of McLennan in Panama, together with those of numerous other collectors, are spread abroad among the scientific periodicals of Europe and America. Even of Mexican zoology, long as it has been worked, we have no general account. To mention all these memoirs in detail would be impossible within the limits of this address; but I will say a few words about the more important of them that have lately appeared.

* Continued from p. 362.

† A general sketch of the Mammal-life of this region is given in my article on the Mammals of South America in the *Quar. Journ. of Science* for 1865, and a Summary of the Birds in Sclater and Salvin's "Nomenclature Avium Neotropicalium."

The French are now publishing a work on the results of their scientific expedition to Mexico during the short-lived Empire. Three parts on the Reptiles by Duméril and Bocourt were issued in 1870, and a part on the Fishes, by L. Vaillant, has recently appeared.

A paper on the Mammals of Costa Rica has lately been published by v. Frantzius in Wiegmann's Archiv. Unfortunately, it seems to have been drawn up mainly from notes without reference to the specimens in the Berlin Museum, but nevertheless contains much that is useful and of interest.

Dr. Günther's admirable memoir of the fishes of Central America, published in the Zoological Society's "Transactions" in 1869, is based upon the collections made by Capt. Dow in various parts of the coast, and by Messrs. Salvin and Godman in the freshwater lakes of the highlands of Guatemala and in other localities.

Its value in relation to our general knowledge of the fishes of this portion of America, heretofore so imperfectly known, can hardly be over-estimated. As regards the birds of Central America, it is much to be regretted that we have at present no one authority to refer to. The collection of Messrs. Salvin and Godman embraces very large series from different parts of this region, and together with those of my own collection, wherein are the types of the species described in my own papers, would afford abundant materials for such a task. Mr. Salvin and I have often formed plans for a joint work on this subject, and I trust we may before long see our way to its accomplishment. A similar memoir on the Mammals of Central America is likewise of pressing necessity for the better understanding of the Neotropical Mammal Fauna. There are considerable materials available for this purpose in the collections of Salvin and Arcé in the British Museum, and I trust that some naturalist may shortly be induced to take up this subject.

2. THE ANDEAN OR COLUMBIAN SUB-REGION.

Of this extensive sub-region, which traverses six or seven different States, there is likewise no one zoological account; but I may mention some of the principal works lately issued that bear upon the subject. Lotaud's "Birds of Trinidad" gives us an account of the ornithology of that island, which forms a kind of appendage to this sub-region, and Dr. Finsch has more recently published a supplementary notice of them. Of Venezuela, Columbia, and Ecuador there are only scattered memoirs in various periodicals on the numerous collections that have of late years been made in those countries to be referred to. Several excellent collectors are now, or lately have been, resident in these republics, Herr Georing and Mr. Spence in Venezuela, Mr. Salmon in Antioquia, Professor Jameson and Mr. Fraser in Ecuador, whose labours have vastly added to our knowledge of the zoology of these districts. When we come to Peru, we have Tschudi's "Fauna Péruana" to refer to, which, though unsatisfactory in execution, contains much of value. How far from being exhausted is the rich fauna of the Peruvian Andes, is sufficiently manifest from the wonderful discoveries lately made by Jelski in the district east of Lima, which was in fact that principally investigated by Tschudi. Of these, M. Taczanowski has lately given an account as regards the birds in the Zoological Society's "Proceedings"; and Dr. Peters has published several notices of the more remarkable Mammals and Reptiles.

Further south, in Bolivia, our leading authority is still the zoological portion of D'Orbigny's "Voyage dans l'Amérique Méridionale." This rich and most interesting district has, it is true, been visited by several collectors since D'Orbigny's time; but the results of their journeys have never been published in a connected form, though many of their novelties have been described. Bolivia, I do not doubt, still contains many new and extraordinary creatures hid in the recesses of its mountain valleys; and there is no part of South America which I should sooner suggest as a promising locality for the zoological collector.

3. THE AMAZONIAN SUB-REGION.

On Guiana, where the Amazonian fauna seems to have had its origin, we have a standard work in Schomburgk's "Reise," the third volume of which, containing the Fauna, was drawn up by the Naturalist of the Berlin Museum. For the valley of the Amazons itself, the volumes of Spix and Martius, though not very accurate, and rather out of date, must still be referred to, as likewise the zoology of Castelnau's "Expédition dans l'Amérique du Sud," for the natural history of the Peruvian confluent. As regards the birds, however, we

have several more recent authorities. In 1873 Mr. Salvin and I published in the Zoological Society's "Proceedings" a *résumé* of the papers treating of Mr. E. Bartlett's and Mr. John Huxwell's rich ornithological collections on the Huallaga, Ucayali, and other localities in Eastern Peru. Subsequently we communicated to the same Society an account of Mr. E. L. Layard's collection of birds made near Para, and took occasion to deduce therefrom some general ideas as to the relations of the Avifauna of the Lower Amazons.

As regards the two lower great confluent of the Amazons, Rio Madeira on the right bank, and the Rio Negro on the left bank of the mighty river, our knowledge of their avifauna is mainly due to the researches of Johann Natterer—one of the most successful and energetic zoological collectors that ever lived—of whose discoveries in ornithology a complete account has lately been first published by Mr. A. v. Pelzeln, of Vienna. It is much to be wished that a similar *résumé* of Natterer's discoveries and collections of Mammals, in which order his investigations were of hardly less importance, should be given to the world; and I trust Herr v. Pelzeln will forgive me if I press this subject on his attention.

The fishes of the Amazons and its confluent are many and various, and fully deserve a special monograph. The late Professor Agassiz made his well-known expedition up the Amazons in 1865 with the particular view of studying its fishes, and amassed enormous collections of specimens for the purpose. Whether (as other naturalists have hinted) Professor Agassiz's estimate of the number of new and undescribed species contained in their collection was exaggerated or not is at present uncertain, as the specimens unfortunately lie unstudied in the Museum of Comparative Zoology at Cambridge, Mass. It is a thousand pities this state of things should continue; and I venture to suggest to the great Professor's numerous friends and admirers in the U. S. that no more appropriate tribute to his memory could be raised than the publication of a monograph of Amazonian fishes based on their collections.

4. THE SOUTH-BRAZILIAN SUB-REGION.

This sub-region, which embraces the wood region of S.E. Brazil and adjoining districts, and contains in nearly every branch of zoology a set of species and genera allied to but separable from those of the Amazonian Sub-region, has been much frequented by European naturalists. Its productions are consequently tolerably well known, though there is even here still very much to be done. Burmeister's "Systematische Übersicht" and "Erläuterungen" may be referred to for information on its Mammals and Birds; likewise Prince Max. of New Wied, "Beiträge," which, although of old standing in point of date, is still of great value. The late Dr. Otto Wucherer, a German physician resident at Bahia, paid much attention to the Reptiles of that district, and has written an account of its Ophidians which will be found in the Zoological Society's "Proceedings."

Hr. Hensel has also recently published in Wiegmann's "Archiv" a valuable memoir on Mammals collected in South Brazil, which should be referred to. Prof. Reinhardt has recently completed an excellent account of the avifauna of the Campos of Brazil, based on his own collections and those of Dr. D. W. Lund; and Hr. v. Berlepsch has treated of the birds of Santa Catharina. These are all three most useful contributions to our knowledge of this sub-region. But it is melancholy to think that although a (*sui-generis*) highly civilised European race has resided in the Brazilian Empire so long, and has introduced railways, steamboats, and many other of the appliances of modern Europe, there has never, so far as I know, been produced by them any one single memoir worthy of mention on the teeming variety of zoological life that everywhere surrounds them.

For information on the animals of Paraguay we must still refer to the writings of Don Felix d'Azara, and to Dr. Hartlaub's reduction of his Spanish terms to scientific nomenclature. But modern information about this part of the South-Brazilian Sub-region would be very desirable.

5. THE PATAGONIAN SUB-REGION.

For the zoology of the Argentine Republic, which forms the northern portion of this sub-region, the best work of reference is the second volume of Dr. Burmeister's "La-Plata Reise," which contains a synopsis of the Vertebrates of the Republic. Dr. Burmeister, who is now resident at Buenos Ayres as director

* See "Travels in Brazil," by Prof. and Mrs. Louis Agassiz, Boston, 1868.

of the public museum of that city, has lately devoted himself to the study of the extinct Mammal-fauna, and specially to that of the Glyptodont Armadillos, of which he has lately completed a splendidly illustrated monograph. He has likewise been the chief adviser of the Government in their plans for recognising the University of Cordova, which will ultimately no doubt do much for the cause of natural science in the Argentine Republic. Mr. W. H. Hudson, of Buenos Ayres, has long studied the birds and other animals of that country, and deserves honourable mention in a country where so few of the native-born citizens pursue science. His bird-collections have been worked out by Mr. Salvin and myself, and Mr. Hudson has likewise published a series of interesting notices on the habits of the species.

The "Zoology of the Voyage of the *Beagle*" contains much information concerning the animals of La Plata, Patagonia, and Chili. The "Mammals" by Waterhouse, the "Birds" by Gould and G. R. Gray, the "Fishes" by Jenyns, and the "Reptiles" by Bell, illustrated with notes and observations of Mr. Darwin, will ever remain among the leading authorities on the animals of this part of America. On the Rio Negro of Patagonia, where Mr. Darwin made considerable collections, we have a more recent authority in Mr. W. H. Hudson, whose series of birds from this district was examined by myself in 1872.

Dr. R. O. Cunningham has recently followed on the footsteps of Mr. Darwin in Patagonia, and besides his journal of travels has published notes on the animals met with, in the Linnean Society's Transactions. Mr. Salvin and I have given an account of his ornithological collections in several papers in the "Ibis."

As regards the Falkland Islands, two excellent collectors and observers have of late years been stationed there, and have provided the means of our becoming well acquainted with the native birds. Capt. Packe's collections have been examined by Mr. Gould and myself, and Capt. Abbott's by myself in a paper to which he has added many valuable notes.

Lastly, as regards Chili, we have Gay's somewhat pretentious "Fauna Chilena," forming the zoological portion of his "Historia Fisica y Politica de Chile." The volume on the Mammals and Birds was compiled at Paris by Desmurs, and that on the Reptiles and Fishes by Guichenot, but they are not very reliable. The naturalists of the National Museum of Santiago, Philippi and Landbeck, have of late years published in Wegmann's "Archiv" many memoirs on the zoology of the Chilean Republic, of which I have given a list in a paper on the Birds of Chili in the Zoological Society's "Proceedings" for 1867. More recently Messrs. Philippi and Landbeck have published a catalogue of Chilean birds in the "Anales de la Universidad de Chile." But Mr. E. C. Reed, F.Z.S., who is likewise attached to the museum of Santiago, writes me word that he is now engaged in preparing for publication a complete revision of the Vertebrates of the Republic, which will no doubt give us still better information on this subject.

6. GALAPAGOS.

Until recently our knowledge of the very singular fauna of the Galapagos was mainly based upon Mr. Darwin's researches, as published in the "Zoology of the *Beagle*," above referred to. Recently, however, Mr. Salvin and I have described some new species of birds from these islands from Dr. Habel's collection, and Prof. Sundevall has published an account of the birds collected there during the voyage of the Swedish frigate *Eugenie* in 1852. Mr. Salvin has likewise prepared and read before the Zoological Society a complete memoir on the Ornithology of the Galapagoan Archipelago, which will shortly be printed in the Society's "Transactions." Much interest has likewise been recently manifested concerning the gigantic Tortoises of the Galapagos, which, Dr. Günther has reason to believe, belong to several species each restricted to a separate island. Indeed, I am much pleased to hear that the Lords of the Admiralty, incited by Dr. Günther's requests, have despatched H.M.S. *Tenidas* for the Pacific squadron at Panama to the Galapagos, for the express purpose of capturing and bringing to England specimens of the tortoises of each of the islands. We may, therefore, hope to be shortly more accurately informed upon this most interesting subject.

Va. THE ANTILLEAN SUB-REGION.

The study of the fauna of the West India Islands presents problems to us of the greatest interest: first, on account of the

* See NATURE, vol. xii. p. 238 (1875).

relics of an ancient and primitive fauna which are found there, as indicated by the presence of such types as *Solenodon*, *Dulus*, and *Starnenas*; and, secondly, from the many instances of representative species replacing each other in the different islands. Much, it is true, has been done towards the working out of Antillean Faunas of late years, but much more remains to be done; and it is indeed scandalous that there should be many islands under the British rule, of the zoology of which we are altogether unacquainted. The greater activity of our botanical fellow-labourers has supplied us with a handy volume of the Botany of these islands; and it is by no means creditable to the zoologists to remain so far behind in this as in other cases already alluded to. Within the compass of the present address it would not be possible for me to enumerate all our authorities upon Antillean zoology, but I will mention some of the principal works of reference under the following heads:—

- | | | |
|------------------------|--------------------|--------------------------------|
| 1. <i>The Bahamas.</i> | 3. <i>Jamaica.</i> | 5. <i>Porto Rico.</i> |
| 2. <i>Cuba.</i> | 4. <i>Haiti.</i> | 6. <i>The Lesser Antilles.</i> |
1. *The Bahamas.*

The late Dr. Bryant has published in the *Boston Journal of Natural History* several articles upon the birds of the Bahamas, where he passed more than one winter. These islands, however, merit much more minute investigation than has as yet been bestowed upon them.

2. *Cuba.*

Ramon de la Sagra's "Historia Fisica y Politica de Cuba" and Lenbeye's "Aves de la Isla de Cuba," were up to a recent period our chief authorities upon Cuban zoology. But Cuba has long had the advantage of the residence within it of an excellent naturalist—Don Juan Gundlach—who has laboured hard towards the more complete investigation of its remarkable zoology. We are indebted to him for collecting the specimens upon which Dr. Cabanis based his revision of Cuban ornithology, published in Wegmann's "Archiv," as also for a tabular list of Cuban birds, published in the same journal for 1861, and for several supplements thereto, for the more recent reviews of the mammals and birds of the island, published in the first volume of Poe's "Repertorio," and for many other contributions to the natural history of Cuba. This last-named work, as also the previous "Memorias sobre la historia natural de la Isla de Cuba" of the same author, contains a number of valuable contributions to our knowledge of the rich fauna of this island, and should be carefully studied by those who are anxious to become acquainted with the peculiarities of the Cuban fauna.

3. *Jamaica.*

Mr. Gosse's meritorious work on the Birds of Jamaica, and his "Naturalists' Rambles," are still the main source of our information on the fine island of Jamaica, and very little has been done since his time. A young English naturalist, Mr. W. Osburn, made some good collections in Jamaica in 1860, of which the Mammals were worked out by Mr. Tomes and the Birds by myself. Mr. W. T. March has also more recently sent good series of the birds of the island to America, and Prof. Baird has edited his excellent notes on them. I must not lose the opportunity of calling special attention to the Seals of the Antilles (*Monachus tropicalis* and *Cystophora antillarum* of Gray), of which, so far as I know, the only specimens existing are the imperfect remains in the British Museum brought home by Mr. Gosse. More knowledge about these animals (if there be really two of them) would be very desirable.

4. *Haiti.*

Of this large island very little more is known as regards its zoology than was the case in the days of Buffon and Vieillot. Of its birds alone we have a recent account in a paper which I wrote upon M. Sallé's collection, and in a more recent memoir drawn up by the late Dr. Bryant, and published in the "Proceedings" of the Boston Society of Natural History for 1863.

5. *Porto Rico.*

Nearly the same story holds good of this Spanish island, of which our only recent news relates to the birds, and consists of two papers—one by Mr. E. C. Taylor in the "Ibis," and the other by the late Dr. Bryant, in the journal above mentioned.

6. *The Lesser Antilles.*

As I remarked above, every one of the numerous islands, from Porto Rico down to Trinidad, requires thorough examination.

* Griesbach's "Flora of the West Indies."

It is remarkable that no one has yet been found to attack this interesting subject, which might easily be performed by excursions during the winter months of a few succeeding years.

As regards the ornithology of these islands, the subjoined summary of what we really know and do not know is mainly taken from a paper on the Birds of St. Lucia, which I read before the Zoological Society of London in 1871.

1. *The Virgin Islands.*—Of these islands we may, I think, assume that we have a fair acquaintance with the birds of St. Thomas, the most frequently visited of the group, and the halting place of the West Indian mail steamers. Mr. Riise, who was long resident here, collected and forwarded to Europe many specimens, some of which were described by myself,* and others are spoken of by Prof. Newton in a letter published in the "Ibis" for 1860, p. 307. Mr. Riise's series of skins is now, I believe, at Copenhagen. Frequent allusions to the birds of St. Thomas are also made by Messrs. Newton in their memoir of the birds of St. Croix, mentioned below. In the "Proceedings" of the Academy of Natural Sciences of Philadelphia for 1860, Mr. Cassin has given an account of a collection of birds made in St. Thomas by Mr. Robert Swift, and presented to the Academy; twenty-seven species are enumerated.

Quite at the extreme east of the Virgin Islands, and lying between them and the St. Bartholomew group, is the little islet of Sombbrero, "a naked rock about seven-eighths of a mile long, twenty to forty feet above the level of the sea, and from a few rods to about one-third of a mile in width." Although "there is no vegetation whatever in the island over two feet high," and it would seem a most unlikely place for birds, Mr. A. A. Julien, a correspondent of Mr. Lawrence of New York, succeeded in collecting on it specimens of no less than thirty-five species, the names of which, together with Mr. Julien's notes thereupon, are recorded by Mr. Lawrence in the eighth volume of the "Annals of the Lyceum of Natural History of New York."

The remaining islands of the Virgin group are, I believe, most strictly entitled to their name so far as ornithology is concerned, for no collector on record has ever polluted their virgin soil. Prof. Newton ("Ibis," 1860, p. 307) just alludes to some birds from St. John in the possession of Mr. Riise.

2. *St. Croix.*—On the birds of this island we have an excellent article by Messrs. A. and E. Newton, published in the first volume of the "Ibis."† This memoir, being founded on the collections and personal observations of the distinguished authors themselves, and having been worked up after a careful examination of their specimens in England, and with minute attention to preceding authorities, forms by far the most complete account we possess of the ornithology of any one of the Lesser Antilles. It, however, of course requires to be supplemented by additional observations, many points having been necessarily left undetermined; and it is much to be regretted that no one seems to have since paid the slightest attention to the subject.

3. *Anguilla, St. Martin, and St. Bartholomew.*—Of this group of islands St. Bartholomew alone has, as far as I know, been explored ornithologically, and that within a very recent period. In the Royal Swedish Academy's "Proceedings" for 1869 will be found an excellent article by the veteran ornithologist Prof. Sundevall, on the birds of this island, founded on a collection made by Dr. A. Von Gös. The species enumerated are forty-seven in number.

4. *Barbuda.*—Of this British island I believe I am correct in saying that nothing whatever is known of its ornithology, or of any other branch of its natural history.

5. *St. Christopher and Nevis,* to which may be added the adjacent smaller islands *St. Eustatius and Saba.*—Of these islands also our ornithological knowledge is of the most fragmentary description. Mr. T. J. Cottle was, I believe, formerly resident in Nevis, and sent a few birds thence to the British Museum in 1839. Amongst these were the specimens of the Humming-birds of that island, which are mentioned by Mr. Gould in his well-known work. Of the remainder of this group of islands we know absolutely nothing.

6. *Antigua.*—Of this fine British island, I regret to say, nothing whatever is known as regards its ornithology. Amongst the many thousands of American birds that have come under my notice during the past twenty years, I have never seen a single skin from Antigua.

* Ann. N.H. ser. 3, vol. iv. p. 225; and P.Z.S. 1860, p. 314.

† "Ibis," 1859, pp. 59, 126, 426, and 565.

7. *Montserrat.*—Exactly the same as the foregoing is the case with the British island of Montserrat.

8. *Guadeloupe, Desrodes, and Marie-galante.*—An excellent French naturalist, Dr. l'Herminier, was for many years resident as physician in the island of Guadeloupe. Unfortunately, Dr. l'Herminier never carried into execution the plan which I believe he contemplated, of publishing an account of the birds of that island. He sent, however, a certain number of specimens to Paris and to the late Baron de la Fresnaye, to whom we are indebted for the only article ever published on the birds of Guadeloupe or of the adjacent islands.

9. *Dominica.*—Dominica is one of the few of the Caribbean islands that has had the advantage of a visit from an active English ornithologist. Although Mr. C. E. Taylor only passed a fortnight in this island in 1863, and had many other matters to attend to, he nevertheless contrived to preserve specimens of many birds of very great interest, of which he has given us an account in one of his articles on the birds of the West Indies, published in the "Ibis" for 1864. It cannot be supposed, however, that the birds of this wild and beautiful island can have been exhausted in so short a space of time, even by the energetic efforts of our well-known fellow-labourer.

10. *Martinique.*—This island is one of the few belonging to the Lesser Antilles in which birdskins are occasionally collected by the residents, and find their way into the hands of the Parisian dealers. There are also a certain number of specimens from Martinique in the Musée d'Histoire Naturelle in the Jardin des Plantes, which I have had an opportunity of examining; but, beyond the vague notices given by Vieillot in his "Oiseaux de l'Amérique du Nord," I am not aware of any publications relating specially to the ornithology of this island. Mr. E. C. Taylor passed a fortnight in Martinique in 1863, and has recorded his notes upon the species of birds which he met with in the excellent article which I have mentioned above; but these were only few in number. The International Exhibition in 1862 contained, in the department devoted to the products of the French colonies, a small series of the birds of Martinique, exhibited by M. Bélanger, director of the Botanical Garden of St. Pierre in that island.* This is all the published information I have been able to find concerning the birds of Martinique.†

11. *St. Lucia.*—Of this island I gave an account of what is known of the birds in a paper published in the Zoological Society's "Proceedings" for 1871, based upon a collection kindly forwarded to me by the Rev. J. E. Sempér. Mr. Sempér subsequently communicated some interesting notes on the habits of the species.

12. *St. Vincent.*—St. Vincent was formerly the residence of an energetic and most observant naturalist, the Rev. Lansdowne Guilding, F.L.S., well known to the first founders of the Zoological Society of London, who, however, unfortunately died at an early age in this island without having carried out his plans for a fauna of the West Indies.

Mr. Guilding paid most attention to the invertebrate animals; but his collections contained a certain number of birds, amongst which was a new Parrot, described after his decease by Mr. Vigors as *Pittacus Guildingii*, and probably a native of St. Vincent.

13. *Grenada and the Grenadines.*—Of the special ornithology of this group nothing is known.

14. *Barbados.*—The sole authority upon the birds of Barbados is Sir R. Schomburgk's well-known work on that island. This contains (p. 681) a list of the birds met with, accompanied by some few remarks. It does not, however, appear that birds attracted much of the author's attention; and more copious notes would be highly desirable.

15. *Tobago.* I believe, besides zoologically to Trinidad. Sir W. Jardine has given us an account of its ornithology from Mr. Kirk's collections.

VI.—THE AUSTRALIAN REGION.

Of the Australian Region I will speak in the following subdivisions:—

1. *Australia and Tasmania.*
2. *Papua and the Papuan Islands.*
3. *The Solomon Islands.*

* See an article on Ornithology in the International Exhibition, "Ibis," 1865, p. 288.

† On animals formerly living in Martinique but now extinct, see Guyon, "Comp. Rend." lxxii, p. 589 (1866).

That we know more of the fauna of Australia than of other English colonies in different parts of the world is certain, but no thanks are due from us for this knowledge either to the Imperial or to any of the Colonial Governments. The unassisted enterprise of a private individual has produced the two splendid works upon the Mammals and Birds of Australia, which we all turn to with pleasure whenever reference is required to a member of these two classes of Australian animals. Mr. Gould's "Mammals of Australia" was completed in 1863. Since that period the little additional information received respecting the terrestrial Mammals of Australia has been chiefly furnished by Mr. Krefft, of the Australian Museum, Sydney, in various papers and memoirs. Mr. Krefft has also written the letterpress to some large illustrations of the "Mammals of Australia," by Miss H. Scott and Mrs. H. Forde, in which a short account of all the described species is given. On the Marine Mammals, however, which were scarcely touched upon by Mr. Gould, we have a treatise by Mr. A. W. Scott published at Sydney in 1873, which contains a good deal of useful information concerning the seals and whales of the Southern Hemisphere.

The magnificent series of seven volumes of Mr. Gould's "Birds of Australia" was finished in 1848. In 1869 a supplementary volume was issued, containing similar full-sized illustrations of about 80 species. In 1863 Mr. Gould reprinted in a quarto form, with additions and corrections, the letterpress of his great work, and published it under the title of a "Hand-book to the Birds of Australia." This makes a convenient work for general reference. Of two colonial attempts to rival Mr. Gould's series I cannot speak with much praise. Neither Mr. Diggle's "Ornithology of Australia" nor Mr. Halley's proposed "Monograph of the Australian Parrots" are far advanced towards conclusion—indeed, of the last-mentioned work I have seen but one number.

Several large collections of birds have been made in the peninsula of Cape York and adjoining districts of Northern Queensland of late years, and it is a misfortune for science that we have had no complete account of them. One of the largest of these, however, made by Mr. J. T. Cockerell, has luckily fallen into the hands of Messrs. Salvin and Godman, and will, I trust, be turned to better uses than the filling of glass cases and the ornamentation of ladies' hats.

It seems to me that there is still much to be done even in birds in Northern Australia, and I cannot help thinking that Port Darwin, the northern extremity of the trans-continental telegraph, would be an excellent station for a collecting naturalist, and one where many novelties, both zoological and botanical, would certainly be met with.

On the Snakes of Australia we have an excellent work published in 1869 by Mr. Gerard Krefft—one of the few really working Australian naturalists, who, it appears, is not appreciated in Sydney as he fully deserves to be. Mr. Krefft, during his long residence in Sydney, has become well acquainted with the Ophidians of the colony and has devoted special attention to them, so that he has the advantage of practical as well as scientific acquaintance with his subject. The late Dr. Gray has written many papers on the Tortoises and Lizards of Australia. Of the latter we have to thank Dr. Günther for a complete monographic list just published in one of the newly issued numbers of the "Voyage of the *Erebus* and *Terror*." Most of the plates of this work were also issued in 1867 by Dr. Gray in his "Fasciculus of the Lizards of Australia and New Zealand."

For information on the fishes of Australia reference must be made to the ichthyological portion of the "Zoology of the *Erebus* and *Terror*," by Sir John Richardson, and to the same author's numerous papers on Australian fishes in the "Annals of Nat. Hist." and "Transactions" and "Proceedings" of the Zoological Society of London. The Count F. de Castelnau, who seems to be almost the only working ichthyologist in Australia, has recently published in the "Proceedings of the Zoological and Acclimatisation Society of Victoria," several papers on the fishes of the Melbourne fish-market and of other parts of Australia, which include a complete synopsis of the known Australian species.

2. PAPUA AND ITS ISLANDS.

I believe that my paper upon the Mammals and Birds of New Guinea, published by the Linnean Society in 1858, was my first attempt to put together the scattered fragments of our knowledge of this subject. In 1859 a British Museum Catalogue by Dr. J. E. and Mr. G. R. Gray, gave a *sumé* of the

then known members of the same two classes belonging to New Guinea and the Aru Islands, and included notices of all Mr. Wallace's discoveries. In 1862 Mr. Wallace gave descriptions of the new species discovered subsequently to his return by his assistant, Mr. Allen. In 1863 Dr. Finsch published at Bremen an excellent little essay called "Neu-Guinea und seine Bewohner," in which is given a complete account of our then state of knowledge of the subject. But within these last ten years still more serious efforts have been made by naturalists of several nations to penetrate this *terra incognita*. Two emissaries of the Leyden (Museum—Bernstein and V. Rosenberg—) have sent home full series of zoological spoils to that establishment, and have discovered a host of novelties. Of these the birds have been described by Prof. Schlegel in his "Observations Zoologiques." An intrepid Italian traveller, Signor L. M. d'Albertis, made a still further advance, when in September 1872 he accomplished the first ascent of the Ariak Mountains, and discovered the splendid Bird, of Paradise and other new species which I described in 1873. Quickly following on his footsteps, Dr. A. B. Meyer penetrated still further into the unknown interior, and reaped the abundant harvest of which he has given us an account in six papers lately published at Vienna. Dr. Meyer has now become director of the Museum of Dresden, and is no doubt occupied in the further elaboration of his rich materials. In the meanwhile some accomplished Italian naturalists are engaged on the collections of D'Albertis and his quondam companion Beccari. Count Salvadori, who is at work on the birds, will take the opportunity of preparing a complete account of the ornithology of Papua and its islands, similar to that in Borneo, of which I have already spoken. The Marquis Giacomo Doria has already published one excellent paper on "The Reptiles of Amboina and the Ké Islands," collected by his compatriot Beccari, and is preparing other memoirs on the Mammals and Reptiles of New Guinea and the Aru Islands obtained by D'Albertis.

Dr. Meyer has lately given an account of his herpetological discoveries in New Guinea, which comprehend several new and most interesting forms, in a memoir read before the Academy of Berlin; and Dr. Bleeker some years ago gave a list of the reptiles obtained by V. Rosenberg in that island, and enumerated the Papuan reptiles then known to him.

All these expeditions, however, have been directed towards the western peninsula of New Guinea, which alone is yet in any way explored by naturalists. Of the greater south-eastern portion of the island (unless we are inclined to give credit to Capt. Lawson's wonderful exploits) we have as yet very little information. A cassowary[†] and a kangaroo, † brought away by the *Basilisk* from the southern coast, both proved to be new to science, as did likewise a Paradise Bird obtained in the same district by Mr. D'Albertis. ‡ This is sufficient to give us an idea of what we may expect to find when the interior of this part of New Guinea is explored. And I may take this opportunity of mentioning that a most active and energetic traveller is perhaps at this very moment at work there. M. L. M. d'Albertis, of whose previous labours I have just spoken, returned to the East last autumn. Letters received from him by his Italian friends in June last state that he had at the time of writing already succeeded in reaching Yule Island near Mously Bay, on the south-east coast of New Guinea, and proposes to establish his headquarters there for expeditions into the interior.

3. NEW IRELAND, NEW BRITAIN, AND THE SOLOMON ISLANDS.

I devote a few words specially to these islands because they are easy of access from Sydney, and because their productions are of particular interest, belonging, as they do, to the Papuan and not to the Polynesian fauna. I have put together what is known of the birds of the Solomon's group in a paper read before the Zoological Society in 1869. Seeing the interesting results obtained from the examination of one small jar of birds collected by an unscientific person, there can be little doubt of the value of what would be discovered on the more complete investigation of the group. As regards New Ireland and New Britain, we have but scattered notices to refer to. The last-named island is, we know, the home of a peculiar cassowary (*Casuarus bennetti*).

* See NATURE, vol. viii. p. 502 (90).

† *Casuarus pectoralis*, Sci., P.Z.S. 1875, p. 89.

‡ *Dorcopsis leucina* (D'Albertis), v. Garrod, P.Z.S. 1875, p. 48.

§ *Perodipus rugglesi*, Slater, P.Z.S. 1875, p. 559.

A list of the fishes of the Solomon Islands is given by Dr. Günther in Mr. Brenchley's "Cruise of the *Curacao*," which I shall allude to presently.

VII.—PACIFIC REGION.

Of this region, where Mammals (except a few bats) are altogether absent, and birds are the predominant form of vertebrate life, I will say a few final words under three heads:—

1. *New Zealand.* 2. *Polynesia.* 3. *The Sandwich Islands.*

1. *New Zealand.*

In New Zealand, of all our Colonies, most attention has lately been devoted to natural history, and several excellent naturalists are labouring hard and well—I need only mention the names of Dr. Hector, Dr. Haast, Capt. F. W. Hutton, and Dr. Buller. The commendable plan of affiliating the various local societies together to one institute has resulted in the production of an excellent scientific journal, already in its sixth volume, which contains a mass of most interesting papers on the fauna and flora of the colony. To refer to these memoirs in detail is quite unnecessary; but it is obvious, on turning over the pages of the volumes of the Transactions of the New Zealand Institute, how great are the exertions now being made to perfect our knowledge of the natural products, both recent and extinct, of our antipodean colony.

Dr. W. L. Buller's beautiful volume on the ornithology of New Zealand, finished in 1873, is likewise a most creditable production both to the author and to those who have supported and promoted his undertaking. Few, indeed, are the colonies that can boast of a similar piece of work!

In 1843 the late Sir John Richardson presented to this association a special report on the Ichthyology of New Zealand; but much advance has, of course, been made since that period.

The lizards of New Zealand have been recently enumerated along with those of Australia in Dr. Günther's memoir above referred to.

2. *POLYNESIA.*

Great additions have recently been made to our knowledge of the natural productions of the Polynesian Islands by the travellers and naturalists employed by the brothers Godeffroy of Hamburg. These gentlemen not only have extensive collections made, but also trouble themselves to get them properly worked out. The excellent volume on the ornithology of the Fiji, Samoa, and Tonga Islands, published in 1867 by Drs. Finsch and Hartlaub, is based entirely upon materials thus obtained, as are likewise the many capital memoirs which fill the parts of the illustrated quarto *Journal der Museum der Godeffroy*—a journal replete with information upon the geography, ethnography, and natural history of Polynesia. Amongst these memoirs I must call special attention to Dr. Günther's "Fische der Sudsee," founded upon Mr. Andrew Garrett's splendid collection of fishes and of drawings of them, coloured from life, of which three parts are already issued. We have now almost for the first time the after opportunity of becoming acquainted with the exceeding beauty of the tropical fishes in life.

The late Mr. Julius Brenchley's account of his cruise in H.M.S. *Curacao* among the South Sea Islands, and published in 1873, contains an appendix of "Natural History Notices," illustrated by figures of remarkable specimens obtained on the occasion. Of these the part relating to the birds is by the late Mr. G. R. Gray, and those concerning the reptiles and fishes by Dr. Günther.

3. *THE SANDWICH ISLANDS.*

The Sandwich Islands stand apart zoologically as geographically from the rest of Polynesia, and merit more special attention than has yet been bestowed upon them. Of their birds, which form the most prominent part of their vertebrate fauna, Mr. Dole has given a synopsis in the "Proceedings of the Boston Society of Natural History."—In noticing this paper in the "Ibis" for 1871, I have introduced some supplementary remarks upon the general facies of the Avifauna.

CONCLUSION.

In concluding this address, which has extended, I regret to say, to a much greater length than I anticipated when I selected the subject of it, I wish to endeavour to impress upon naturalists the paramount importance of locality.

In the study of distribution more probably than in any other direction, if perhaps we except embryology, will be ultimately found the key to the now much vexed question of the origin of

species. The past generation of naturalists could not understand the value of locality. A museum was regarded as a collection of curiosities, and so long as the objects were there it little mattered in their eyes whence they came. The consequence is that all our older collections, and even, I regret to say, our national collection itself, are filled with specimens utterly without a history attached to them, unless it be that they were purchased of a certain dealer in a certain year. Even in the present generation it is only the more advanced and enlightened thinkers that really understand the importance of locality. It is with the hope of impressing the value of locality and distribution more firmly upon you that I have devoted my address not to the general progress of biology, but to the present state of, and recent additions made to, our knowledge of the geographical distribution of the Vertebrata.

Dr. Carpenter, in moving a vote of thanks to the President for his address, said its value would only be fully appreciated by the working naturalist studying and consulting it in the prosecution of his researches. Such a stock-taking was of the highest value in guiding to the right study of what was known, and in laying bare deficiencies. Within a few years the subject of geographical distribution had arisen to great dimensions, both in relation to the origin of species and to the changes in the earth's surface since the present distribution of life had been approximately attained. Any single fact with regard to distribution had its value, but accuracy was vital; as he proceeded to show. The different species of fresh-water fish in Swiss lakes were now regarded as modifications due to differences of food, temperature, bottom, &c., having their slow effect in developing races since the time when the various waters were in communication, and if changes were admitted to such an extent in our existing fauna as the result of plain causes, it was legitimate to argue that much greater changes might have taken place in the ages of geological time.—Professor Allman spoke of the increased importance of all the results of exploration since the promulgation of the doctrine of descent, which was now almost universally accepted in one form or another.—Professor Rolleston said that Dr. Sclater's paper on Geographical Distribution had come out in 1858, before Messrs. Darwin's and Wallace's papers had been published; and yet what he had laid down in 1858, he had in no important points had to modify. He did not know of any biological doctrines had undergone so little change since that period.—Dr. Sclater announced that he proposed to add an appendix to his address, containing the full titles of all the works he had referred to.

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Professor Newton read a paper "On certain neglected subjects of ornithological investigation." He said that it seemed to him that ornithologists had been getting into certain well-worn ruts, to the abandonment of other tracks which were well worth travelling upon. He had recently had occasion to take stock of our present ornithological knowledge, and on the whole the result was gratifying. Some departments had received an enormous impetus from the doctrines of evolution, and that impetus would continue and would probably be increased. Some years ago there was a very general disposition to cry down species-mongers, as they were called in opprobrium; but it was a very short-sighted view; and in his opinion they were having their revenge, for their work had now a value far above that which it had in the Pre-Darwinian days. The result of labours on geographical distribution was good, and was gradually helping to build the edifice of evolution; not that the edifice was erected yet; its walls were still far from complete. Yet he thought its completion was about as sure as anything well could be. The subject of what he might call developmental osteology, in which the illustrious name of Parker stood practically alone, was one in which it might truly be said that the harvest was plentiful and the reapers few. There was room for a score of Parkers; yet it was no more likely that they would get them than that they would get a score of Shakespeares. Fossil ornithology had not as yet produced very great results, but descriptive anatomy was in a fairly good condition, although he was afraid that a great many skilled observers of the outsides of birds knew very little about it. As to pterylography, he feared it was not very much thought of, and that a vast majority of ornithologists did not know the meaning of the word. He recommended all to read the translation of Nitzsch's great work on the subject in the Ray Society's publications. He noticed the greatest falling-off in observational ornithology. They had outdoor ornithologists by