A few suggestions may be made respecting the best modes of preventing the ravages of the Hessian fly. They have all been published before, by others, but they are of such a nature that there is little probability that any of them will ever exterminate the insect. The stouter varieties of wheat ought always be chosen, and the land should be kept in good condition. If fall wheat is sown late, some of the eggs will be avoided, but risk of winter-killing the plants will be incurred. If cattle are permitted to graze the wheat fields during the fall, they will devour many of the eggs. A large number of the pupæ may be destroyed by burning the wheat-stubble immediately after harvest, and then ploughing and harrowing the land. This method will undoubtedly do much good. As the Hessian fly also lays its eggs, to some extent, on rye and barley, these crops should be treated in a similar manner.

New Haven, Conn.

Art. XV.—*Proceedings of Learned Societies.*

I. *Association of American Geologists.*

The second annual meeting of this Association was held during the second week in April, at the rooms of the Academy of Natural Sciences in Philadelphia. The following is an abstract of the proceedings.

Monday, April 5th, 1841, 4 o'clock, P. M.—The Association met pursuant to the adjournment of last year. The regularly appointed presiding officers being absent, Prof. Henry D. Rogers was called to the chair. After the completion of some business arrangements, the Association adjourned until 10 o'clock, A. M. of Tuesday.

Tuesday, April 6th, 1841, 10 o'clock, A. M.—The Association met pursuant to adjournment. *Prof. Silliman* took the chair. *Dr. L. C. Beck* was appointed secretary. *Messrs. W. R. Johnson, Vanuxem, H. D. Rogers, Mather*, and *Locke*, were appointed a committee to report a plan of business for the meeting.

The subject of mineral manures having been referred at the last annual meeting, was proposed for discussion. Remarks were offered, and facts stated by *Mr. Martin H. Boyé, Drs. Charles T. Jackson, James B. Rogers, J. Locke*, and *Mr. B. Silliman, Jr.*

Mr. Boyé enquired whether the antacid powers of magnesia, and its effects on vegetation, had been noticed, as it exists in the dolomitic limestone.

Dr. Jackson inferred from his observations, that magnesia is injurious only when used in a caustic state, in the same manner as caustic lime is known to be injurious to vegetation by abstracting carbonic acid from the atmosphere, and from decomposing vegetable and animal matters. It also acts unfavorably in virtue of its hydraulic power; rendering in some cases, the soil very hard. He further stated, that when composted with peat and swamp muck it gained from these substances phosphoric acid, and thus became the means of conveying to wheat and other cereal grains the phosphate of magnesia, known to be always found in their ashes. Dr. Jackson further considered the combinations of lime with the organic acids of soils as deserving much attention. He had found subsoils to contain a larger quantity of crenates of lime than the soil, and that some streams in like manner contained a larger proportion of soluble crenates than others, and these former are most valuable for the purposes of irrigation. Dr. J. recommends the employment of a compost of lime, swamp muck or peat, and animal manure, and he attributes the beneficial effect of this in part to the evolution of ammonia consequent upon the decomposition of the organic matters.

The discussion then turned on the character of hydrated peroxide of iron on vegetation. It was thought by Dr. Jackson, that the injurious effects sometimes known to arise from it were to be attributed to free sulphuric acid contained in it from the decomposition of sulphuret of iron. A marl was cited which at first produced very luxuriant vegetation, but at a subsequent period was found to destroy the plants growing where it had been used, owing to the decomposition of sulphuret of iron contained in it, producing free sulphuric acid, which corroded the plants. *Prof. H. D. Rogers*, thought that some of the marls of *New Jersey*, contained so much sulphuret of iron as to require more alkaline matter than was to be found in them to neutralize the acid resulting from their decomposition. Still it was thought that *small quantities* of sulphuret of iron, in a marl, would by its decomposition be useful in agriculture.

The subject of potash in soils was next brought before the meeting. *Dr. Jackson* inquired if any experiments had been

made on this subject by gentlemen present. He had digested soils from Maine, New Hampshire, and Rhode Island, with boiling water, without discovering more than a trace of potash; while the method proposed by Mitscherlich of digesting the soils in free sulphuric acid, always gave decided indications of potash. He was led to infer, therefore, that the mica and other minerals containing potassa were by this method decomposed.

Mr. B. Silliman, Jr. stated, that the soil of the Nile, when treated according to the method of Mitscherlich, gave abundance of potash, but not any appreciable quantity with boiling water; he was therefore led to believe that the mica, contained abundantly in the soil, was decomposed by the sulphuric acid.

Resolved, That a committee be appointed to prepare a detailed report upon the subject of soils and mineral manures, embodying as well the fruits of their own investigations as the results arrived at by others, and that the same be presented at the next meeting.

Drs. C. T. Jackson, Robert Rogers, Mr. M. Boyè, Dr. L. C. Beck, Dr. W. Horton, Mr. B. Silliman, Jun., and *Prof. Booth*, were appointed on the above committee.

The committee appointed to prepare a plan of business, made a report, which was adopted.

Prof. Mather asked for and obtained leave to defer his report on "Drift," until the next meeting of the Association; in the mean time he was requested to make an oral communication on this subject during the present meeting.

Prof. Locke read a paper "On the Geology of some parts of the United States west of the Allegany Mountains."

In this paper the author exhibited particularly the points of agreement between the lead region of the upper Mississippi, and that of Derbyshire in England, and between the mountain limestone of Europe and the "cliff limestone" of the west. He showed that the two rocks agree in geological position, in external and chemical characters, in fossil remains, and in metallic veins; being both highly metalliferous and abounding in lead and zinc ores occupying vertical fissures. He described the upper, middle, and lower beds of the "cliff limestone" of the lead region of the west as differing somewhat in characters and in fossil remains, and suggested the inquiry whether these three beds, together with the blue fossiliferous limestone which underlies them, (the probable equivalent of the Trenton limestone,) and the alternations of the lower magnesian limestone with the saccharoid sandstone, found at Prairie du Chien, should be considered distinct formations, (as their fossil remains would to some extent

indicate,) or as different members of one formation—the mountain limestone.

In reply to some remarks by *Prof. H. D. Rogers*, *Prof. Locke* observed, that he did not undertake to be the advocate of absolute equivalency, but merely to point out the agreement and disagreement of certain formations in America with similar ones in Europe. He was of opinion, however, that certain points of equivalency must be admitted, as for example granite, the great coal formations, &c.

Prof. Mather proposed the subject of "Joints of Rocks" for discussion during this session of the Association; and *Prof. H. D. Rogers* proposed that of "Fossil and Recent Infusoria."

The Association then adjourned until 4 o'clock this afternoon.

April 6th, 1841, 4 o'clock, P. M.—The Association met pursuant to adjournment, *Prof. Locke* in the chair.

Mr. William C. Redfield exhibited specimens of fossil shells, from the tertiary marl-beds at Washington, Beaufort county, North Carolina.

Mr. R. stated that these beds, which are about sixty miles from the Atlantic, are found from fifteen to twenty feet below the adjacent surface, and two or more feet lower than the usual level of Pamlico river and sound. The fossils are in a good state of preservation, and are supposed to belong to the miocene period.

Prof. Locke read a paper "on a new species of Trilobite, found at Cincinnati, Ohio," and called by him Isotelus maximus.

This species is characterized by its elliptical terminations, and by a thorn-like process about one tenth of the length of the animal, projecting backwards from each angle of the shield, similar to an Ogygia. He exhibited casts of one entire specimen, nine and three fourths inches in length, and of a fragment of another of double that size in linear dimensions, which of course must have been nineteen and a half inches long—the largest specimen hitherto known to have been found.

Dr. Jackson stated that trilobites had been found in the limestone at the mouth of St. Croix river. He then exhibited the following specimens of minerals and fossils, viz.

Fossils from the limestone belonging to the red sandstone group of Machias, Maine. A new mineral from Unity, New Hampshire, which he has analyzed and proposes to describe under the name of chlorophyllite; it was remarkable as containing a large amount of phosphoric acid. A new mineral from Natick, Rhode Island, described by him under the name of Masonite. Tin ore from Jackson, New Hampshire, near the celebrated gorge of the White mountains. Phosphuret of copper and iron mixed with

tremolite, from the town of Warren, N. H.; the mass yields from 6 to 12 per cent. of metallic copper. Recent bituminous coal from the vicinity of Newfield, Maine, taken from a peat bed. New red sandstone from Tobig river, in New Brunswick, containing about one half its weight of gypsum. Syphonia, a fossil-like substance with tubulæ running through them and assuming various forms. They were supposed to be concretions formed around twigs and roots of trees or other organic matter.

Dr. L. C. Beck read a paper "On the Sulphur Springs of the State of New York."

In this paper the author noticed, 1st. The geographical range of these springs, their geological positions and associations. Under this head it was stated that they are found in almost every formation, from the slates of the Hudson river to the shales of Erie and Chatauque county, having a range over nearly the whole state, and being found in almost every county. 2d. The amount of gaseous matter evolved by these springs. This cannot be correctly ascertained, but from many facts stated by the author, there can be no doubt of its vast quantity. Some instances were mentioned in which large streams and ponds were impregnated with sulphuretted hydrogen. It was also remarked, that independently of the amount of gas which is held in solution by the waters of these springs, there is often a flow of gas which seems to be undissolved or uncombined. 3d. Some facts were stated in regard to the uniformity in the composition of these springs. In all cases in which they have been examined, they contain, in addition to the sulphuretted hydrogen, a small proportion of carbonic acid. The solid matters are almost invariably sulphates of lime and magnesia, with smaller proportions of carbonate of lime, and occasionally sulphate of soda. It was especially observed that sulphate of iron is very rarely found among the solid ingredients of these waters. Common salt is often found in the sulphur springs which occur in the vicinity of the Onondago brine springs. 4th. The author next adverted to the observations which had been made in regard to the temperature of the New York sulphur springs. Although these have not yet been very extensively conducted, those which have been made seem to warrant the inference that the temperature of these springs is somewhat higher (say 1° to 3°) than that of the mean temperature of the localities in which they are found.

The author then proceeded to examine the theories which have been proposed to account for the formation of sulphur springs. The decomposition of iron pyrites, often assigned as a cause, was objected to on the ground that it was not sufficiently general—that it did not meet those cases in which these springs are found in the older rocks—that from what is known concerning the decomposition of iron pyrites, it seems to be in-

adequate to account for the enormous quantity of sulphuretted hydrogen which is evolved, and lastly, that the almost entire absence of sulphate of iron in the New York sulphur springs, is irreconcilable with this theory.

The author then noticed the two general theories which have been proposed in regard to the origin of these springs, and gave the preference to the chemical theory, or that which attributes them, as the products of the great volcanic focus, to a chemical agency, as most consistent with the facts hitherto observed in the State of New York. He proposed, however, to extend the chemical theory so as to include the action of water upon the sulphurets of the bases of the alkalies and alkaline earths assumed to exist in the interior of the earth.

The Association then adjourned until 10 o'clock, Wednesday morning.

Wednesday, April 7th, 1841, 10 o'clock, A. M.—The Association met pursuant to adjournment. *Prof. Silliman* in the chair.

The subject of sulphur springs was discussed by *Messrs. H. D. Rogers, Locke, M. H. Boyè, Johnson* and *Mather*. *Mr. Vanuxem* announced his intention of presenting his views in regard to the New York sulphur springs at the next meeting of the association.

Prof. Hubbard presented a specimen of the slate found at Waterville, Maine, containing impressions, which in the Geological Report of Maine, were described as resembling ferns and fuci, which they resembled more than any thing else that had been found at that time, and of course an error in regard to their nature was unavoidable. Having received Murchison's Silurian system about two years since, Prof. H. found that the impressions were true Annelides and belong to the two genera Myrianites and Nereites figured in that work; thus carrying the occurrence of organic life in the New England rocks, one step lower than had heretofore been observed, and showing a coincidence between the Waterville slate and the slate containing the Annelides described by Murchison and included by him among the Cambrian rocks.

Dr. Jackson observed that he had received information from other gentlemen, that impressions of ferns occurred in the Waterville slate and had stated this in his first annual report of the geology of Maine. He had, however, subsequently visited the locality and satisfactorily ascertained that the slates of Waterville do not belong to the coal formation, and this fact was stated by him in his second report. Dr. J. remarked, that in justice to the gentlemen referred to, it should be observed that Prof. Sedgwick and

Mr. Murchison's report was not then published, and consequently these fossils could not be identified with the Annelides there described. On seeing this work Dr. J. had been able so to identify them, and he now concurred in the views expressed concerning them by Prof. Hubbard.

Prof. Mather stated that he had found an entire analogy in the fossils of the slates on the Hudson river, in Rensselaer and Saratoga counties, and in the western parts of the state.

Mr. Vanuxem confirmed the statements of Mr. Mather in regard to the identity of these slates.

Mr. W. C. Redfield made some observations concerning the fossils in the flagging slates employed in the city of New York. These slates are generally obtained from the counties of Greene and Ulster, N. Y. He referred to the corner of Cedar street and Broadway, and to the walk in front of the Spring street church, near the Hudson, as exhibitions of these impressions.

Prof. H. D. Rogers observed, that the pavement in front of the United States Bank, (Philadelphia,) afforded a similar exhibition.

Dr. Jackson now offered some general remarks upon the geology of the states of Maine and New Hampshire.

At 12 o'clock the Association adjourned, as a mark of respect to the memory of General Harrison, late President of the United States, whose funeral took place at this hour.

April 7th, 1 o'clock, P. M.—The Association met, *Prof. Silliman* in the chair. After the transaction of some ordinary business,

Mr. W. C. Redfield laid on the table sundry specimens of fossil fishes found in the red sandstone formations of Connecticut, Massachusetts, and New Jersey.*

Of eight species from these formations comprised in the collection, five species are found to belong to the genus *Paleoniscus*, and three species to the genus *Catopterus*. It is remarkable that nearly all of these several species are common to most of the known localities of these fossils in the above mentioned states. The importance of this fact, as aiding to establish the cotemporaneous character of these formations, induced Mr. R. to place this collection before the Association.

Mr. R. stated that the lithological appearances of the shales in which the fossil fishes are found, as well as of the more minute and undeter-

* See Mr. Redfield's paper, published at length in the present number of this Journal.

mined fossils which they contain, are nearly alike in all the localities which he has visited in the above mentioned states. Slight contortions of the strata with small faults or dislocations, which in some cases affect the fossil specimens, are also common to the several localities, and seem to be referable to like causes.

In addition to the above, Mr. R. also exhibited specimens of a new species of *Catopterus* from the rocks which overlie the coal mines in Chesterfield county, Virginia.

Some remarks upon the elevation of trap dykes were made by the chairman, and *Profs. H. D. Rogers, Mather*, and *Hitchcock.* The Association then adjourned until 4 o'clock.

April 7th, 4 o'clock, P. M.—The Association met, *Prof. Silliman* in the chair.

Mr. Vanuxem, from a committee appointed at the last meeting of the Association, presented a report in regard to the "Ornithichnites or foot-marks of extinct birds in the new red sandstone of Massachusetts and Connecticut," observed and described by Prof. Hitchcock. This report confirms the opinion respecting these appearances now entertained by Prof. Hitchcock.

Report on the Ornithichnites or Foot Marks of Extinct Birds, in the new red Sandstone of Massachusetts and Connecticut, observed and described by Prof. Hitchcock, of Amherst.

The undersigned, forming the committee to whom the subject of the origin of the bird-tracks of Prof. Hitchcock was assigned, beg leave to present the following brief report.

It may be well previously to state, that the object of the meeting in appointing this committee, was founded solely upon the desire to produce, if possible, unanimity of opinion, there being a few of the members who dissented from the views, published by Prof. Hitchcock. In our country, the subject, as it undoubtedly ought, had attracted considerable attention. It had been very favorably received and republished in Europe, and from its great importance to Palæozoic geology, an attempt should be made to settle the question; for were the views of our highly respected member correct, we were made acquainted with the earliest period in which biped animals existed whose foot-marks were analogous to, if not identical with, those of the tread of birds. On the contrary, if wrong, we were presented with another class of facts, which show that certain appearances supposed to belong solely to animal life, were held and presented by the vegetable kingdom likewise.

We shall now state, in a few words, what we suppose are the general facts upon which Prof. Hitchcock's views were founded, and then the facts of those who assumed the opposite opinion.

The first and most obvious impression upon the mind, on looking at the indentations or marks, is their thin tripartite form, resembling the tread or foot-mark of those kinds of birds which show three toes, the fourth one being rudimental, and are referable to no other known kind of animal. The tracks or foot-marks in several localities are arranged in a determinate order, like those of a bird or fowl moving in a straight line, the toes or marks in all such cases being alternate; that is, if the right foot be presented on the rock, the left would next follow, and thus right and left in regular succession, sometimes with many repetitions. In other instances, the foot-marks presented no determinate direction or order, as might naturally be supposed of a bird or any other animal having no particular place or object in view.

In all cases where a succession of tracks was observed, there was an uniform correspondence as to size, and considerable regularity as to distance between the tracks. Whatever deviations were observed, they were not greater than might be supposed to take place in animals possessed of voluntary motion.

On some surfaces, not unfrequently one or more different kinds of track were exposed, belonging, as was reasonably conjectured, to different species and genera of ornithichnites.

That the slaty material of the rock showed that the impressing body possessed force or weight, for frequently the thin layers or laminæ were bent downwards for an inch or more, and that the mud of which the slate was formed was of a highly adhesive or tenacious character.

In all cases the foot-marks or part impressed, was the fixed part of the rock; the part removed when the lower side was turned upwards, shewed the cast or what corresponded with the toes or foot. That no trace of any organic matter could be perceived occupying the cavity or mould, the cast or part in relief being in all respects like the material of the rock of which it formed a part.

Finally, that the foot-marks belonged to a group of rocks which must be considered to have been produced by the same general causes which gave rise to the new red sandstone of Europe, and referable only to that sandstone. This sandstone presents foot-marks in many localties, though comparatively but a few years have elapsed since attention has been called to them. Some of the specimens have reached this country, and had they not, the information is well given by Dr. Buckland in his Bridgewater Treatise. The most remarkable of these foot-marks, is that of the chirotherium from the quarries of Hesberg, near Hildburghausen in Saxony, and greatly resembles a fleshy human hand. These, in the drawing and in the specimen which we have seen, are alternately right and left. Other foot-marks have been observed by Mr. Linse in the same sandstone, having made out four species of animals, some of which are conjectured to belong to gigantic Batrachians. Near Dumfries, the foot-marks

of animals, probaly tortoises, were obtained from the same sandstone, but as yet no tracks like those of New England have been discovered.

The facts, &c. which led to a different conclusion are these. First, that the forms assumed by fucoidal plants were numerous and imitative, some resembling the tail of a rooster, the cauda galli; another, which was like unto a large claw or paw, and which may have been a Lusus naturæ, and the two specimens on the table of the Association, which present in relief a distinct tripartite form. These, as they all appertain to rocks of great antiquity in comparison with those of New England, it appeared more reasonable to believe that there might be resemblances as perfect, as the fossils with a tripartite character were approximations to the forms in question.

That no trace of organic matter could be discovered by the eye in the greater number of the fucoides. In some, such as the Harlani, they have been seen to be made up of small pebbles, presenting no little difficulty, not to the manner only in which the organic matter was replaced, the external form being complete, but the nature of this material, which could make so definite an impression and preserve its form entire.

There were other facts which showed resemblances, such as that the part in relief was the part removed when the fucoides was attached to the sandstone at its upper part. It may also be stated, that the appendages to the heel of some of the New England tracks, might have been caused by a bird whose legs were feathered, but not to a wader, and they favored their vegetable origin, for the appendages might readily be conceived to be either leaves or radicals, or both.

From a comparative examination of the facts on both sides, your committee unanimously believe, that the evidence entirely favors the views of Prof. Hitchcock, and should regret that a difference had existed, if they did not feel assured it would lead to greater stability of opinion. To liken things to what we know is the nature of mind, the error from this tendency increases with ignorance, and diminishes as knowledge increases, so that he that knoweth all things, as is self-evident, can commit no error when following this instinct of his being. The discoveries of Prof. Hitchcock were published at a period when the mind of those who embraced the negative side of the subject was preoccupied with the anomalous vegetation with which many of the Silurian rocks of New York abound, and to which provisionally the name of fucoides had been given. From this imitative character, and from finding a few specimens presenting a tripartite or trifurcate form, &c. it appeared not only possible but probable, that the impressions from Massachusetts and Connecticut, were with greater propriety referable to fucoidal bodies, than to those which Prof. Hitchcock had assigned them.

We may here remark how essential it is that truth or the facts which make manifest any truth, should first be presented to us; so readily is the

mind impressed when not preoccupied, and when a strong impression is made, be it ever so false, it is no easy matter to free ourselves from it. From this circumstance we can readily foresee the advantage which future generations will possess over those of the present and especially those of former times. As the progress of knowledge is certain, each day will lessen error and enlarge the domains of truth, and should man be true to his permanent interests, error finally will cease to have existence.

Signed, HENRY D. ROGERS, LARDNER VANUXEM, RICHARD C. TAYLOR, EBENEZER EMMONS, T. A. CONRAD.

Mr. Vanuxem read a paper "On the Ancient Oyster Shell Deposits observed near the Altantic coast of the United States."

Among the unsettled subjects of geology in our country, is the origin of the deposits of oyster shells, (*Ostrea Virginica*,) observed in many parts of the Atlantic seaboard, of which a few only of those near South Amboy have come under our notice. But the greater number of those of the largest dimensions are in the waters of the Chesapeake. Some of these southern deposits of shells are enormous, covering, it is said, acres of ground, adding no small weight to the truth of that belief that considers them *in situ*, as ancient oyster beds, raised from their original position by the uplifting of our coast, of which the fact of their generally holding, if not a real, an apparent similarity of level would seem to be ample confirmation. This theory of their being in place, is highly satisfactory, being in accordance with the less modern deposits beneath them, adding one more to the number of elevating movements to which our coast has been subjected, thus mutually confirming each other, making the certainty of these movements sure.

When the nature of their origin was advanced by Mr. Conrad, I confessed a decided bias; for I knew not the facts upon which Dr. Ducatel, the geologist of Maryland, maintained the opposite one. None were known to me adverse to the views of Mr. Conrad, for the history of our country afforded no light that could be recollected, either as to the origin of these oyster shell deposits, or to any extraordinary manifestation of gastromic power in the aborigines, in respect of this article of diet, which would lead me to infer their existence, and which the magnitude of some of the deposits required.

The eastern shore of Maryland presents many deposits of these oyster shells, hitherto until recently, unused and little examined, so far as knowledge has been received this way. Now, as many of the planters in that section of the country are waking from the deep slumber of the past, and turning their attention to the all-important subject of improving their lands by the use of lime, a few of these deposits have become the subject of investigation, furnishing facts, which, were the same discovered elsewhere, would settle the question of their origin, and in favor of the Maryland geologist.

At the mouth of Pickawaxent Creek, about eighty miles below Washington, there is an extensive deposit of oyster shells, at which an establishment has been formed, which, in a few months has converted many thousand bushels of them into lime. Before any excavation of the mass was commenced, I had directed the attention of Mr. Downing—one of the partners concerned—to the doubtful nature of their origin, requesting that all facts tending to throw light upon them should be carefully observed and preserved. When Mr. D. first went into the country, he was in favor of the views of Mr. Conrad; it was only by the examination of the mass at the Pickawaxent, of another not remote from that one, and from subsequent observation in the city of Baltimore, showing the amount of shells which there accumulates, was he assured that their origin was to be referred to man, and not to other or more elementary powers of nature.

The first and most important fact there observed, was that neither he nor any of the hands employed in getting out the shells had been able to find any two valves which fitted each other, excepting in one instance; a waterman having brought the specimen to him. The deposits having the nature of a mass or heap composed of shells whose valves were separated before being thrown together.

That in many parts of the mass arrow-heads and fragments of pottery have been found in the progress of excavation—these in no wise different from those found in old settlements of the Indians.

That the bottom of the bed is formed of the yellow loam or soil of the country, and that the roots and other parts of the cedar of the country have been met with at the bottom of the bed, showing a growth upon the surface, before the shells were deposited upon it.

That these deposits are at the mouths of the creeks, extending up the creeks, and rarely extending along the river shore, owing, as Mr. Downing conjectures, to the excellent fishing which the creeks furnish, and which would give to those who accumulated the shells, a twofold advantage.

That the shore is low on that side of the river where they are found, and the recent oyster in great abundance on that shore, whilst the channel is on the Virginia side, and no deposit of oyster shells existed in that section of country.

That these deposits are of some comparative antiquity, is to be inferred from the soil which is found upon them, and the existence of an exceedingly old cedar growing upon the top of a mass, and from the silence of history or tradition respecting them.

Against these facts which show an undoubted human origin for these deposits of oyster shells, there are others cited by Mr. Conrad which he has made me acquainted with, since this paper was written, which either I had not known or they had escaped my memory, and are equally con-

clusive as to the opposite opinion. The facts are, that masses exist composed of whole shells, as at Easton, on the eastern shore of Maryland. That in some localities fragments of older fossils are found with them, and which must have been thrown amongst the oysters by the waves of the estuary from their position below. And again that deposits of the shells exist in situations too remote from present oyster beds to have been removed by human agency, such as those in Cumberland county, in New Jersey; therefore it would appear that both causes have operated to produce them, and that no single generalization can comply with the requisition of the facts which they present, leading as they do to a twofold, one from opposite conclusions, one referable to human, the other, to natural causes, and that severally they must be examined in order to ascertain to which of the two causes any given mass is to be referred.*

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Prof. Booth stated that his observations upon these deposits had led him to the same conclusion as that which had been arrived at by Mr. Vanuxem, viz. "that they are sometimes referable to human agency, and at others to natural causes." In answer to an inquiry, Prof. B. observed that these shells reduced to powder had been used with great success in the State of Delaware, as a manure. *Prof. Hitchcock* stated that the fertilizing powers of these deposits of shells had also been tested by experiments on Cape Cod. Facts were stated by the chairman and *Prof. Mather* in regard to beds of oyster shells similar to those described by *Mr. Vanuxem*, on the Island of Nantucket, and on Long Island.

Prof. Bailey commenced his account of "Fossil Infusoria," by an exhibition and description of the microscope employed by him in his researches.

Messrs. Charles B. Trego and *B. Silliman, Jun.* were appointed assistant secretaries. The Association then adjourned until 9 o'clock, Thursday morning.

Third day of meeting, Thursday, April 8, 1841.—The Association met at 9 o'clock, A. M. *Prof. Silliman* in the chair. The minutes of yesterday were read and adopted.

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* Since the meeting of the Association, I have found on conversing with Dr. Ducatel that the impressions which I had of his views were founded upon his first report, that of 1834, for in his subsequent ones, he makes known their twofold origin. We should withdraw this paper did we not believe that it would be of service; for it not only settles the point in question, which was its object, but it affords a useful lesson as to caution in an expression of the opinions of others.

Peter A. Browne, Esq. laid on the table, for the inspection of the members, a suite of specimens, chiefly fossils, from the chalk basin of Paris, collected and labelled by A. Brongniart.

Prof. Locke made some observations concerning the connection of magnetism with geology, mentioning an instance where he found an increase of the dip and intensity as he approached, from south to north, a certain point or meridian line, and a decrease as he receded from it; also remarking that a similar change is found upon crossing the Ohio river: querying from this, whether the water of large streams running east and west, has an influence on the magnetic relation.

Dr. Houghton remarked, that in the vicinity of the great northwestern lakes a change in the magnetic deflection was frequently found on approaching within a few miles of a large body of water.

Dr. R. E. Rogers called the attention of the Association to the subject of limestones, observing that he thought the magnesian character of these rocks generally had not received sufficient attention. He stated that he had found, upon analyzing some of the lower limestones of Pennsylvania, a larger proportion of magnesia than is requisite for the formation of a true dolomite, and threw out the query as a point of scientific interest, whether the carbonate of lime and carbonate of magnesia were chemically combined in the proportions to form dolomite, and this mingled throughout the excess of the carbonate which might be present, or whether the two carbonates were mechanically and uniformly intermingled.

Dr. Jackson stated, that he considered the granular or crystallized dolomite to be a regular chemical double salt, consisting of one equivalent of carbonate of lime and one equivalent of carbonate of magnesia. But he had never found any magnesian limestone to contain *more* than this proportion of magnesia, although he had frequently analyzed limestones containing a *less* proportion than one equivalent of magnesia. His published analyses will illustrate this remark.

Dr. J. inquired whether Dr. Rogers had ascertained if the limestones to which he alluded did not contain the hydrate or silicate of magnesia, mixed with dolomite. If the rock was of the compact variety, this might have been the case.

Dr. James Rogers thought we must consider dolomite as a true double salt : 1 atom carbonate of lime + 1 atom carbonate of magnesia ; the excess of magnesia found in our limestones must be considered a mechanical mixture.

A communication was received from *Peter A. Browne, Esq.*, expressing a willingness to read before the Association "an Essay on Aërolites or Meteoric Stones," at the next annual session. Laid upon the table.

Prof. Mather made a verbal communication on the joints in rocks, particularly as they occur in the primary, transition and secondary of this country. He found two principal sets of joints prevailing ; the first had a general direction of north by northeast, the second set were nearly perpendicular to the former—besides these, there were two other sets not so well defined. The joints in the primary were not so smooth and well marked as in other formations ; this observation was not intended to apply to the joints of slate rocks.

Dr. Jackson cited the joints or fractures of the conglomerate around Boston, and particularly at Roxbury, Mass., and also in the island of Rhode Island, at a place called Purgatory, the large pebbles are broken by these fractures, without dislocation or loosening from their beds. He supposed the parallel and uniform cracks in the lime rocks and slates of that country to have connection with the different epochs of irruption of the trap, granite and porphyry.

Dr. Douglass Houghton inquired of Dr. Jackson if these cracks in the conglomerate had reference to the line of bearing, remarking that in Michigan they were nearly at right angles to the line of the longer diameter of the pebbles. Dr. Jackson replied that such was the case in the cases he had cited ; that at Purgatory the pebbles were very large, ovate, and arranged with their longer diameters in one direction, and seemed to be joined together by very little cement, and yet they were broken at right angles to their longer diameter, without dislocation. He stated that Mr. A. A. Hayes had found that chloride of calcium would concrete pebbles of quartz into a firm mass—this fact might elucidate the present subject. Specular iron was generally observable among the interstices of the pebbles at Purgatory, and more or less of iron and lead ore was generally to be found at the juncture and fissures of the trap dykes.

Prof. Hitchcock thought that the steps of the new red sandstone of the Connecticut valley were the result of the fractures referred to by Prof. Mather—they were nearly coincident with the strike of the strata, as if caused by elevatory movements. He found difficulty in distinguishing between fissures produced by mechanical violence and joints properly so called; he viewed those of the conglomerate as mechanical, those of the slates as chemical. Two cases occurred to him as worthy of notice; the first was of a dyke of greenstone crossed by parallel transverse planes two or three feet apart and at right angles to the strike of the vein. The second case seemed to throw some light on the origin of this class of phenomena; it occurred in a bed of the common blue diluvial clay—the horizontal layers were unmoved, but some of them were divided into double rhombs. The experiments of Mr. Fox, of England, in the lamination of clay by galvanism, seem to explain this structure.

B. Silliman, Jr. had found this rhombic structure in great perfection in the argillaceous sandstone of the Connecticut valley at Hartford, in Connecticut, where this variety of sandstone is used for flagstone. Many of the joints parallel to this rhombic structure are filled with carbonate of lime.

Dr. C. T. Jackson stated that the great trap dykes of Nova Scotia had the perpendicular columnar structure in a high degree—in the smaller dykes this structure prevails from side to side of the dyke, perpendicular to the walls. He thought that in all cases these phenomena were referable to the way in which the dykes cooled—the structure being perpendicular to the cooling surface—thus the narrow dykes cooled from side to side, and the heavy ones from the upper surface downward.

Prof. Henry D. Rogers remarked, that the trap dykes of Pennsylvania and the magnetic iron ore of New Jersey were abundantly characterized by the columnal structure. He viewed the horizontal columnar structure of the magnetic iron ore, as a very important indication of its igneous origin.

This discussion was here suspended to give an opportunity for Prof. Bailey to read his paper on recent and fossil infusoriæ.*

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* As this paper of Prof. Bailey is to appear in full, with plates, in the October No. of this Journal, it has been thought unnecessary to attempt here any abstract of his remarks before the Association.—B. S. Jr.

Dr. Jackson stated that the mass of infusorial deposit found under peat bogs is hydrate of silica, which loses by being heated to redness from 12 to 15 per cent., principally vegetable matter. Great abundance of this material occurs at Newfield, in Maine, where it covers many hundred acres, and is five or six feet thick. After burning, it is so white and beautiful that it has been fraudulently sold for magnesia alba. The ammonia which is evolved in its destructive distillation, is probably derived from the crenic and apocrenic acids which it contains. Phosphate of lime and manganese are found in it in small quantities. As a fertilizer of land, it is considered of use when containing in large quantity the juices of plants.

A memoir from M. Alexandre Vattemare was presented, proposing a general system of exchange of objects of nature and art among all nations. It was by motion laid on the table.

The subject of bowlders and diluvial scratches was then brought up for discussion by Prof. Mather, and a protracted debate ensued, in which many of the members joined.

Prof. Mather inferred from the facts in the case, that the bowlders and diluvial scratches had, in general, come from the north; those on the east of the Hudson from the northwest, those on the west from the northeast, as by the result of two forces.

The diluvial furrows are, in general, parallel to the valleys in which they are found—thus in the small transverse valleys, the scratches are found parallel to the direction of the valleys—and not coincident with those of the main valleys. All the bowlders seem to have been brought from the northwest, both at the east and beyond the river St. Peter's at the west, and very few are found below 38° or 39° of north latitude.

The chairman (*Prof. Silliman*) cited the recorded observations of Mr. C. Darwin, naturalist to H. M. ship Beagle, that in South America no bowlders occur nearer the equator than about 40° south latitude.

Prof. Mather had not seen any bowlders in the coal region of Ohio, and very few in Kentucky. He thought that the bowlders mentioned by Mr. Hodge in the gold region of North Carolina, were not transported masses, but were composed of granite which had suffered decomposition *in situ* by atmospheric agency.

Prof. Henry D. Rogers said there was need of much caution in the use of the term bowlder, as regards the size of the mass to which it should be restricted; he was inclined to give the term much latitude. Thus he conceived that a current of drift coming from the north and meeting the terraces of Pennsylvania, would there be arrested and deposit its larger masses—and so from stage to stage, until the onward current would carry forward only the smallest sand; in this way, we may find among the drift of the south, all the materials derived from the northern rocks.

He concluded that all the materials of a current of drift, find their resting place in accordance with gravity.

Prof. Mather doubted whether the large bowlders found in Long Island, resting on beds of sand or fine gravel, could be thus accounted for, because a current of sufficient force to move such large masses would have carried away the sand.

Prof. Rogers replied, that diluvial action could not be restricted to a single epoch.

We must find in secular and periodical elevation, the cause of the translation of the beds of infusorial earth recently found in the tertiary of Virginia, which are there covered by the quiet strata of the Meiocene. We have evidence of numerous slight elevatory movements on the eastern coast of North America, and the various terraces of our rivers seem to present the same phenomena; for the source of these elevatory movements we must look to the great volcanic foci of Greenland.

Prof. Locke mentioned a locality in Ohio, at which the limestone is ground down to a perfect plane, as if it had been done by a stone-cutter by grinding one stone on another, over an extent of ten acres. Upon this planished surface, lines have been engraved in systems perfectly straight and parallel, running from northwest to southeast. Some of these lines are fine, as if cut with the point of a diamond, and others perhaps half an inch broad, and one eighth of an inch deep, scaled rough in the bottom, as if they had been ploughed by an iron chisel properly set and carried forward with an irresistible force. Prof. L. inferred from the facts of the exact straightness and parallelism of these lines, that they had been formed by a body of immense weight, moving with a momentum scarcely affected by the resistance offered by the cutting of the grooves. Such a momentum and

actions would be supplied by a floating iceberg, whose lower surface should present projecting sharp points of imbedded bowlders.

Prof. Mather further stated, that the bowlders of Ohio were in continuous lines and groups, and not scattered promiscuously. On the river St. Peter's, the bowlders may be seen extending for miles, as along a coast line; in some situations one might see them bounding the horizon as far as the eye could reach.

Dr. Locke, in conformity with Lt. Mather's statements, mentioned a region of bowlders in Ohio, extending from the town of Eaton quite across the state; five miles in width and over forty in extent.

Dr. C. T. Jackson remarked, that the phenomena of diluvial currents were well exhibited in the vicinity of Providence, at Cumberland, R. I. A large mass or mountain of porphyritic titaniferous iron of very peculiar character exists in that place; to the north of it no bowlders are to be found, but on the south, huge bowlders of it may be seen, and so abundant that the stone walls are built of them; and below, at Papoose Squash Neck, small bowlders of the same characteristic rock are found; south of Newport, and still further south, the same are met with of a smaller size, the whole extending from north to south forty miles, and from six to fifteen in width, diverging to the south.

The characteristic macle rock at Lancaster, Mass., presents similar phenomena, being found in loose masses to the south as far as Bolton, while none can be found to the north of the locality.

He considered the power of the diluvial currrent greater to the north than at the south, since the evidences of it in Maine are much greater than in Rhode Island; bowlders have been found on Mount Katadin as high up as four thousand feet; he thought there was no evidence of any elevation of the rocks after the diluvial current had passed.

Mr. Nicollet proposed, at a future meeting, to make some remarks upon, and to exhibit specimens from, the cretaceous formation on the upper Missouri.

Mr. Redfield expressed a wish that the attention of the Association should, at some convenient time, be called to the recent sand formation along the eastern coast of the United States.

Adjourned to meet this afternoon at 4 o'clock, at the rooms of *Mr. Richard C. Taylor*, for the purpose of viewing a model of

the coal region of Dauphin and Lebanon counties, east of the Susquehanna.

Thursday, 4 o'clock, P. M.—The Association assembled at the rooms of Mr. Taylor, where that gentleman exhibited a highly interesting model in plaster of the Dauphin and Lebanon coal region, embracing, altogether, an area of seven hundred and twenty square miles, showing the range of the mountain elevations, with their relative height and position; also their elevation above tide level; the dip of the rocks, the position of the coal seams, and much other useful information.

Mr. Taylor accompanied this exhibition with remarks explanatory and statistical, in relation to this coal region, and made some observations on the importance of this mode of exhibiting the geological features of a country, expressing the hope that the day would come when models of this kind, representing the several states, and even the whole United States, shall be constructed. He also enlarged upon the propriety of following, as closely as possible, the actual conformation of the country in drawing sections, and of adopting uniform modes of illustration by colors, &c., and the importance of an equal scale of extension and elevation as far as practicable in such sections.*

Prof. H. D. Rogers followed with observations upon the Pennsylvania coal formations and the range of their underlying rocks, detailing what he conceived to be the cause of the inverted dip observable along the southern border of the Kittatiny series, ascribing it to a great force acting laterally, and folding and crushing the axes so as to produce this inverted dip by tossing the strata many degrees beyond the perpendicular, and thus producing the present apparent dip of the lower stratified or sedimentary rocks *beneath* the primary.

Adjourned to half past nine o'clock to-morrow morning.

In the evening, the members of the Association had the pleasure, in common with a number of citizens, of listening to a very interesting and appropriate address from Prof. Hitchcock, embracing all the points at present most interesting to the American geologist.†

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* See Mr. Taylor's article published entire, with a colored section, in the present number of this Journal.—B. S. Jr.

† As this address is to be published entire by the Association, and it is intended to give an abstract of it in the next number of this Journal, no farther notice of it is inserted here.—B. S. Jr.

Fourth day of session, Friday, April 9, 1841.—The Association met, pursuant to adjournment, at half past nine o'clock, A. M. *Prof. Silliman* in the chair.

After the minutes of yesterday had been read and adopted, *Dr. Beck* moved a series of resolutions, of which the first was adopted, as follows:

Resolved, That the thanks of the Association be presented to Professor Hitchcock for the interesting and valuable address delivered last evening; and that a copy of the same be requested for publication.

The committee on business reported the following resolutions, which were all adopted excepting the first,—it being laid on the table.

Resolved, 1. That the committee recommend to the Association the first Monday of May as the period for the next annual meeting.

2. That the Association adjourn its present annual session this week.

3. That a committee of five be appointed to draft a constitution and by-laws for the regulation of future proceedings of the Association, and that each member of the committee be recommended to draft a plan of organization, to be discussed by the committee.

4. That at each meeting a local committee of three members, resident at the place of the next annual meeting, be appointed, for the purpose of making arrangements for the reception of the Association.

5. That the members of the "Academy of Natural Sciences" be invited to attend the present session of the Association, and to participate in its proceedings.

Prof. Renwick, *Mr. Nuttall*, and *Dr. Hayden* of Baltimore, were recommended as members of the Association.

Dr. Harlan exhibited models of the fossil remains of the *Dinotherium giganteum.*

The first specimen presented to the view of the Association, was the cast of a small model of the *Dinotherium giganteum* or the great fossil *Tapir* of Cuvier—the only model of the kind, which, as far as Dr. Harlan is aware, has yet reached America. The Paris Garden of Plants, possesses a model of the skull of the size of nature, which is sold by the German naturalists, Messrs. Klipstein and Kaup, for $100. The dimensions of this skull are four feet in length, three feet in width, and two feet in height. In peculiarity of structure and colossal dimensions, the

Dinotherium constitutes one of the most curious and interesting animals of an antediluvian Fauna. M. Klipstein, Professor in the University of Giessen, a few years since, discovered a perfectly preserved specimen of the skull on the borders of the Rhine. Baron Cuvier had many years previously described, in his Fossil Animals, some remains of this animal as allied to the genus *Tapir*. The fragments subjected to his observation consisted only of two imperfect pieces of the lower jaw, and some molar teeth. From such data alone, he was able to represent them as belonging to two distinct species, *Dinotherium giganteum* and *D. Cuvieri*, and to estimate the size of the larger species at eighteen Paris feet, which was subsequently proved to be correct. In 1829, Mr. Kaup, director of the museum at Darmstadt, discovered and described numerous portions of this animal, all obtained from the same strata of the tertiary sand of Eppelsheim.

The whole animal creation, fossil or recent, presents no parallel to the structure of the lower jaw and tusks of this animal. The anterior portions are recurved downwards, and from which depend two enormous tusks, in a direction downwards and backwards. The upper jaw is destitute of incisors. The configuration of the anterior nares and their vicinity, demonstrates that the animal was supplied with a *proboscis*, and like the hippopotamus and tapir, the habits of the animal were evidently aquatic; and the peculiar arrangement of the tusks was evidently adapted to the nature of the animal's food and the means of attaining it—they would be very useful in unison with its powerful claws, in eradicating from the mud the thick and succulent roots of aquatic plants, which probably constituted its principal nourishment. A correct notion of the enormous dimensions of this animal may be obtained by a view of the models of the tusk after nature, as well as by a series of the molars of one side of the lower jaw. It evidently attained a size far exceeding that of the hippopotamus of our day.

The last or ungual phalange, presents so close analogy to that of the Manis or scaly ant-eater, that Cuvier, at first sight, referred this species to an animal of that genus, and named it *Manis gigantea*. In offering you my own views of this peculiar specimen of a departed type, it should be stated that various notions exist among different naturalists, as to the real nature and habits of the animal in question. Some German naturalists place it among the *Phocæ*. Blainville took it for a pachydermatous animal, closely allied to the elephant. Kaup considered that it might range as a fifth and last family of the class Edentata. Others referred it to the herbivorous Cetacea, &c. &c.

Dr. H. also made some observations upon the remains formerly described by him as belonging to the "Basilosaurus," but which he is now satisfied, from the microscopic examinations of a section

of one of the teeth by Prof. Owen, should be referred to a genus of the aquatic mammalia, and which is now named "Zygodon," —specimens of the vertebræ of which, from the tertiary deposits of Alabama, he exhibited to the Association.

Mr. Nicollet then made some highly interesting remarks upon the geology of the region on the Upper Mississippi, and the cretaceous formation of the Upper Missouri.

He referred to his arrival in this country for the purpose of making a scientific tour, and with the view of contributing to the progressive increase of knowledge in the physical geography of North America. After spending several months in Philadelphia, Baltimore and Washington, he proceeded through the southern states; explored the south Allegany range, the states of South Carolina, Georgia, Kentucky, Mississippi, Alabama, Florida, Louisiana, Arkansas Territory, and Missouri; ascended the Red River, Arkansas river, and to a great distance the Missouri river. Having thus made himself well acquainted with the lower half of the Mississippi, he undertook the full exploration of that celebrated stream, from its mouth to its very sources; the latter of which he succesfully reached near the close of the month of August, 1836. During five years of unremitted exertions, he took occasion to make numerous observations calculated to lay the foundation of the astronomical and physical geography of a large extent of country, and more especially of the great and interesting region between the Falls of St. Anthony and the sources of the Mississippi. With these labors was connected the study of the customs, habits, manners and languages of the several Indian nations, that occupy this vast region of country.

Mr. N. acknowledged, in feeling terms, the generous hospitality, on the part of our citizens generally, of the agents of the American Fur Company, the civil and military officers, as well as the kind protection of the government, extended to him on all occasions, so as greatly to facilitate his operations and second the accomplishment of his designs. At the expiration of this long and arduous journey, Mr. N., broken in health, and his means exhausted, returned to Baltimore, where he soon received a flattering invitation from the war department and topographical bureau to repair to Washington. The result of his travels having been made known to these departments and appreciated by them, he was intrusted with the command of a new expedition, to enable him to complete to the greatest advantage of the country, the scheme which he had himself projected in his first visit to the far west; namely, the construction of a map of the region explored by him. This map having been recently submitted to Congress, the senate of the United States has, unanimously, ordered its publication under the direction of the topographical bureau. It is to be accompanied by a report embracing an account of the physical geog-

raphy of the country represented, together with the most prominent features in the geology and mineral resources of other sections of our western states not embraced within the limits of the map.

Mr. N. then went on to give a succinct account of his geological researches, which, modestly disclaiming any pretensions to be considered a professed geologist, he had felt an irresistible inclination to engage in, as a subject of general and growing interest. This account he offered as a more appropriate theme, in view of the objects contemplated by the present meeting.

Mr. N. said he had traced a magnesian limestone—the cliff limestone of Dr. Owen—which is probably referrible to the mountain limestone of European geologists, over a vast extent of country, within the valley of the Mississippi. Connecting his own researches with the facts brought to light in the survey of the Iowa and Wisconsin Territories by Dr. D. D. Owen and Prof. John Locke, and with the observations of Dr. Henry King, during an exploration of the country watered by the Osage river, Mr. N. thought himself warranted in assigning the Falls of St. Anthony on the Mississippi river, as the northern limit of this formation, which to the west, extends to Fort Leavenworth on the Missouri river, and to the south, embraces the metalliferous region of the state of Missouri. This limestone, containing *trilobites*, *catenipora*, and other coralline fossils, is the metalliferous rock not only in Missouri, but in Iowa and Wisconsin, from which the lead and copper ores are extracted. The rock intervening between it and the coal formation is characterized by the occurrence of the *Pentamerus oblongus*. In this relative position, also are found thin beds of oolitic limestone, that are perhaps referrible, geologically, to the oolitic limestone of Tennessee, described by Dr. Troost, who indicates the *pentremites* as their characteristic fossil; a large number of these fossils, in a loose state, was collected in the vicinity of these rocks. Shallow coal basins frequently occur in Missouri and the south part of Iowa Territory; but on the Mississippi river, the coal disappears, about thirty miles above St. Louis; thence, ascending the river as far as the great Platte river, the cliff limestone and the coal rocks present themselves in alternate succession. In the vicinity of the Platte river, as well as at Council Bluff, a limestone containing *cyathophylla* of large size, *encrinites*, and other fossils, appears in a position seemingly between the cliff limestone and the coal. Near the confluence of the Sioux river and the Missouri, there occurs a formation overlaid by a thick deposit of clay, containing, in abundance, several species of *ammonites* and *baculites*, *belemnites*, *inocerami*, &c. &c., beautifully raised on their exterior and sparry in their interior. Some of them were exhibited to the meeting. These fossils were identified with similar ones belonging to the green sand deposit of New Jersey, a member of the chalk series; but no true chalk or flint (silex pyromage) was observed. The occurrence of this formation had

already been indicated, by some fossils that Lewis and Clark and Mr. Thomas Nuttall had brought along with them from their travels, and which were described by Dr. Morton. Mr. N. exhibited farther, some fossil bones which had been submitted to the inspection of Dr. Harlan, who describes them as belonging to *vertebræ* of a Squalus and of a nondescript crocodile, also articulated vertebræ of an animal referrible to the order *Enalio-sauri* of Conybeare. The surface presented by a transverse section of these vertebræ, Dr. H. thinks peculiar, as also the mode in which the ribs are attached to a small process in the middle of the inferior surface of each vertebra. From their size and unique character, it is quite probable that these vertebræ form a part of the skeleton of the *Sauro-cephalus lanciformis*, (Harlan,) an animal possessing still more of the fish than the lizard, than exists in the organization of the *ichthyosaurus*, in which respect these vertebræ correspond. According to Dr. Harlan, similar fossils have been found in the green sand of New Jersey and in the chalk of England.

Mr. Nicollet concluded by remarking, that he had followed up and described this formation, along an extent of upwards of four hundred miles, and from information received and from fossils that had been furnished to him, thinks that it extends to the west at least as far as the sources of the rivers Running Water, White, Shayeune, &c. and northwest along the Missouri probably to the Yellow Stone, being an extent in length of about one thousand miles.

Mr. Hodge followed with some observations concerning the secondary and tertiary deposits of the Carolinas.

The remarks of Mr. Hodge regarding the secondary and tertiary deposits of the Carolinas, will be found embodied in the next number of this Journal. He next noticed the deceptive appearance of the bowlders of quartz and primary rocks, scattered over the country north of Columbia, S. C., and extending throughout the gold region of North Carolina, all *seemingly* referrible to a similar cause with that which covered the hills of the northern states with their bowlders. But according to the previously expressed opinions of Messrs. Vanuxem and Mather, these are considered not to have been transported to any distance, but to belong to the rocks in their immediate neighborhood.

He asked attention to the subject of the deposit gold mines; whether these were not still in progress of formation, notwithstanding the opinions to the contrary found in many of the foreign treatises; mentioning their occurrence always near the veins of the ore, and of the fact of veins having been discovered by working the deposits up to them, above which the gold suddenly ceased. Of the power of the freshets, the discovery of the little buried village in Nacochee Valley, Ga., was mentioned as a remarkable evidence. His opinion was, that though many of the deposits referred themselves far back to the period when the whole country was

overspread with diluvium, still that the deposits have been going on ever since. Specimens were shown from, and some remarks made, concerning the gold and copper ores of Davidson and Guilford counties, N. C. Veins originally worked for the former, gradually passed into lodes of sulphuret of copper and iron, though these formed a very small part of the veins at the surface. Rich specimens of the double sulphurets from the Harlan mine, Guilford county, were exhibited, in which mine the lode is over ten feet thick, or the depth of one hundred and five feet, and consists almost entirely of these ores.

Some account of King's silver mine, Davidson county, was given, and specimens of the varieties of the silver ore shown. The mine was originally worked for lead, the ore being a carbonate, very rich, and in beautiful crystals. Native silver was discovered, and the pig lead already made, found to contain a considerable amount of that metal. Phosphate of lead, copper, zinc and sulphuret of iron, were also mentioned as occurring in the lode, which was twelve feet thick. Some of the ore was of a soft light magnesian character, and though its specific gravity could not be twice that of water, yet it was considered a rich silver ore.

The lode lies between granite and a magnesian rock above. All the metalliferous veins, it is believed, are found at the point of contact of these two rocks.

Peter A. Browne, Esq. presented to the Association a section of the rock strata on the Schuylkill above Philadelphia, drawn about the year 1825, being the first geological section made in the state of Pennsylvania.

Dr. Houghton then made some remarks upon the subject of the metalliferous veins of the northern peninsula of Michigan.

He began by remarking, that that portion of Michigan lying between Lakes Huron and Michigan on the south, and Lake Superior on the north, is known as the upper or northern peninsula, while that portion of the state lying south of the Straits of Mackinac, is more usually known as the southern or lower peninsula.

The rocks of the easterly portion of the upper peninsula, for a distance of one hundred and fifty miles, consist of a series of fossiliferous limestones and shales, resting upon sandstones, the whole dipping a few degrees east of south. The limestones appear only on the southerly portion of the peninsula, while the underlying sand-rocks form the immediate coast of Lake Superior.

At a point very nearly one hundred and fifty miles west from the easterly extremity of the peninsula, and near to the immediate coast of Lake Superior, several low ranges of granitic hills make their appearance, which hills are flanked on the south, by quartz rock, alternating with

mica, talcose and clay slates. These hills have a general easterly and westerly direction.

Northerly from these, other ranges of hills occur, having a similar direction, but in the several ranges as we proceed north, the granitic character becomes less and less perfectly defined, being first sienitic, after this altered sienite, and finally the outer or northern range is made up of well defined trap. This range of trap hills continues very nearly unbroken for a distance of one hundred and thirty five miles within the limits of Michigan.

The trap rock, which chiefly appears as a compact greenstone, is nevertheless, quite uniformly bounded on the north by an amygdaloid, against or upon which rests a very coarse conglomerate, and upon this a series of alternating strata of conglomerate and sandstone, the whole being capped by an extensive formation of red sandstone.

The group of stratified rocks referred to, which have an entire thickness of several thousand feet, dip very regularly, and usually at a high angle, into the basin of Lake Superior; and since the same is the fact in regard to the rocks upon the north coast, that lake may be said to occupy a synclinal basin.

After some remarks upon the successive elevation of the several ranges of hills referred to, together with the long intervals of time that would appear to have elapsed between the several uplifts, Dr. H. proceeded to say, that with our present imperfect maps, it would be nearly impossible to convey a clear conception of its geographical geology, and that in fact he had made these references, only to render more intelligible what he wished to say upon the subject of the metalliferous veins of the district.

It is a fact well known, that south from the district referred to, transported masses of native copper are occasionally met with, in the diluvial deposits which are so abundantly spread over the country; and these loose masses are distributed over an area of many thousand miles, including southern Michigan, Wisconsin, Illinois and Indiana. In northern Michigan they are still more frequently met with.

The great transported mass of native copper on the Ontonagan river, so frequently alluded to by travellers, and which he, Dr. H., estimated to contain about four tons of native metal, was stated to have all the characters of the other loose masses referred to.

The source of these transported masses has, heretofore, been somewhat obscure, although there has been good reason to believe, that most of them had their origin from the trap rocks, but whether from true veins or from the mass of the rock itself, was not known. He said that after examining the country with care, he was enabled to state, that without doubt a very considerable portion of them had their origin from what may be regarded as true veins.

Those which were regarded as true veins, were uniformly noticed to originate in the trap rock, but they were frequently traced across the superimposed sedimentary rocks, to and including the red sandstone. The direction of the veins across the upper rocks most frequently corresponds to the dip of those rocks.

Dykes of trap, traversing the conglomerate and sandstone, were stated to be of frequent occurrence; but these dykes very rarely cut *across* the strata of the upper rocks, or in other words, they mostly occupy places corresponding to the lines of stratification, for which reason the veins referred to, cut across the dykes at very high angles.

So far as we are enabled to judge from the examinations which have been made, those veins originating in the outer range of trap hills are the only ones in the district deserving the name of metalliferous veins. Not only do the separate veins vary from a mere line to several feet in thickness, but those traversing the several rocks above the trap, are usually very much expanded in their passage across the upper rocks.

By far the most important minerals contained in these veins are the several ores of copper. The metal occurs in a native form associated with the grey and red oxides, carbonate and silicate, together with several mixed compounds. Sulphuret of copper is exceedingly rare, and pyritous copper has not been found in what was regarded as a true vein, though this last named mineral, associated with the sulphuret and carbonate of lead, was noticed in small ramifying veins, in what may perhaps be regarded as a distant portion of the range under consideration. Native silver was very rarely seen in the form of specks and strings associated with the native copper.

Most of the ores of copper occur in the greenstone, amygdaloid and lower portions of the conglomerate, or at points in near proximity to the dykes before referred to, and they are most abundant at, or near to the junction of the trap and conglomerate, or in immediate vicinity of the dykes, thus following the general laws respecting the deposits of the metallic minerals.

As the veins recede from the trap, the place of the copper is frequently supplied by the silicious oxide and carbonate of zinc, together with calcareous spar, which latter usually fills the entire vein in its passage across the sandstone.

The veinstone in those portions of the vein most rich in the ores of copper is chiefly quartz, and this is frequently filled with minute specks and filaments of the native metal.

Dr. H. conceives these to be veins of sublimation, or in other words to be simple fissures filled from below by the metal in a vaporous state, and that all the compounds had their origin from copper in a native form. The conglomerate was stated to have been noticed where the cement consisted

to a large extent of ores of copper, and even of copper in a native state. This was observed only in close proximity to considerable veins.

The veins, as well as different portions of the same vein, are very variable in their metalliferous character, portions being apparently rich, while others are completely barren. With the present knowledge upon the subject, we can scarcely arrive at safe conclusions as to the value of these veins for the purposes of mining, but upon the whole they may be looked upon favorably rather than otherwise.

Adjourned to 4 o'clock this afternoon.

Friday, 4 o'clock, P. M.—*Prof. Silliman* being absent, *Dr. Locke* was called to the chair.

Dr. Jackson gave his views in relation to the construction of geological maps, suggesting the importance of concert and uniformity in design and execution, as regards *scale*, *coloring*, *symbols*, &c. on the part of the various state geologists employed throughout the Union. The subject was further discussed by Dr. Locke and Prof. Johnson, who concurred in the views of Dr. Jackson.

On motion of *Prof. Mather*, the subject was referred to a committee consisting of *Dr. Jackson*, *Dr. Locke*, and *Prof. Mather*, who are to report at the next annual session of the Association.

Prof. Johnson exhibited a section drawn across the Frostburg coal basin, extending between the Little Alleghany and Savage Mountains, a distance of about four miles. He offered some observations concerning this coal-field, and enlarged upon its value and importance as a coal and iron region.

Mr. Hodge and *Mr. Trego*, who had explored that portion of this basin which extends into Pennsylvania, also made some remarks in which they differed from the views of Prof. Johnson; particularly with regard to his opinion that some of the upper strata of the carboniferous rocks near the Savage Mountain, rest *unconformably* upon the lower ones.

Mr. Hodge placed on the table some clay concretions from Kennebec river.

On motion of *Dr. Beck*, *Resolved*, That when this Association terminates its present session, it adjourn to meet in Boston, on the last Monday in April next.

Dr. Jackson, *Prof. Hitchcock*, and *Mr. Moses B. Williams*, were appointed a local committee, (pursuant to a resolution re-

ported by the committee on business,) for the purpose of making suitable arrangements for the next session of the Association.

The secretaries were intrusted with the preparation and publication of an abstract of the proceedings of the Association.

Resolved, That the chairman of the present session be requested to open the next session by an address.

Dr. S. G. Morton was then appointed chairman, and *Dr. Jackson* secretary, for the next session.

Dr. L. C. Beck, Prof. H. D. Rogers, Prof. Hitchcock, Dr. Locke, and *Dr. Jackson*, were appointed a committee to prepare a constitution, by-laws, &c. for the government of the Association, according to a resolution of the committee on business.

Dr. Griscom made a communication respecting the Duane "steel ore" of New York.

Adjourned to 9 o'clock to-morrow morning.

At 8 o'clock in the evening the Association had the pleasure, in common with a respectable audience of ladies and gentlemen of Philadelphia, of hearing a most interesting and instructive address from *Prof. Silliman*, on the general principles of geology, and subjects connected with its progress in America.

Fifth day of session, Saturday, April 10, 1841. The Association met this morning according to adjournment of yesterday. *Dr. Locke* in the chair.

The minutes of yesterday's proceedings were read and adopted.

Dr. Morton opened before the Association a vessel of earthen ware taken from the Pyramids of Sakhara in Egypt, and forwarded to him by the American consul at Cairo, which contained an embalmed body of the *Ibis religiosa*, or sacred bird of the ancient Egyptians. The earthen vessel containing this relic of the most remote antiquity, was of a cylindrical or rather a conical shape, having a lid or cover fixed on the larger end, closely fitted on and luted with a composition resembling common mortar of lime and sand.

Dr. M. remarked upon the interest attending these relics, owing to their complete preservation—the bones, feathers, and even animal matter being frequently found almost unchanged, except by desiccation. The specimen opened was one of uncommon interest on account of the great perfection and almost interminable number of the bandages of linen cloth in which it was enfolded, and the high preservation of the most delicate parts of the plumage. The

position of the bird in the embalmed specimens is found to be invariably the same. The neck and head are drawn down between the legs, the lower mandible being presented outward and downward, and the legs drawn forward beneath the body of the bird, as if in a sitting posture, with the wings folded over the neck and legs. Some specimens less perfectly bandaged seem to have undergone a process of carbonization, and on the removal of the linen folds crumble into a dark powder, in which the bones appear, though reduced to a brittle state.

Dr. Morton referred to the very recent appearance of the pottery ware in which these specimens were contained; notwithstanding their extremely ancient date, which is at least three thousand to four thousand years. The pyramids of Sakhara are among the most ancient monuments of human art. These cases containing the embalmed ibis are still found in great numbers, though the traveller, Dr. Pococke, gave his opinion one hundred years ago, that they would probably soon become extinct.

Dr. Morton then proceeded to open another envelope containing some unknown embalmed object, which he conjectured to be a mass of snakes or serpents. This was less carefully enclosed than the ibis, being coarsely enveloped in rags rather than bandages, though still covered by hundreds of folds of linen. These being at length removed, disclosed *the wing of a bat!*

The next embalmed object unfolded was a young crocodile, (*Crocodilus niloticus*,) about a foot in length, and in good preservation. Dr. M. observed that this animal is found in embalmed specimens of all sizes, from the apparently just hatched young to those of five feet in length, one of the latter size being at present in his collection.

Mr. Quinby exhibited specimens of silver, lead, and other ores from the Andes in Peru, accompanying them with some observations upon their product, situation, &c.

Prof. Johnson showed specimens of magnetic iron ore from the State of New York, which he had found to contain titanic acid, combined with iron and manganese.

Dr. Locke made some observations on the application of magnetism to the discovery of metallic veins and deposits.

The following resolutions being moved by *Prof. Rogers*, were unanimously adopted.

Resolved, 1. That the thanks of the Association be presented to *Prof. Silliman*, for the interesting lecture delivered by him last evening.

2. That the thanks of the Association be presented to the Academy of Natural Sciences for the use of their rooms during the present session.

3. That the sincere thanks of the Association be presented to *Prof. Silliman*, for the highly able manner in which he has discharged the duties of chairman at the present annual meeting.

4. That the thanks of the Association be presented to *Dr. Beck* for the able and laborious manner in which he has discharged the duties of secretary throughout the first year, and at the present meeting. Also that the thanks of the Association be given to *Messrs. B. Silliman, Jr.* and *Charles B. Trego*, for their valuable services as assistant secretaries.

On motion of *Prof. Rogers*, amended by *B. Silliman, Jr.*, it was *Resolved*, That the Association publish five hundred copies of the address of Prof. Hitchcock, under the direction of the secretaries, which shall be distributed, as soon as practicable, to all the members of the Association; and that the expense of publication be defrayed by a pro rata charge on each member, to be paid at the next meeting of the Association in Boston. Such copies as are not distributed to members under this resolution, to be sold for the benefit of the Association.

On motion of *Prof. J. C. Booth*, it was also *Resolved*, That the names of all the officers of the Association, of the local committee, and the names and addresses of all the members of the Association, be appended to the address of Prof. Hitchcock.

The Association then adjourned to meet in Boston on the last Monday in April next, (1842.)

B. Silliman, *Chairman.*

L. C. Beck, *Secretary.*

B. Silliman, Jr. } *Assistant Secretaries.*
Charles B. Trego, }

II. *Boston Society of Natural History.*

At a regular meeting of the Society, held on the 21st day of April, 1841,

Dr. C. T. Jackson having announced that at the late meeting in Philadelphia of the Association of American geologists, it had