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THE

CANADIAN
Naturalist & Geologist,

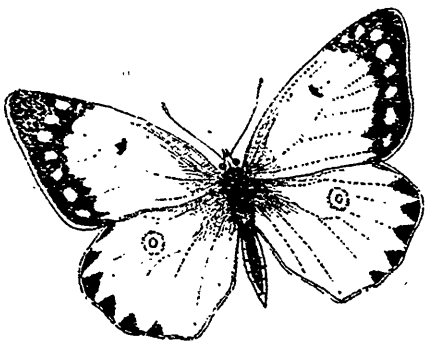
AND PROCEEDINGS OF THE

NATURAL HISTORY SOCIETY

OF MONTREAL.

CONDUCTED BY A COMMITTEE OF THE NATURAL HISTORY SOCIETY.

VOL. II. SEPTEMBER, 1857. No. 4.



Montreal:
B. DAWSON, No. 23, GREAT ST. JAMES STREET.
LONDON. SAMPSON LOW, SON & Co.

PRINTED BY JOHN LOVELL, MONTREAL.

Price Three Dollars per Annum, in Advance.

THE

Canadian Naturalist & Geologist.

This Magazine will appear bi-monthly, and be conducted by the following Committee, appointed by the Natural History Society of Montreal:—

J. W. DAWSON, A. M., F. G. S., *Principal of McGill College.*

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PLATE IV.

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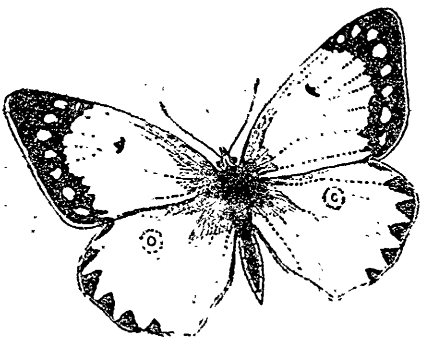

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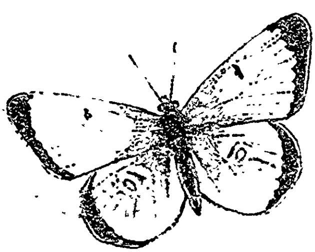
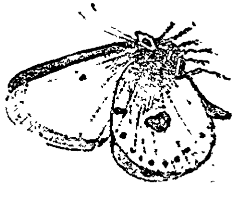




2 *b* 2 *c*

1 Papilio Troilus. 2 *a* Colias Philodice, (female).
2 *b* ——————— (male).

PLATE V.

ILLUSTRATIONS OF STERNBERGIA.

Fig 1

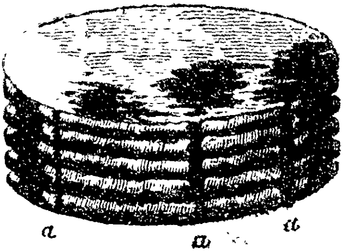


Fig 2

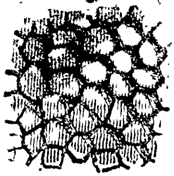


FIG. 1.—Portion of Sternbergia, (nat. size,) (a) Remains of Woody Fibre.

FIG. 2.—Transverse Section of one of the Diaphragms of Fig. 1, (magnified.)

Fig 3

Fig 4

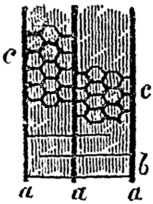


FIG. 3.—Junction of Diaphragm and Wood of Fig. 1, (magnified.)

FIG. 4.—Woody Tissue of Fig. 1, (highly magnified.) (a) Cell-Walls. (b) Medullary Rays. (c) Hexagonal Discs.

Fig 5

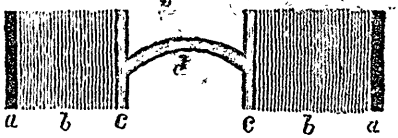


Fig 5, A

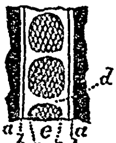


FIG. 5.—Transverse Section of Recent Cecropia peltata, (nat. size.) (a) Bark. (b) Wood. (c) Pith lining Medullary Cavity. (d) Diaphragm of Pith.

FIG. 5. A.—Section of young branch of a species of Ficus, showing the outer pith tissue and partitions, and the spaces between the latter still filled with the ordinary or inner pith. Reference letters same as Fig. 5. (e) Ordinary Pith.

Fig 6

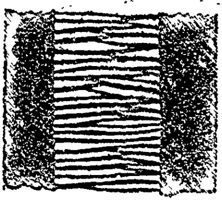


Fig 7

FIG. 6.—Flattened Sternbergia with compressed Bark, (nat. size.)

FIG. 7.—Flattened Trunk, one foot in diameter, with Sternbergia. (a) Portion of

THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOLUME II. SEPTEMBER, 1857. NUMBER 4.

ART. XXIV.—*Eleventh Meeting of the American Association for the Advancement of Science.*

The American Scientific Congress has just closed its sitting in our good Canadian City of Montreal, effecting a virtual Scientific annexation of American to British American minds, in their action in the wide field of physical and natural science. The Meeting has been a highly successful one, creditable alike to the assembled science of America, and to the city of Montreal, and we trust will produce lasting good effects, unalloyed by those small jealousies and heartburnings that too often remain after great assemblies of men, whatever the objects in which they may have been engaged.

We cannot attempt to present to our readers a full report of the proceedings of the Association. In its more ephemeral form this has been well done by the newspapers, and in its more permanent form it will appear in due time in the proceedings. We purpose merely to preserve a record of leading features of scientific progress evidenced in the meeting, and of points especially important to Canada. In doing so we shall draw largely on the reports in the Montreal newspapers, especially the *Herald* and *Gazette*; reports which are in the highest degree creditable to those prints, and could not easily have been surpassed in any part of America.

The opening Meeting was imposing and interesting. The Divine blessing was invoked on the proceedings by the Bishop of Montreal, in a singularly appropriate and beautiful prayer. Prof. Caswell, the Vice-President, who, owing to the lamented death of the great microscopist Bailey, was called to preside, delivered a short but happily conceived inaugural address, from which we extract the following sentences, as worthy of being embalmed in the memory of Canadians and Americans:—"It augurs well for the interests of Science that so many have come to this gathering to place their choicest contributions on her altar, and to welcome to her fellowship the humblest laborer in her cause. I think also that it is a matter of congratulation that we have met without the limits of the United States. However it may have been in former times, it is not now the case that mountains or seas interposed make enemies of nations. In the onward march of Science, it is one of the felicities of our time, that little account is taken of the boundaries that separate states and kingdoms. The discoverer of a new law or principle in nature, of a new process in the arts or a new instrument of research, of beneficial tendency, is speedily heralded over land and ocean; is welcomed as the benefactor of his race, and is immediately put into communication with the whole civilized world. We have before us a practical illustration of the amenities of science. We of the United States are here convened on British soil, little thinking that we have passed the boundary of the protection of American law, or that amidst the generous hospitality of this enterprising commercial capital of a noble Province of Great Britain, we are aliens to the British constitution. We have left the American eagle, but we assure the gentlemen of Canada that we feel in no danger of being harmed by the British lion. I have said that we are aliens to the British constitution; but that must of course be taken in the narrowest and most technical sense, for I am proud to say, on deliberate conviction, that nothing is alien to the British Constitution that looks to the perfection of knowledge, to the furtherance of the arts or the amelioration of the condition of humanity. I further say, and (turning to Gen. Eyre) I here speak by permission, that the proudest achievements of British arms, and they have been proud enough for the highest desires of ambition or of glory, have been less glorious than that patronage of science, that success in the arts, and those attempts to improve the condition of our race, which have placed Old England in the van of nations. At no period of time has that patronage been more wisely directed, or those noble efforts more earnestly persevered in than under the reign of the present illustrious Queen, whose virtues are alike the ornament of her sex and Crown. There is something of special fitness in our assembling here at this time—at a moment when England and America are shaking hands with each other across the broad bosom of the Atlantic, when that electric chain which is to bind them in perpetual friendship, is being placed securely in the depths of the ocean far out of reach of any temporary storms which may impair its repose or lessen its efficiency."

The Association was then welcomed to Canada, on behalf of the Province, the Local Committee, and the Natural History Society, in few but fitting words, by His Excellency the Administrator of the Government, Sir W. E. Logan, and Principal Dawson.

The division into sections is not so perfect in the American as in the British Association. The smaller number of scientific men and of papers, affords a reason for this; but we think that much more and better work could be done by a more minute sub-division. At the late meeting, after the primary division, established by the constitution, into sections of Physical and Natural science, but one sub-section was formed, that of Ethnology and Statistics. We shall take the matters presented to these sections in their order; dwelling especially, however, on the subjects more appropriate to the sphere of this publication.

SECTION OF PHYSICAL SCIENCE.

THE ZODIACAL LIGHT

Is a phenomenon interesting to the Naturalist as well as to the Physicist, and which like the Aurora Borealis, has formed a sort of stalking horse for makers of hypotheses. Commodore Wilkes, in a short paper, directed the attention of Section A to a very extended series of observations made by the officers of the United States Exploring Expedition, and more fully followed out, and represented in maps of the heavens, by the Japan expedition. The result of these observations is to suggest a very simple mode of accounting for this singular appearance. "When in command of the United States expeditions he had been especially directed to observe this light, and orders were accordingly given to the officers of the watch to look out for the light, and when they saw it to call the commander and such other officers as took an interest in its observation. These gentlemen made diagrams of the appearance, which were handed to him for comparison, so that the results were not those of the observation of one but of many observers. At first few could distinguish this light, but after some time, they could readily point it out in its relation to the stars. In these observations he was much indebted to Mr. Dana. The first time of passing through the tropics, where the light is most visible, it was unfortunate that there was great obscurity of the atmosphere. This caused a want of means for comparison; but this deficiency had been supplied by some obtained from the Japan expedition. All the observations of the Zodiacal light showed that it had not changed its appearance since two centuries ago when first noticed by Cassini, and by observing it particularly, with reference to the great circles of the globe—ecliptic and equinoctial—it becomes manifest that all changes of its appearances depend on the position of the spectator on the surface of the *globe*. After mentioning the several theories which have been promulgated at different times to account for this phenomenon, he stated his opinion that none of them satisfactorily accounted for the observed facts. The drawings were made as the phenomena appeared to the eye, being projected therefore on vertical and horizontal lines. When the light first appeared it was generally as an arc near the horizon; but it rose in a few minutes from 30° to 80°. The light then began to spread, and show a diffused light, which gradually became more visible, till it was in its perfection at the moment when the arc obtained its highest altitude, and it became difficult to ascertain where the diffused light began and ended. At length it lessened in intensity and the whole gradually subsided. The apex of the light was always East or West of the Sun, usually about 90°, sometimes 100°. The evening and the morning zodiacal light did not agree in phase or azimuth. In fact it was plain that the cause of this light could not be far removed from the earth's atmosphere. Within the tropics, and when the ecliptic was perpendicular to the horizon, the zodiacal light was confined to a slender column, having its diffused light little extended. Without the tropics it was always inclined to the horizon. Corresponding observations made on the same day also showed an inclination in opposite directions, the two appearances of the light being inclined towards each other. This showed that it was the same object seen from different positions, North or South of the ecliptic, and having its locality within the tropics. The Zodiacal light was not seen till the twilight ceased, but that gave only an indefinite idea of the time when it became visible at different places, because in the tropics there was little twilight. In northern latitudes the light had a greater altitude; but owing to the long twilights, was little visible, though it might be observed in the vernal and autumnal equinoxes even in this latitude. The light in the morning was not of the same colour as in the evening; in the first case being greyish, in the other having a reddish hue, depending on the approach or heat of the sun. After sunrise, he had seen it reach the zenith, with a breadth of only 2½ degrees. Sometimes the phenomenon was very beautiful, as if a gauze veil were spread over the atmosphere, through which the stars could be readily, though dimly seen. Thus the light stood alone and distinct from all others, its central line being parallel to the ecliptic, a little to the north or south of it, but sometimes corresponding with it. His idea of the origin of the light, from all these facts, was that it was the effect of the illumination of that portion of the earth's atmosphere on which the sun's rays fell in a perpendicular direction. To illustrate this, let it be remembered that if the sun's rays were admitted perpendicularly through a hole in the shutter, and all reflected light cut off, the atmosphere, or the particles floating in it become plainly visible as well-defined objects."

On a subsequent day the same subject was brought forward by the Rev. M. Jones, U. S. N., who on the basis of a series of observations made by himself at Quito, maintained the conclusion that the Zodiacal light is a circle of nebulous matter not heliocentric, as heretofore supposed, but geocentric; in short if we understand the view correctly, that this mysterious appearance is an attendant on our planet, related to it as the well known rings are to Saturn. We are not in a position so to investigate the facts presented, as to accept either of these theories as final, but it is evident that Commodore Wilkes and Mr. Jones have collected facts that will bring us nearer to settled conclusions on the subject.

Passing over several papers of a more purely physical character, we reach a singular and elaborate series of papers by Mr. Gibbons, of the U. S. mint, on the

WEIGHTS AND MEASURES OF VARIOUS COUNTRIES.

These papers presented in a condensed form many curious though well known facts, bearing on Ethnology and Natural History, of which the following may serve as specimens:

"He began by stating that about 1900 years ago, or about 52 years before the Christian Era, Julius Cæsar had described the inhabitants of Great Britain and Gaul, as making use of brass and iron rings by weight for money. Gold ring money of the Celts was also annually dug up in Ireland, and similar money was employed by the Scandinavians, on the shores of the Baltic. They were multiples of one certain ounce or integers of its proportions; the word for ounce being claimed as a purely Celtic one. Recently an ambassador wrote from Antwerp that he had purchased a gold chain of Rubens with the links stamped by the goldsmiths of the day to mark their weight and fineness. In South Africa, at the present day, there was a similar employment of metal rings. And a civilized country of antiquity, as appeared from paintings still remaining on walls, employed rings which were carried for cash to Ethiopia. Another nation had pieces of coin stamped with the likenesses of idols for the same purpose. The old pound of the Anglo-Saxons was called Easterling, from that came the modern sterling. In France there was a pound called the pound of Rochelle, and the Germans named it the pound of Cologne. A new system by which the pound of silver in tale was also made the pound in gross was arranged by Charlemagne, in the eighth century. In England, under William the Conqueror, it was decreed that weights, &c., should remain as they had been under his predecessors. In 1266, by consent of the whole Realm, it was determined that the silver penny, called esterling, should be round, and should be of the weight of 32 grains of wheat taken from the middle of the ear. Twenty of these penny weights were to make an ounce, 12 ounces one pound; 8 lbs. of silver a gallon of wine; and 8 gallons of wine a bushel, the eighth part of a quarter. Troy weight is supposed to have been derived from the Eastern nations, and transmitted first to Troyes, in France, from Cairo, during the crusades. From Troyes it was carried into England by the Goldsmiths, and found favor there under Henry 8th, who began to debase the standard fineness of silver coins, and to reduce their weight. Before this, a statute established a common standard by which silver and wheat were assumed to be the natural tests, the one of the other. Unfortunately, neither was exactly suited for the purpose. It had been found by experiment with white and red wheat from North Carolina—North Carolina flour having been reported the finest specimen at the great exhibition in London—that of red wheat 40 to 43 grains were required to balance a grain of silver, and from 28 to 35 or 36 grains of white wheat effected the same thing. In short, grains were not intended to serve as a just measure for perfect comparison, multiplication or division. Again, there was no such thing naturally as pure silver. It was produced only by art, and imperfectly reduced silver could not offer any just rule for the adjustment of weights and coinage. Attempts had been made to ascertain the purity of a silver penny of William the Conqueror, and it turned out there were in it 40-1000 of some base alloy. Now, in the U. S. Mint, at present, 3-1000 of alloy was all that was allowed for casual impurities. It was now never intended to make the metal perfectly pure; but whatever its purity, the rule adopted must be exactly followed out both with respect to the proportion of the precious metal and of the alloy. The old silver penny was a coin, a weight and a measure, and as its character of purity changed, the characters of all moneys, weights, and measures deduced from it were changed in the same proportion, for they did not depend upon the one element of weight or fineness; but on the products of both. The key stone was a penny sterling; but an error in this key stone made the whole arch fall, because the metallurgical inaccuracy was not checked by any metrical exactness. The bases being inaccurate no truth could be elicited from calculations founded upon them."

Troy weight being thus illustrated, the following remarks were made on the carat weights of the East:—"Among Eastern nations carat grains were used to determine the weight of Pearls and precious stones. Originally a bean, the Karat, was thought when dry to vary very little in weight. A natural section divides this bean into halves, which are again cut into quarters and are again divided, the smaller divisions being used to mark the different degrees of fineness of gold and silver The Chinese use a peculiar kind of pea and grains of maize and Indian corn. In Sumatra grains of rice are used. Thus a gardener's trade basket seems to have afforded all the standards required, and all the weights wanted by our ancestors, until nearly the close of the last century. The author then went on to show by the result of various trials the great discrepancy really existing between these original standards of weight, some grains weighing twice as much as others. Hebrew writers say that the barley corn was an element in the valuation of the shekel. The chemists of the middle ages used nitric acid and muriatic in preparing the precious metals, and in earlier times they had what is called the dry process, which i 'escribed by Hebrew writers with great minuteness. In South America the Eastern methods prevail, and it is a remarkable circumstance that a pilot in Pizarro's expedition observed, in one of the native vessels, a scale for weighing gold similar to what he had been accustomed to see in his own country. The principle of procedure in preparing gold has in all ages been the same, although the practice has differed. In the second chapter of the Book of Genesis, the different qualities of gold are spoken of, and through these records of antiquity examples are given, similar to the modern process, of melting, casting, graving and stamping metals. From these facts he concluded that very great progress in the arts and sciences must have been made at the time when these books were written."

Lastly, the avoirdupois weight, according to Mr. Gibbons, can claim a very remote antiquity, and is also based upon the weights of seeds:—" This kind of weight, which he stated to have been fixed in various countries by an arbitrary rule, was anciently called Poids de Marc, and *was designed for weigbable articles* —" Choses Poisibles" and to be used for current market purposes. It had its origin in Babylon, " a city of Merchants," and was carried to Atlantic Spain by colonists from Tyre about 3056 years ago. Spain produced a large amount of gold, and the Royal mint was noted for the purity of its coin, but in the 14th century no less than 150 mints were licensed, so that the coin became so debased that all trade was carried on by barter. At an early period it was said that there was a mint in nearly every county in Great Britain. *In ancient times it is supposed that an affinity* existed *among the* weights and monies of the various nations similar to that now existing among modern nations. Thus the average weight of a shekel, a coin of current money, is described as being half an ounce avoirdupois in refined silver, and by Hebrew tradition it weighed 320 common barley corns ; and proof of an understood standard of current money in very ancient times is given in the sale of several instances in the sacred writings; as in the sale of Joseph by his brethren; the purchase of a burying ground by Abraham, which was evidently " a cash transaction," the payment being made in metallic silver, current money among the merchants ; and the payment of his fare in a Spanish vessel by Jonah—all showing that there was a well understood standard, and it is supposed that this standard was computed by the avoirdupois weight. The avoirdupois weight is supposed not to have been introduced into England from Europe until 1335. Mr. Gibbon then went on to speak of the standards of value established at different times in the U. S. and British mints, stating that the coin had a somewhat depreciated value, established by an arbitrary rule adopted for the purpose of convenience, as compared with the original standard in Spain. According to the present value of the ounce avoirdupois, the shekel would be worth 63 cents, or about an English half-crown. He then spoke of the origin of the word dollar, which he derived from the Greek word for image, the word coin being attributed to a similar derivation. This derivation arose from the fact of coins being issued from the temples, the image stamped upon them being a guarantee of the purity and due weight of the coin. Mr. Gibbon then made some remarks upon the relative value of gold and silver, 16 ounces of silver being equal to 1 of gold. He then went on to speak of the certainty, drawn from observations already stated, that a regular coinage must have existed in very early times, and of the fact that some ancient process of mintage must have existed of a simple and inexpensive nature, as it is known that wherever there was a Greek colony there was a Greek coinage. A comparison between the present process and that of the past induces a conviction that the same means were adopted before the days of Moses which were afterwards contrived by Sir Isaac Newton, Master of the British mint during the reign of George the 1st. The following quotation from Deuteronomy, chap. 25, v. 15, is the conclusion of the paper: "Thou shalt have a perfect and a just weight, and a perfect and a just measure shalt thou have, that thy days may be lengthened in the land which the Lord, thy God, giveth thee."

Our old nursery idea that fire will not burn well in sunlight, was overthrown by Prof. Le Conte, in a paper on

SOLAR INFLUENCE ON COMBUSTION.

"He gave a sketch of various experiments tried by other scientific men with regard to this subject. He then explained the experiments by which he had endeavoured to ascertain whether the influence of Solar light on combustion was such as had been indicated by previous experiments, especially those of Dr. McKeever. The result of his experiments was a negative one the difference between the rapidity of combustion in the light and in darkness being extremely small, and sometimes in favor of the light and sometimes in favor of the dark, while the difference between them on different days sometimes amounted to 9 per cent. This fact he held to be a proo. that the former theory had been too rashly generalised from isolated facts, and he came in general to the conclusion that the observed influences upon the rate of combustion were due to the state of the atmosphere, and not to any Solar action. Following up this conclusion, and guided by a large number of well authenticated and carefully observed experiments carried on under various circumstances, the deduction drawn was that combustion was retarded by rarifiaction and accelerated by condensation. He then detailed a number of observations by which it was found that the ratio of combustion was greater than the ratio of density. One great result of all these observations and experiments was that there is an immense number of atmospheric influences, the effect of which have as yet been undiscovered. There were, however, two conclusions which he believed to be established. First, that *Solar light* does *not* seem to exercise any sensible effect upon combustion; and secondly, that variations in the *density of the air do exert* a striking effect in retarding or accelerating the rapidity of the process—the rate of burning augmenting with every increment of density, and *vice versa*."

Prof. Olmstead of Yale College, communicated an interesting paper on

THE AURORA BOREALIS,

in which he criticised the Electric theories of this phenomenon: —"The Professor commenced by a reference to a paper which he had previously written on this subject, and which was published among the contributions to the Smithsonian Institute. In this paper he had recorded a number of *facts* derived from a series of observations upon the very strickingly magnificent Auroras which had been witnessed during a period of about twenty years, commencing about the year 1837. The theory which he had deduced from these facts was, that contrary to the general hypothesis which ascribes the Aurora to Terrestrial sources, its origin was cosmical, the matter being derived from the planetary spaces.—His arguments in favor of this theory, in opposition to the electrical hypothesis, were based upon the immense extent of the phenomena beyond the reach of atmo pheric excitations; secondly, from their occurring at the same hour of the night in places very far distant from each other; thirdly, from the velocity of their motions; and fourthly from the periodicity of their occurrence during a certain time, and then disappearing altogether from the heavens. With regard to their having a revolution round the sun, he thought that to be affected by the question of zodiacal light, with which he thought they had some connection; and if it should appear that the Zodiacal Light was a ring round the earth it would not affect this conclusion. He had previously stated that the long series of brillant Auroras which had been recently witnessed would soon be over and not appear again until after a period of about forty years; the regular period being calculated at sixty years. He would ask members of the Association to remark that for five or six years past the brilliancy of the Aurora had diminished, and he would ask those who could not look back to 1837 and 1840 when the maximum brightness of the Aurora was observed, not to consider the appearances now seen as comparable to those exhibitions which the older members could remember. He would ask them only to consider as the Aurora those immense banks of light which, in 1835 and 1837 used to appear in the North West, rising into columns of a scarlet or blood-red colour, with spindles moving to the South East, and arranging themselves in a magnificent crown round the zenith; while the whole heavens were suffused with crimson light. For five or six years no such exhibition had occurred. In 1840 there were 75 strikingly magnificent exhibitions of the Aurora, while for several years they had scarcely seen one. After the discovery of the analogy between electricity and lightning, it became the practice to ascribe everything to electricity. No one could doubt that electricity holds a high place among the ultimate causes of natural phenomena; he only objected to ascribing everything to that agency without even first proving its presence. This practice had damped enquiry into many phenomena, and among others, into those relating to the Aurora Borealis, and it was always deemed sufficient to say that the Aurora was an electrical phenomena. Various arguments were urged in favour of the electrical hypothesis, and upon them he would remark that the resemblances between electricity and the Aurora had been greatly overstated. Fire, the sun, a lamp, or a star have all some resemblance to the Aurora, but from his own observation he was compelled to say that the likeness was very faint, both with regard to the shape of the light and its motions. The reasoning was this. Lightning was known to be the discharge of electric clouds, and because the Aurora was said to be like the flash of lightning, it was supposed to be discharge of electric clouds in the higher strata of the atmosphere. This rested on very small foundations; for instance, the same Aurora had been known to be visible from the extreme point of Asia to the coast of California. Electricity would not account for this. As for the shape and form of the phenomena they might be accounted for by various means as well as by electricity. From the foregoing considerations he was led to conclude that any argument founded upon the resemblance between electricity and the Aurora was inconclusive and unsatisfactory. The defenders of this hypothesis had not agreed in anything but that the Aurora was in *some way or other* connected with electricity, but they disagree as *to the mode in which it is done.* The Professor then went on to discuss the various theories that had been advanced by different writers upon the cause of the Aurora, and in commenting upon them he begged to call attention to the real question, which was this—What is the origin of the Aurora Borealis? Is the matter which composes it derived from the earth in any way, or does it come down from the planetary spaces? If the Zodiacal Light is a ring round the earth and affords material for meteoric stones, much more fully might it be concluded that the Aurora is ferruginous, and that would help them to explain the hypothesis that the Aurora is magnetic. No doubt, electricity might present some of the appearances of the Aurora, but it was not sufficient to account for them all. The motions of the Aurora were progressive and not instantaneous, as was the case with electric flashes. Moreover the periodicity of the Aurora was not accounted for by the electric hypothesis. By another hypothesis the Aurora was ascribed to magnetism. It must be admitted that there is some connection between the two, as is shown in various ways, but these facts merely prove that it has magnetic qualities—they prove nothing as to its origin. The material of which it is composed and its extent, are not accounted for by any of these hypotheses, while they are satisfactorily accounted for by assigning it to a cosmical origin."

The great tides of certain bays and Estuaries are of much interest to the geologist, and from a paper contributed by Prof. Bache

ON THE HEIGHT OF TIDES ON THE ATLANTIC COAST,

it appears that the causes producing the seunusual tides are much more extensively distributed than hitherto supposed:—"It was well known that when the tide flowed into any bay whose mouth was favorably placed for the reception of the tide wave flowing in, the height of the tide increased as it advanced towards the head of the bay. Extended observations went to show that the same phenomenon was observable in the greater divisions of the coast. He divided the Atlantic coast into three great parts, which he called the great southern, great middle and great eastern bays. The first extended from Cape Florida to Cape Hatteras, the second from Cape Hatteras to Cape Cod, the third thence to Cape Sable and perchance to Cape Race. His own observations extended as far north as Cape Ann, and he had been assisted in making up the results by Mr. Portalis. The tidal observations for New Brunswick and Nova Scotia (including Cape Breton), and part of Newfoundland, were obtained from Captain Shortland and Admiral Bayfield of the Royal Navy, whom he desired thus publicly to thank for their kindness. He should make no farther use of the information they had communicated to him than as helping out the illustration of his theory of the rest of the coast of North America, leaving them to bring before the public and reap the honor of their own investigations. Pursuing his subject, he showed that at the southern headland of the southern bay, Cape Florida, the mean tide was 1-10th foot; at Cape Hatteras, the northern headland 2 feet; while at Savannah, at the bottom of the bay, it rose to 6 feet, and it was found that the tidal lines between these points corresponded with the lines of the coast. At Cape Hatteras, again, and Cape Cod on Nantucket, the tides were the same, (2), while at New York, the bottom of this bay, they rose to 7. At Nantucket the transition from the regime of the middle to the eastern bay was sudden, and they had within a few miles five co-tidal lines touching the coast, which elsewhere were widely apart. From Cape Cod to Cape Ann, at the bottom of the great eastern bay, there was a rise of from 2 to 8 or 9, diminishing again at Cape Sable to 6, but he had reason to believe that this bay really extended to Cape Race. He next proceeded to notice the several bays and inlets along the coast, which generally showed the same characteristics in a more marked manner. In the Bay of Fundy, for instance, the height of the tides increased from Portland to Grand Manan from 8 or 9 to 17, and thence to the bottom of the bay to 36. Prof. Bache's paper was illustrated with some very interesting diagrams and charts, shewing the wonderful coincidence of the height of the tides in various places, with the lines of the coast."

Prof. Henry read a paper on

SOME PHENOMENA OF ICE.

"He said that they were in the habit of receiving all sorts of communications and curiosities at the Smithsonian Institution; and more questions were put them than many very wise men could hope to answer. One cold day in winter, a countryman was shown into his office, who said he had travelled 20 miles to bring him a curiosity. He proceeded to unpack it, and instead of an animal, as he had expected, he found it to be a milkpan filled with frozen water. On the top of the ice in it was a strange formation, created without apparent cause. A crystal of ice protruded from it in a slightly oblique manner, in shape almost like an isosceles triangle, with its sides somewhat curved. This crystal was found to be hollow. After ordering a drawing to be made of it, the matter was laid aside for subsequent consideration, and not again taken up until questions were subsequently put to him respecting the cracking of ice in very cold weather. It was well known that in the process of the solidification of melted metals, and the freezing of water, the crystals are produced in the direction of the surface from which the heat escapes. In the freezing of the water in a vessel of this sort, the crystals run in nearly horizontal lines, crossing each other at an angle of 60 degrees. The water, freezing first from the sides and bottom of the vessel, left in the centre and top a triangular space, which the yet unfrozen but expanding water found too small for it. It rose above the level of the ice, therefore; its edges freezing there again, the same phenomenon recurred, and the crystal was built up. Ice having once been formed, however, followed the law of all other bodies, contracting with cold and expanding with heat. Thus it was that in very cold weather the ice was found to crack open sometimes with a loud report, the cracks taking place in the parts of least resistance, generally the narrowest portion of the body of water frozen over. The crystals formed on the surface of large bodies of water in the process of freezing were nearly perpendicular, the cooling surface being that exposed to the cold winds. This was easily seen as the ice decayed, and the crystals separated the one from the other. The subsequent expansion of the ice by the recurrence of warm weather sometimes brought the edges of the fissures together, and crushed the newly-formed ice into a heap or mound. This same effect upon frozen earth had caused in some places during the past winter the cracking of the ground with loud reports, which had alarmed people in the vicinity."

Some discussion ensued as to the hollowness of the crystal which did not seem satisfactorily accounted for. It was suggested, however, that the enclosed water must have found means of escape ere the solidification was complete.

We close our brief and imperfect notice of the Physical section. with two papers by Prof. Smallwood. One of these related to that mysterious substance, or probably modification of the oxygen of the atmosphere, OZONE. The other was an interesting account of the METEOROLOGY OF MONTREAL AND ITS VICINITY. These papers we do not at present notice more at length, as we hope to have the papers themselves for publication.

SECTION OF NATURAL HISTORY AND GEOLOGY.

The first paper in this section, by Mr. Snell, described some processes for the quantitative assay of chromium by the blowpipe. The next was that on *Sternbergia*, by Prof. Dawson, which we publish in the present number. Mr. Lesley then read a description of some curious *Flexures of the strata*, in the Broad-top coal field of Pennsylvania, which he attributed to enormous lateral pressure acting on soft beds, compressed between sheets of inflexible sandstone. The results, as exhibited by Mr. Lesley, from actual measurements, are very singular, and most perplexing to the miner and geological observer.

Sir W. E. Logan then read a paper explanatory of the destinction between the great series of ancient metamorphic rocks which he had named respectively the

HURONIAN AND LAURENTIAN SERIES OF CANADA.

"The sub-silurian azoic rocks of Canada occupy an area of nearly a-quarter of a million of square miles. Independent of their stratification, the parallelism that can be shown to exist between their lithological character and that of metamorphic rocks of a later age, leaves no doubt in my mind that they are a series of very ancient sedimentary deposits in an altered condition. The further they are investigated, the greater is the evidence that they must be of very great thickness, and the more strongly is the conviction forced upon me that they are capable of division into stratigraphical groups, the superposition of which will be ultimately demonstrated; while the volume each will be found to possess, and the importance of the economic materials by which some of them will be characterised, will render it proper and convenient that they should be recognized by distinct names, and represented by different colors on the geological map. So early as the year 1845, as will be found by my report on the Ottawa district (presented to the Canadian Government the subsequent year), a division was drawn between that portion which consists of gneiss and its subordinate masses, and that portion consisting of gneiss interstratified with important bands of crystalline limestone. I was disposed to place the lime-bearing series above the uncalcareous, and although no reason has since been found to contradict this arrangement, nothing has been discovered especially to confirm it: while the complication which subsequent experience has shewn to exist in the folds of the whole, (apparent dips being from frequent overturns, of little value,) would induce me to suspend any very positive assertion in respect to their relative super-position, until more extended examination has furnished better evidence. In the same report is mentioned among the azoic rocks, a formation occurring on Lake Temiscaming, and consisting of silicious slates and slate conglomerates, overlaid by pale sea-green and slightly greenish-white sandstone with quartzose conglomerates. The slate conglomerates are described as holding pebbles and boulders (sometimes one foot in diameter,) derived from the subjacent gneiss, the boulders displaying red feldspar, translucent quartz, green hornblende and black mica, arranged in parallel layers, which present deflections, according with the attitude in which the boulders were accidentally enclosed. From this it is evident that the slate conglomerate was not deposited until the subjacent formation had been converted into gneiss, and very probably greatly disturbed, for while the dip of the gneiss, up to the immediate vicinity of the slate conglomerate, was usually at high angles, that of the latter did not exceed nine degrees, and the sandstone above it was nearly horizontal. In the report transmitted to the Canadian Government in 1848, on the North Shore of Lake Huron, similar rocks are described as constituting the group which is rendered of such economic importance from its association with copper lodes. This group consists of the same silicious slate and slate conglomerate, holding pebbles of syenite instead of gneiss, similar sandstones, some of them tinged green, and similar quartzose conglomerates, in which blood-red jasper pebbles become largely mingled with those of white quartz, and in great mountain masses predominate over them. But the series is here much intersected and interstratified with greenstone trap, which was not observed on lake Temiscaming.

These rocks were traced along the north shore of Lake Huron, from the vicinity of Sault Ste. Marie for 120 miles, and Mr. Murray ascertained that their limit on the Lake Shore occurred near Shibahahnahning, where they were succeeded by the underlying group. The position in which the group was met with on Lake Temiscaming is 130 miles to the north east of Shibahahnahning, and last year Mr. Murray, in exploring the White Fish River, was enabled to trace the out-crop of the group characterized by slates, sandstones, conglomerates, greenstones, and copper-lodes for sixty five miles from Shibahahnahning to the junction of the Maskinongé and Sturgeon rivers, tributary to Lake Nipissing. The general bearing of the out-crop is N. E., and an equal additional distance in the same direction, would strike the exposure on Lake Temiscaming. In the portion which Mr. Murray examined last year, the dip appears to be about N. W., often at a high angle, while that of the subjacent gneiss is more generally S. E., sometimes at a low angle, and in some places nearly horizontal. To the eastward of this out-crop, Canada has an area of 200,000 square miles; this has yet been but imperfectly examined, but in so far as investigation has proceeded, no similar series of rocks has been met with in it; and it may safely be asserted that none exists between the basset of the Lower Silurian and the gneiss, from Shibahahnahning to the Mingan Islands, a distance of more than1,000 miles, and probably still farther to Labrador. The group on Lake Huron we have computed to be about 10,000 feet thick, and from its volume, its distinct lithological character, its clearly marked date, posterior to the gneiss, and its economic importance as a copper-bearing formation, it appears to me to require a distinct appellation and a separate color on the map; without which, indeed, the investigation of Canadian geology could not be conveniently carried on. We have in consequence given to the series the title of Huronian. A distinctive name being given to this portion of the Azoic rocks renders it necessary to apply one to the remaining portion. The only local one that would be appropriate in Canada, is that derived from the Laurentide range of mountains, which is composed of it from Lake Huron to Labrador. We have therefore, designated it as the Laurentian series. These local names are, of course, only provisional, devised for the purpose of avoiding periphrastic or descriptive titles, the use of which has been found inconvenient; and they can be changed when more important developements, proved to be the equivalents of the series, are met with elsewhere.

In answer to a question whether these Huronian Rocks were older than the Silurian, or whether there was any indication of their being Silurian metamorphosed; Sir William said the Huronian rocks lie unconformably under the Silurian, and that the lower beds of the Silurian in contact with the Huronian are made up of its ruins. They found the Huronian in nearly a vertical attitude, but there is no possibility of doubt as to the comparative age of the Huronian and Silurian rocks."

ORIGIN OF MAGNESIAN ROCKS.

Mr. T. Sterry Hunt then read a very interesting paper on Mineral Waters and on the origin of Magnesian Rocks. "He alluded first to the deposits of mineral springs and especially of calcareous waters, as having played an important part in the formation of rocks. The deposits of such waters are however generally destitute of carbonate of magnesia, which is held in solution by them, and only precipitated on evaporation. Carbonate of soda is very abundantly distributed in certain mineral waters, and these mingling with sea-water, or with mineral waters analogous to it in their nature, have at first the effect of eliminating the lime as a carbonate, leaving the greater part of the magnesia in solution, ready to be precipitated in part by evaporation, or more completely by the farther addition of carbonate of soda. In this way dolomites may be deposited in the open sea, and may form, as they often do, the cementing material of conglomerate or coralline limestones. They may be equally formed by the evaporation in limited basins or lagoons, of waters holding carbonate of magnesia dissolved in the manner above described; in the latter case, we can easily understand the precipitation of magnesian carbonate unmixed with lime. The interstratification of dolomites with pure limestones in the Silurian rocks of Canada, was described as irreconcilable with the hitherto received theories of the origin of dolomites, and it was maintained that the hypothesis now proposed, is the only one which meets the conditions of the problem."

SUBSIDENCE OF LANDS.

Professor G. H. Cook, of Rutger's College, then read a paper on the subsidence of the land on the sea coast of New Jersey and the adjoining States. "Mr. Cook said that in the course of some geological examinations near the coast of Southern New Jersey, his attention was frequently called to various facts indicating a change in the relative level of the land and water at some recent period. An attentive examination of these facts led him to the conclusion that a gradual subsidence of the land was now in progress throughout the whole length of New Jersey and of Long Island; and from information derived from others, he was induced to think that this subsidence might extend along a considerable portion of the Atlantic coast of the United States. The occurrence of timber in the marshes and water below tide-level was common along their whole Atlantic shore. Almost every one familiar with shore-life had observed the remains of logs, stumps, and roots in such places, although they had been looked upon generally as the remains of trees torn from their original place of growth by torrents, or by the necessary moving of the shores, and deposited in the places where they were found by the ordinary action of the water. But close examination made it evident that they grew upon the spots where they are found. The stumps remain upright—their roots are still fast in the firm loamy ground which underlies the marsh, and their bark and small roots remain attached to them. The localities in which they are most abundant are such as are least liable to be affected by the violent action of the water or of storms. Thus they are by far the most abundant on the low and gently sloping shores of Long Island, New Jersey, and all the States farther South which are protected from the violent action of the surf by a line of sand beaches, at the same time that the numerous inlets allow free access to the tides. In these protected situations hundreds and even thousands of acres can be found in which the bottom of the marshes and bays is as thickly set with the stumps of trees as is the ground of any living forest. His own observations were chiefly made upon the southern part of New Jersey, following the shores of Delaware Bay from its head down to Cape May, and the Atlantic shore from Cape May north to Great Egg Harbor, and thence eastward at several points along the south shore of Long Island. In the ditches in the marshes, above Salem, great numbers of the stumps and trunks of trees are met with at all depths, quite down to the solid ground. At Elsinboro' Point, a little farther down on the Delaware Bay shore, the cutting away of the marsh by the water has left great numbers of stumps exposed, where they can be seen at every low tide still firmly rooted in the hard ground. In the bank of Alloway's Creek, a few miles below, the remains of trees can be seen under the same circumstances. They are also common in all the marshes of Cumberland County, and great numbers of them can be seen in the marshes on Maine River, at Dorchester and below. In Cape May County they are seen everywhere in the marshes and the creeks, on the Delaware Bay; on the inside of Seven Mile Beach, on the sea side; and below Luckahoe, on Great Egg Harbour. In the marsh on the Raritan, above South Amboy, hundreds of them were dug out in cutting a canal across a bend in South River. The marshes on Staten Island also contain buried timber; and on Long Island, at Hempstead, at Babylon, and still further east, the same fact is of constant occurrence. At several places in Southern New Jersey an enormous quantity of white cedar timber is found buried in the salt marshes—sound and fit for use, and a considerable business is carried on in mining this timber and splitting it into shingles for market. At Dennisville there is a large tract of marsh underlaid by cedar swamp, earth and timber. By probing the marsh with an iron rod, the workmen find where the solid timber lies, and then removing the surface sods and roots, they manage to work in the mud and water with long one-handed saws and cut off the logs, which then rise and float, as the timber is not water-logged at all, but retains its buoyancy, and the removal of that nearest the surface releases that which is below and it rises in turn, so that a new supply is constantly coming up to the workmen. In this way a single piece of swamp which is below tide-level has been worked for fifty years past, and still gives profitable returns.

Prof. Cook here referred at considerable length to the opinions of various parties who had been making similar examinations to those detailed, showing by reference to a map the various positions in which they had been made, and also quoted several authorities as to the fact of land having been submerged within a recent period. The owner of an extensive tract of land, between Maurice River and West Creek, informed him that within the last fifty years he had lost 1,000 acres of timber by the tides running higher on the upland than they formerly did. On West Creek he was shown portions of upland on which good crops of wheat had been raised, within thirty years, which was now liable to be overrun by the tides. The same farm has, within the the last fifty years, lost 50 acres—part wood and part cultivated land—in the same way. After quoting the published opinions of Professor Hitchcock, Professor Dawson and others, Professor Cook said—After examining all he had been able to find written, he could find no other theory which would embrace all the facts, than that of a slow and continued subsidence of the ground. In regard to the rate at which this subsidence was going on, the Professor quoted the result of several examinations, and said with these several results—three of a subsidence of 3 feet in 150 years, one of two feet in 100 years, two of 1 foot in fifty years,—and one of 4 inches and one of 8 inches in 2 years, he might, with some degree of probability, set the average subsidence in the district where the observations were made, at two feet in a century. The opportunities for accurate observation was less frequent in several of the places mentioned than in the southern part of New England; but from the phenomena of the marshes and of the submerged forests of Long Island and in northern New Jersey, he inferred that there was no material difference in the rate from that already deduced."

METAMORPHISM OF SEDIMENTARY ROCKS.

A subject of commanding importance in chemical geology, is the METAMORPHISM OF SEDIMENTARY ROCKS; but hitherto chemists have regarded it as a difficult and uninviting field. We are glad to find that Mr. Hunt, of the Canadian Survey, has been cultivating it with marked success. His paper on this subject was replete with suggestive facts and inferences; much more so than can be gathered from the following somewhat meagre abstract.

"The fact which forms the point of departure for the history of the metamorphic rocks is this:—That the sedimentary strata common to different geological formations, may under certain conditions, be converted into crystalline rocks. One of the most important results of modern geological research has been to show that the crystalline schists of various regions are stratigraphically identical with unaltered sediments of Silurian, Devonian, and even of later secondary age, although regarded as primitive rocks by the geologists of the last generation. Mr. Hunt observed that we have besides those sedimentary rocks of mechanical origin, which are composed of the ruins of felspathic and quartzose rocks, others of organic origin, and finally deposits of limestone, dolomite, magnesite, carbonates and oxyd of iron, and manganese. These chemical deposits are often mingled with those of mechanical origin. He contended that a dry heat, producing fusion of the sediments, cannot be admitted to explain the changes which they have been found to have undergone, from the fact that such a temperature was incompatible with the existence of alkaline silicates and of graphite in the limestone. The influence of hot water alone is equally inadmissible, for the silica being dissolved by water before it could act upon the bases, we should find the quartzites rendered vitreous and crystalline.

He regards the changes as having been produced by the action of small amounts of carbonate of soda in aqueous solution forming with the quartz, silicate of soda, which is afterwards decomposed by the earthy carbonates; yielding silicates of these bases, and reproducing the carbonate of soda. A portion of the alkali is, however, always fixed and rendered insoluble in the process, so that with a limited portion of soda, the action is at last exhausted. These reactions, resulting in the production of silicates of lime, magnesia, &c., take place even at 212 ° F, and the intervention of alumina gives rise to garnet, chlorite and epidote. The absence of iron from some felspathic and quartzose sediments, and its accumulation as beds of iron ore, he regards as effected by the agency of organic matters, which reduce the iron to protoxyd and render it soluble in wate., which afterwards deposits it as oxyd or carbonate. The same process produced the fire-clays and ironstones of the coal period, and is now operating in bogs and marshes. In this way we have beds of argillaceous and felspathic materials freed from iron.

CRYSTALLINE ROCKS OF THE NORTH HIGHLANDS OF SCOTLAND.

We give in full a paper on this very interesting subject, communicated by Sir R. Murchison and Mr. Salter. It brings within the limits of the recognised subdivisions of the Silurian System in Britain and America, a group of metamorphosed rocks, hitherto of uncertain age.

LONDON, July 27, 1857.

MY DEAR SIR WILLIAM,—Being unable, to my great regret, to attend the Montreal Meeting of the American Association for the Advancement of Science, where my distinguished friend Professor Ramsay, will represent British Geologists and our Survey, I beg to communicate to you, and any geological contemporaries who may be present, the final determination of a question which has been much agitated in this country, and which has just been settled by a comparison with North American typical fossils of Lower Silurian age. This question is: what is the true place in the geological series, of those great masses of crystalline or sub-crystalline stratified rocks, in the North Highlands of Scotland, in some of which organic remains were discovered by Mr. Charles Peach, in 1855?

That discovery induced me, in the same year, to re-visit the localities in the north-west part of Sutherlandshire, to the east of Cape Wrath (Durness), in which the fossils had been detected; my chief object being to ascertain if the views of former explorers of that region, including Sedgwick and myself, in 1827, were correct; viz., that these quartz rocks and limestones, associated with mica schist and a sort of gneiss, are of a more ancient date than the great series of Old Red Sandstone, or Devonian deposits, that occupy so large a portion of the north-east of Scotland, and are particularly developed in Caithness and the Orkney Islands.

The results arrived at in that excursion, in which I was accompanied by Prof. James Nicol, were communicated at the meeting of the British Association at Glasgow, in September, 1855, and published in the volume of that year—(See Transactions of the Sections, 1855, p. 85). I then re-affirmed the opinions I had formed in the year 1827, in company with Professor Sedgwick, as to the anteriority of all these quartz rocks with intercalated limestones, to the Old Red Sandstone, or Devonian System; and judging from the facts that such crystalline and sub-crystalline strata reposed unconformably upon an ancient granitoidal gneiss, and were flanked and surmounted by the ichthyolitic deposits of Caithness, I expressed my belief that, although very imperfect and difficult of absolute determination, the fossils there found by Mr. Peach were of Lower Silurian age.

At that time, my eminent and lamented friend, the late Hugh Miller, had suggested theoretically that the quartzites and limestones of the North Western Highlands might prove to be the metamorphosed equivalents of the Old Red series of the East Coast; and, subsequently, Prof. Nicol has even endeavored to show that these rocks may be the metamorphosed representatives of the carboniferous series of the South of Scotland! Both these suggestions were of course opposed to my own belief, and as they have been put forth by distinguished contemporaries, I have now to show how my own views have been sustained.

Within these few weeks, Mr. C. Peach has found, in the same locality, (Durness), other and better preserved fossils, which have, I rejoice to say, set the *questio vexata* at rest, as will be seen by the annexed note of Mr. Salter, who unhesitatingly compares these remains with those known to Mr. James Hall, yourself, and other North American Geologists, as occupying the true Silurian position of the calciferous sandrock and base of the Trenton Limestones.

It is of course most gratifying to me to find that the general views of succession of the rocks of my native Highlands, indicated so far back as the years 1826-7,—opinions then formed irrespectively of zoological evidences, and simply from the physical relations of the rock masses, should have been thus supported by fossil discoveries.

North American geologists will, of course, have no difficulty in understanding and admitting the conversion of Lower Silurian sediments into quartz rocks, crystalline limestones, mica-schists, chloritic slates, &c.; since their own eastern coast ranges exhibit such phenomena, some of which have been described and mapped by yourself.

To the geologists of the old country this determination is of the deepest interest; for it gives them a key to unravel the real age of large masses of the quartzites, limestones, chloritic and clay slates, mica-schists and quasi-gneissic rocks (sometimes more sometimes less metamorphosed) which occupy vast wild tracts of the Highlands of Scotland.

The general order of the Scottish rocks is, therefore, pretty well ascertained. The lowest known rocks are masses of granitoid gneiss, on the upturned edges of which repose certain hard gritty beds, and conglomerates, often of a red colour, which, in the early days of our science, were confounded with the Old Red Sandstone. Now, however, that the existence of conglomerates at different levels in the Lower Silurian rocks of the south of Scotland has been demonstrated, (See Siluria, p. p. 156-160,) the old views dependent on the mineral characters only, have been swept away. The lowest, indeed, of the conglomerates on the northwest coast of the Highlands may pass for the Cambrian Rocks of the Geological Survey. Then follows in an ascending order, the series of quartzites, mica and chloritic schists, &c., with included limestones, representing in a metamorphic condition the Lower Silurian sediments.

It is highly probable that the Upper Silurian rocks which exist partially in the south of Scotland, have no real equivalent in the Highlands; since the metamorphic rocks above adverted to, are unconformably overlapped by those conglomerates and sandstones which form the very base of the Devonian rocks or Old Red Sandstone.

That great series is clearly exhibited on the north east coast of the Highlands, and is made up of three subdivisions; viz., (a) Lower Conglomerates and Sandstone, (b) Middle Flagstones and Schists, with abundance of the well known ichthyolites, and (c) Overlying Sandstones—the latter constituting the northern headlands of Caithness, and the chief hills of the Orkney Islands.

I feel confident that this triple series represents in full, as I have endeavored to show in my work, Siluria, the Devonian rocks of Devonshire, as well as the slaty rocks of the Rhenish Provinces (including the Terrain Rhénan of Dumont.)

The *experimentum crucis* as respects Russia, was in fact settled by the discoveries of my colleagues De Verneuil, and Keyserling and myself, when we found the fossil shells of Devonshire and of the gorges of the Rhine, in the same beds with the ichthyolites of the Scottish Old Red; many species being identical.

In turning to Ireland we have there obtained evidences illustrative of the conversion of Lower Silurian rocks, as shown by sections across the Connemarra Mountains, where a great succession of crystalline limestone and quartzites, including the green Connemarra Marble, having been observed to lie directly beneath strata with fossils of the Llandovery Rocks (Middle Silurian), I have had no hesitation in considering these altered masses to be representatives of the Lower Silurian of other tracts. (See Siluria p. 108.)*

Again adverting to Ireland, the Survey under our friend Mr. Beete Jukes has ascertained, that in the Dingle Promontory true Upper Silurian Rocks, with both Wenlock and Ludlow fossils are conformably surmounted by many thousand feet of hard chloritic and silicious grits and schists (Glengariff grits), which represent in my opinion the great mass of the Devonian Rocks. The peculiarity, however, of the Irish section is that between these Glengariff Grits, and that which has hitherto been exclusively called the Old Red Sandstone of Ireland, there is a great hiatus; for the latter reposes on the edges of the former, and passes conformably under the carboniferous deposits.

* NOTE.—I examined this tract last year in company with Mr. Jukes, Mr. Griffith and Mr. Salter. Mr. Du Noyer has ably mapped and delineated the country.

This phenomenon, however, simply shows that a great break or local change in the sediments, took place in the S. W. of Ireland which had no existence in the north east of Scotland, where the Old Red or Devonian series is continuous.

I cannot on this occasion enter into questions of detail concerning the localities where the Upper Silurian strata pass upwards with perfect conformity into the Old Red or Devonian rocks,) or indicate other tracts in Europe (notably in France and Spain) where on the contrary the Upper Silurian is entirely omitted. In regard to local dislocations, I particularly refer you to my comparison of the Old Rocks of the Thuringerwald and the Hartz.* I will simply conclude this letter by calling your attention to what is now seen to be the true method of comparing the Older Palæozoic or Silurian Rocks of distant regions.

When that skilful and profound geologist, Mr. Barrande, published in the course of last year his most instructive essay, entitled "Parallèle entre les dépôts siluriens de Bohème et de Scandinavie," he showed how with an agreement in generic characters of the fossils of each Silurian zone, thus indicating a general harmony, there was a great contrast in the species of marine animals in each of the countries compared. By applying this method in a different sense, I may now say that when the Silurian rocks are viewed in their extension through the same latitudes, a remarkable specific agreement is clearly traceable. On the other hand the Silurian fossils of Bohemia are in accordance with those of France and Spain, or along another and distinct broad southern zone of the same age.

The Silurians of Scandinavia are of the British and American type. In making known the description of the Silurian rocks of Norway by Mr. Kejereslf †, I have recently shown how remarkable is the persistence of the Lower Silurian types (even in species) when these rocks are followed from Scandinavia into the British Isles, and to how great an extent this resemblance of type is preserved, even when the Atlantic is traversed, and that the same strata in the crust of the globe are again met with in North America. The occurrence in the south of Scotland of the *Maclurea magna* of Hall, of the *Isotelus gigas* in Ireland, and of the fossils of your calciferous sand-rock in our Scottish Highlands, are all most satisfactory proofs that the order in Canada and the country

* Quarterly Journal, Geological Society, November, 1855.

† Journal Geological Society, about to be published.

of our kinsmen is, with certain modifications, the same as in the ancient realm of Caractacus.

Excuse this hurried letter, and wishing you as successful a meeting as your labors and those of my other eminent friends in the United States deserve,

Believe me to be,

Yours very sincerely,

RODERICK I. MURCHISON.

To Sir W. Logan.

NOTE ON THE FOSSILS BY J. W. SALTER, F.G.S.

The specimens previously sent from Durness were far from satisfactory, and though clearly Palæozoic, could not be appealed to as settling their true place. They might, indeed, have been either Carboniferous or Devonian, although Sir R. Murchison had offered strong geological reasons to lead us to suppose them to be Lower Silurian forms. One cast in particular, which was at first doubtfully regarded as a *Maclurea*, though it had a right-handed curvature of the whorls, is now more properly referred to *Raphistoma* or *Ophileta*. And an *Orthoceras* present in the same beds could not decide the case. But those lately collected by Mr. Peach leave no doubt as to the true age of the beds. The principal fossil will be particularly interesting to Canadian geologists —being the same as one from the "Calciferous Sandrock" of Beauharnois, and which, being undescribed, has received the MSS name of *Ophileta compacta*. The genus is doubtful, and the fossil is probably only a sub-genus of *Raphistoma* (Hall)—the species of which have a wide umbilicus (bounded by a very prominent ridge) and straight-sided whorls. This species in Canada grew full an inch and a half wide, and had as many as six or seven whorls, flat above, and with a sunk, apex, and a very broad and wide umbilicus, so that the entire shell is much attenuated, and the inner whorls would easily break out, as in Mr. Halls's figure of *O. levata*, Pal. 4, 7; Pl. 3, vol. 1, fig 4. The whorls of that species are much less carinate below, and the umbilicus not nearly so wide. *O. compacta* will be fully figured and described in a decade of the Canadian fossils—it is unnecessary to say more of it here. It is curious that the *Euomphalus* (*Maclurea matutina*) which accompanies the Beauharnois fossil in Canada, is found also in the Highland beds, with another thick whorled species. Again, a species of *Pleurotomaria*, known in America in the Trenton Limestone—the *P. subconica* (Hall)—comes so very near to one of our fossils, that it might well be only a variety of the species. The Highland fossil has rather more numerous whorls, and perhaps a broader band. The genus *Oncocerus*, so characteristic of the Trenton Limestone, also occurs, but of a larger species, with more numerous septa than the *O. constrictum*. As the calcareous beds in Canada frequently contain the fossils of more than one sub-division of the New York series, it is not more than we should expect, to find the above fossils associated in a single thick band of limestone. It is most satisfactory to find, in the northernmost part of Scotland, the representatives of the Calciferous Sandrock and the Trenton Limestones—as in the South of Scotland, that of the Chazy limestone.* And as the former repose upon a quartz rock with abundance of fucoidal impressions, the suggestion is obvious that such rock may, perhaps, occupy the place of the Potsdam sandstone.

Note.—Mr. C. Peach is now proceeding, at my special request, to endeavor to collect more fossils, not only at Durness, but throughout the Assynt and other tracts into which the same limestones and quartzites extend.

J. W. Salter.

DRESSING METALLIC ORES.

A more practical subject than the majority of those discussed in this Section, was introduced by Prof. Silliman. This new method devised by himself, appears fitted to effect a very important saving in labour, and if so it must greatly facilitate the working of our Canadian mines, in districts where labor is dear and not easily obtained.

"Professor Silliman gave a brief description of a new system of dressing Metallic Ores. The Professor said the object of his remarks was to describe the general principle of a system of ore dressing, devised and put in practice at the Copper Mines of the Bristol Mining Company at Connecticut, under his own direction. The main features of this system are the perfect separation of the finer portions of the product of stamping and crushing, commonly known as "Slime Ore," from the coarser portions, without the aid of sieves or screens,—the application of the well known system of jigging directly to the stamped ore, which has hitherto

* The great *Maclurea* of Grivan, in Ayrshire, has been identified with the *M. magna* (Hall) by Prof. McCoy.

been incapable of this mode of treatment. The adoption of such mechanical arrangements has rendered the whole process of ore-dressing one continuous and self-sustaining system, in which human labor bears an exceedingly small ratio to the results obtained, compared with any system hitherto devised. In this system, the waste or refuse material is disposed of exclusively by gravity and moving water, without handling, while the ore is brought up to the highest mercantile percentage, however poor the original ore may be, no appreciable quantity of ore escaping as the waste.

The first of the above results is accomplished by the use of a new and exceedingly simple hydrostatic apparatus, devised by Mr. Stadtmuller, Mining Engineer to the Bristol Mining Company. (A model and sectional drawings of the apparatus were here shown to the audience.) The efficient cause of the success of this apparatus is the movement of a current of water in an inverted cone of iron, having an annular space surrounding an inner cone. The ore is admitted at the top, and is distributed over a conical surface to meet the ascending current of water, which is so adjusted in volume and force by a proper valve, and by a nice proportioning of the parts, that all the finer and more muddy portions of the ore are carried over the upper lip of the apparatus, while at the bottom escapes, with a more forcible current of water, through an adjustable orifice, all the coarser ore and metallic practicles These are certainly free from all slime, and are dressed upon a continuous arrangement of self-acting jiggs, and are carried immediately to a percentage suitable for market. The proportion of the ore, (about one half,) which escapes at the upper portion of the hydrostatic cone, is treated by alternate subsidence in large conical vats, the denser portions from the bottom of which are dressed upon Bradford's ore separators, (a pan of copper having the reciprocal motion of the miner's shovel,) which have been found, when served with only the class of ores properly adapted to them, admirably successful and economical. The ores, too fine or small in size for the separator, are treated upon a large conical table of circular form, with a very gentle current of water spreads in a thin sheet over the table, thus clearing the last traces of ore from the finer particles of sand with which they are mingled. This paper was illustrated by models and drawings, and by samples of the ore thus dressed, shewing in a very decided manner the beauty and efficiency of the system.

SUB-DIVISION OF THE LAURENTIAN ROCKS OF CANADA.

Hitherto these ancient and highly metamorphic rocks have been regarded by geologists as an inextricable mass of confusion. Sir W. E. Logan has set himself to unravelling their intricacies, with a patient perseverance of which hardly any other geologist is capable. A summary of his results was presented in the following manner:—

"I have already indicated the probable separation of the Laurentian rocks of Canada into two great groups: that characterized by the presence of much lime and that without; but from recent investigation, the result of which has just been reported to the Canadian Government, it appears to me almost certain that the former of these two great groups will be capable of subdivision, and that some of its bands of limestone, with their associated strata, are of sufficient importance to be represented separately on the map. Having followed out one of these bands of limestone through all its windings, for a distance of eighty miles, the object of the present paper is to exhibit to the Section its geographical distribution, and the forms it presents in the physical structure of the region which it characterises. What at first appear to be two bands of these limestones, emerge from beneath the Lower Siurian series in the township of Grenville, on the Ottawa, and run into the interior parallel to one another, striking N. N. E. They are about two miles separated from one another, and both, with the gneiss between, dip in one direction, which is N.N.W, at angles varying from about 50 to 70 degrees. Attaining the rear of the township, a distance of about ten miles, the two bands unite, and are found really to constitute but one, the thickness of which, as far as I can make it out, is from 500 to 1,000 feet. It is plain from this distribution that the limestone is part of the out crop of an undulating sheet, the ridges of which have been worn down. But in the horizontal section of an undulating surface, similar forms in the distribution of the rim, may be derived from the anticlinal or synclinal part of the undulation, and as the dips on the opposite sides are both one way, it is a question to which part the area belongs. Within a short distance of the eastern side of the limestone, in fact, touching it in one place, an intrusive syenite makes its appearance belonging to a mass which occupies about 30 square miles in the townships of Grenville and Chatham, and runs to a point in Wentworth. The intrusion of such a mass of igneous rock as this can scarcely fail to have had a considerable effect in modifying the attitude of the strata which surround it. The crystalline condition of the syenite shews that it was slowly cooled under great pressure, and we cannot now say whether it was a deep-seated part of an outburst which reached the surface, as it was then constituted, or whether it was originally overlaid by masses of gneiss and limestone, which have since been worn away. In either case the probability is, that it would give to the strata now surrounding it, an anticlinal form. It seems probable, therefore, that the western dip, belonging to the eastern band of limestone, where it approaches the syenite, is a true one, and that the form between the bands is synclinal. This appears to be corroborated by the fact that where transverse valleys occur between them, the wearing down of the intermediate gneiss widens the calcareous bands, particularly the east one, and narrows the interval.

The calcareous sheet having thus the form of a trough, the western dip of the western out-crop must be an over turn; and two spurs of the rock which point to one another, the one turning south from the western belt, and the other north from the eastern, must constitute a subordinate anticlinal. Without reference to minor corrugations, the general form of the area would be that of two troughs joined together, each about a mile and a half wide, with an overturn dip on the west side, the one trough running north and south, and the other, as far as unconcealed by the superior fossiliferous strata, south-south-west and north-north-east. The opposite sides of this calcareous trough run into two valleys, which unite at its northern extremity. But though the limestone then crops out, the valley continues northward into Harrington, and after a short interval shows an isolated patch of limestone of about a mile and a half in length, by a mile in breath, possessing, of course, a synclinal form. Beyond this, the valley splits into two, and while one branch runs rather north of N. E., the other turns N. of E. Eacn of these valleys is paved with limestone, the distribution of which shews a continuation of the synclinal form, with a bend more to the eastward than before.

The calcareous band on the western side has been traced to the north boundary of the township of Harrington, whence it crosses into Montcalm. It there appears to turn to the westward, but it has not yet been farther accurately examined. The eastern branch has been followed for between six and seven miles into Wentworth, when it appears to turn upon an anticlinal axis, and proceeding in a bearing S. S. W., for seven miles, it attains the southern boundary of the township, close upon the east side of the northern prolongation of the intrusive syenite. It runs in the same bearing for about 3 miles along the eastern side of this into Chatham, and becomes deflected to the S. E. by the main body of the syenite, to which it runs parallel for about three miles. It then folds upon the axis of a synclinal, and running N. N. E. for upwards of five miles, returns into Wentworth, where it gradually bends round more to the eastward, and in about five miles reaches a position in the Gore of Chatham. It here folds over upon the axis of an anticlinal, and turning S. S. E. it maintains this course for about eight miles, in which it crosses into the Seigniory of Argenteuil and reaches the vicinity of Lachute, where it once more bends upon a synclinal axis, and proceeding eastward for about a mile, plunges under the Potsdam Sandstone and is lost.

In the winding course derived from the plications of the strata, the limestone usually presents a valley on the geographical surface; but to the west of all the folds that have been described, a bold ridge of gneiss runs from the front of Grenville to the rear of Harrington, the distance being about 20 miles and the bearing N. N. E. On the west side of this ridge, about midway of the length, there are two areas about five miles long and broad, presenting the forms of valleys, which are underlaid by limestone, so distributed as to render it probable that they are two outlying parallel troughs joined together, belonging to the same calcareous sheet as the one described. There would thus be four main synclinals and three main anticlinals, and the breadth they occupy altogether is about eighteen miles, giving about four and a-half miles for the breadth of each undulation.

Bands of dolomite sometimes accompany the limestone, which is often interstratified with bands of quartzite. The quartzite appears to be heaviest near the junction of the limestone and gneiss, becoming thinner and less frequent as we recede from the calcareous rock. The greatest mass of quartzite met with, had a vertical measure of 400 feet, and it was in stratigraphical position beneath the limestone. The quartzite and the gneiss on each side of the limestone are often very thickly studded with garnets, and in some cases the aggregation of these is so close as to constitute a granular garnet rock. In the Gore of Chatham a band of limestone about three-fourths of a mile to the north-west of the one described, has been traced running paralle with it for seven miles. If the form which has been attributed to the first band be correct, the second would overlie it, with a great mass of gneiss between. A third band of limestone occurs about six miles north of the second; this has been traced for about four miles running east, which would be nearly parallel with the bearing of the second. In this bearing it has not yet been followed farther than to within a short distance from the line between the Seigniory of Argenteuil and the township of Abercrombie, towards the rear of both.

Continuous exposures of limestone have been met with on the west side of the Rivière du Nord at St. Jerome. They have been followed for two miles with a north bearing, and the strike of the stratification between Saint Jerome and the rear of Abercrombie, is such as to make it probable that the St. Jerome rock will ultimately prove to be a part of the third band. A feature common to both localities is the occurrence immediately near the limestone, of immense masses of lime feldspar. North of the Argenteuil band, eight miles, examined across the stratification, consist almost entirely of it, in the form of labradorite, of which masses of the opalescent variety are in some parts enclosed in a paste of the mineral without any play of colors, these feldspars are accompanied with hypersthene and ilmenite. This felspar rock is abundant at St. Jerome, and its stratified character is conspicuously displayed, the beds running parallel with the limestone.

Mr. Hunt has traced a band of crystalline limestone for eleven miles, running diagonally across the township of Rawdon in a north bearing. On the west side of this, lime-feldspar forms the great bulk of the rock exposures for twelve miles across the measures, and shows a well-marked stratification. It appears probable that the Rawdon calcareous band is the same as the St. Jerome band, and that a synclinal axis exists between the two, the turn of the calcareous band on which is covered up by the fossiliferous rocks to the south.

In Chateau Richer below Quebec, a band of limestones occurs about a mile from the fossiliferous deposits, and to the northwest of it lime-feldspars present, a breadth of eight miles. On an island near Parry's Sound on Lake Huron, Dr. Bigsby observed the occurrence *in situ* of the opalescent variety of labradorite, and the name of the mineral reminds us of the existence of the rock beyond the eastern end of the province. It thus appears probable that a range of rock will be found winding irregularly from one end of the province to the other, of sufficient importance to authorise its representation by a distinct color on the map, and a distinct designation in geological nomenclature."

THE DEPOSITION OF NATIVE METALS IN VEIN FISSURES, &c., BY ELECTRO-CHEMICAL AGENCY.

Prof. Chapman, of University College, Toronto, brought forward at considerable length his views on the origin of native metals in vein fissures. These views are at variance with those of the majority of chemists and geologists, at least in their application to the copper deposits of this continent. We give, therefore, an extended, and we believe faithful statement of Prof. Chapman's views from the *Gazette.*

"From the known fact that solutions of various metallic salts may be decomposed by voltaic agency, and the metal obtained in the simple state, it has long been a favorite theory with many geologists, that depositions of native metals, in veins, &c., are due to a similar cause. That such may be a perfectly legitimate conclusion in many instances, I am quite ready to admit; but, in applying this view to any particular case, it is necessary, unless the explanation is to be regarded as a mere theory of convenience, that certain collateral circumstances be not altogether excluded from consideration. If these circumstances oppose themselves to our theory, and remain by it altogether unanswered; nay, if but a single well-proved fact withhold its concurrence from the conditions demanded—surely it is more consistent with our obligations to scientific truth, that we abandon the theory at once—however plausible in itself, and however convenient in its application—rather than attempt to maintain it by keeping these opposing conditions out of sight, or by wilfully ignoring their value. Now, my object in the present brief communication, is simply to bring before the notice of the Section, certain facts, experimental and otherwise, which appear to me to prove most incontestibly, that, in nine cases out of ten, the so-called electro-chemical theory as explanatory of the organ of native metals in veins, is entirely fallacious.

We will take the case of native copper, under its known conditions of occurrence in the Lake Superior District and other parts of North America. The electro-chemical theory is constantly being brought forward in explanation of this particular case. As the copper is here, nominally, in intimate association with vast masses of erupted trap, it might naturally be inferred that the presence of both trap and copper was equally due to igneous action; or, where the copper occurs in small strings and arborescent masses apart from the trap, to a modification of this action, in volatilization and subsequent reduction of chlorid of copper or some other volatile compound. But the upholders of the electro-chemical theory, find these views apparently too simple for their approval. It is very possible that the copper may have originated by some other agency; but the following facts will, I think, shew that this unknown agency was not the electro-chemi cal principle, whatever else it may have been. The copper is very constantly found in the interior of zeolites or calc-spar, or surrounding crystals of the latter substance in such a manner as to shew that the calc-spar was solid before the solidification of copper—the copper often presenting the most sharply-cut impressions, even to the minutest striæ of the crystals of the calcareous spar. I mention this well-known condition of occurrence first, because it is commonly referred to as affording a strong proof of the deposition of the copper according to the electro-chemical theory, although nothing can really be more fatal to its reception.

The conditions of occurrence just alluded to, may, in the estimation of some, disprove the igneous origin of the copper; but equally do these conditions disprove its origin according to the other view. In the first place, it must be remembered that the zeolites, and carbonate of lime also, are *non-conducting bodies;* and hence that no deposition of metal can be made to take place upon them, by the electro-chemical process, unless their surfaces be first coated with graphite or some other conducting substance. This may be readily shown by the simple method of ascertaining the conductibility or non-conductibility of mineral bodies employed by Von Kobell. The substance under examination is to be placed in a solution of sulphate of copper, and touched by a slip of zinc, or a piece of zinc bent into a kind of tongs may be used to hold the mineral. A deposition of metallic copper will rapidly take place upon conducting bodies, such as pyrites, galena, graphite, anthracite coal, &c., &c.; but not upon non-conductors, as quartz, the felspars, garnet, calc-spar, malachite, and other similar minerals.

This fact, when forced upon the attention of those who maintain the electro-chemical theory, has been allowed to be "an objection"; but that is not the proper term. It is an insuperable obstacle—

nothing less—to the legitimate adoption of this theory; and until it can be satisfactorily explained away, to attempt to account for the origin of the copper by reference to the principle in question, is surely, to say the least, a mere waste of words. A few other objections to this electro-chemical hypothesis may be briefly touched upon. This hypothesis exacts necessarily a solution of the copper in some form or another.

Now, many of the minerals associated with these copper deposits—carbonate of lime, for instance,—are readily altered by immersion in cupreous solutions; whereas the crystals of carbonate of lime actually occurring with the copper, as well as those met with in its immediate neighborhood, exhibit no appearance of alteration, but retain on the contrary, their white color and original surface condition. By placing these same crystals for a short time in a solution of sulphate of copper, they become converted at the surface into malachite, or into a copper carbonate of similar aspect, more especially if the solution be kept at a moderately elevated temperature. Again, if the enormous deposits of Lake Superior originated in this manner, might we not reasonably look for the presence of vast secondary products, the results of the chemical decompositions which must necessarily have taken place. It is asking almost too much to assume that these secondary products may, from their solubility, or from other causes, have entirely disappeared, without leaving behind them very manifest traces of their former presence. But, yet again, if we assume this origin for the copper, we must necessarily assume also that the cupreous solution came from above: that it is to say, from an *overlying*, not from an *underlying* source; as otherwise, from the filling up of the fissures, the supply would quickly have been cut off. This involves manifold difficulties of an easily imagined character.

My object, in the present note, is not to propose theories in explanation of the origin of these copper deposits, but simply to shew that if one of the hypotheses already advanced with this view—that which attributes the larger copper masses (in intimate association with the trap) to direct igneous action, and the smaller, arborescent and more distant masses to gaseous emanations as previously explained—be not free from difficulty; the other, or so-called electro-chemical theory, is, in the cases referred to, absolutely untenable; and, amongst other reasons, chiefly for this, namely: that the deposition of the copper on non-conducting bodies is opposed to all known principles. It is to be hoped, therefore, that those who still feel inclined to adopt and maintain this theory of convenience, will not forget to enlighten us as to the cause of the peculiar departure from known laws exemplified in the cases under review."

QUESTIONS CONNECTED WITH THE SALTNESS OF THE SEA.

A second paper by Professor Chapman, related to the use of the Saltness of the Sea. This is a subject of which too narrow views should not be taken, since it is easy to perceive many important uses secured by the substances held in solution in the ocean. Professor Chapman brought forward an interesting experiment, illustrative of the equal diffusion of this saline matter, under circumstances unfavourable to transference of the water itself; and leading to the conclusion that one important consequence of the saltness of the sea is the regulation of the rate of evaporation from its surface.

"It is a current opinion that, in consequence of the surface of the sea becoming salter and hence heavier by evaporation, a downward motion of the surface water necessarily takes place; and hence Lieutenant Maury's hypothesis that the sea is salt in order to produce circulation. Some time ago I suggested another object in explanation of the saltness of the sea, viz.: that the sea is salt in order to regulate evaporation. The greater the amount of salt, the slower the evaporation of the water,—and the reverse: so that, if by any easily conceivable cause, or combination of circumstances, the normal degree of saltness becomes either increased or diminished—a kind of self-regulating force is set up to resist the continuation of the abnormal action, until time restore the balance. Even leaving out of consideration the equalizing effects produced by the accession of fresh water to the surface of the sea by rain and rivers, it seemed to me that the principle of diffusion was in itself sufficient to prevent the sinking of the water thus affected by evaporation; or, at least, to prevent the sinking of this water to any extent. But how to prove the point. The fact that the saltness of the open sea was substantially the same at considerable depths and at the surface, says nothing; as it would necessarily follow, that for every heavy particle of water that sunk, a lighter particle would rise up to supply its place; and hence the composition of the water would be kept uniform, without the principle of diffusion being in any way required to explain the phenomenon. After some consideration I adopted the following method, as one sufficiently trustworthy to afford an answer to the question under review:—I procured a leaden pipe one inch in diameter, and bent into the form of the letter U: each upright being about thirty-nine inches in height, and the connecting piece at the bottom rather more than twelve inches long. This I filled up to about an inch on each side with a solution of common salt in rain water (the salt being present to the amount of 3.786 per cent.,) and then I carefully closed one end, leaving the other end open, but protected from dust by a cone of silver-paper fixed on a bent wire, and so arranged as not to prevent evaporation. The per centage of salt (3.786) was carefully ascertained, and the apparatus left in an unoccupied room, the window and door of which were kept almost constantly open, in order to promote the evaporation of the solution as much as possible. After the lapse of about three months, (April 18 to July 14,) portions were taken from each end of the tube, and from the connecting piece below, (a small orifice being made in this;) and the amount of salt in each portion was accurately determined. Now if the principle of diffusion had not been brought into play, it is evident that the solution in the open limb of the tube ought to have been stronger than that in the closed limb, although, by the circulating process, the amount of salt at the top and bottom of the former might have been alike; and, again, it will be equally evident that if the principle of diffusion were brought into play, the supposed sinking of the surface solution, as the result of evaporation, must be altogether imaginary. Six separate determinations, two from each of the three portions of the tube, shewed a per centage of salt essentially the same. The following table exhibits the results obtained:

		Solution.	Am. of Salt.	Per ct'ge of salt.
1	A. From the top of the open limb,..	302·261..	11·59...	3·030..
	B. From the bottom of the same,..	300·24...	11·51...	3·835..
	C. From the top of the closed limb,.	288·60...	11·055..	2·831..
2	A. From the top of the open limb,..	264·84...	10·16...	3·837..
	B. From the bottom of the same,..	290·10...	11·12...	3·833..
	C. From the top of the closed limb,.	306·66...	11·75...	3·832..

These experiments justify us, I think, in assuming, that owing to diffusion, the surface waters of the sea do not become heavier than the lower strata simply by losing water by evaporation. It is quite true, that under the influence of evaporation a lowering of temperature may take place, and that an upward and downward circulation, to a certain extent, may in this manner be produced*; but the same reasoning will apply to bodies of fresh-water,—and hence the object of the salt in the sea remains still unexplained. In conclusion, therefore, I feel justified in expressing my sustained belief, that the theory which I have proposed to account for the saltness of the sea is worthy of our acceptance; this theory being, that the sea is salt, essentially if not principally, in order to regulate evaporation.

NEWER PLIOCENE FOSSILS OF THE ST. LAWRENCE VALLEY, by Professor Dawson. The object of this paper was in the first place to notice several fossil shells recently found by the author and others in these deposits, and which did not appear to have been previously observed. The species mentioned were:—

Natica Heros, Say, - - - - -	Beauport.
Natica Grœnlandica, Beck, - - - -	do.
Fusus tornatus Gould, - - - -	Montreal.
Fusus harpularius, Couthoy, - - - -	
Rissoa minuta, - - - - - -	Montreal.
Turritella, (like *erosa*.) - - - - -	Beauport.
Bulla oryza, Tott, - - - - -	Montreal.
Spirorbis sinistrorsa, Montagu, - - -	do.
Univalve, (perhaps *Menestho albula*) - -	

Most of these are shells now living on the Atlantic coast of America, north of Cape Cod, and some of them ranging very far north. The paper then referred to the distribution of the various kinds of drift in the vicinity of Montreal, and to the conditions of the sea areas, in which the shells and other marine animals of the Newer Pliocene period existed in the St. Lawrence Valley. "Good evidence exists of a sea beach on Montreal Mountain, at an elevation of 470 feet above the sea. The sea area corresponding to this beach must have extended to the Laurentide hills and the escarpment of Niagara, and communicated freely with the ocean on the east. On the other hand there are lower shores of the same period only 100 feet above the St. Lawrence. These must have belonged to a

* It should be stated that no intermixture could have taken place in the closed limb of the apparatus described above by ascending currents produced by unequal temperatures, as the temperature of the lower portion of the closed tube was kept purposely lower (or at least prevented from becoming higher) than the upper portion by means of a damp rag permanently attached to it.

very narrow prolongation of the present gulf of St. Lawrence. The conditions of climate, ice, drift, &c., corresponding to these different shores must have been very diverse."

Again, in the stratified drift, it is possible to recognise, within a few inches of each other, a bed containing deep-sea shells, and another containing species that are littoral; these sea bottoms corresponding to different levels of the land. It is evident that any conclusions with reference to the climate indicated by the marine fauna of these successive beds of marine detritus, must take into account these fluctuations of the sea level, and the changes in animal life consequent on them. Taking these into account, positive and reliable results may be attained; and the study of such districts as the St. Lawrence valley may be made to contribute toward the elucidation of the conditions of life in older formations."

NORTH AMERICAN LAKES.

The fluctuations of level of the American lakes, have often formed a subject of inquiry and speculation. They were brought before the Association by Mr. Whittlesey. "These fluctuations presented three distinct features. There was first the general rise and fall, extending through a long period of time; then the annual rise and fall which occurs regularly within a certain period of each year, and which he styled the annual fluctuation; then there was the third, a local, fitful, and irregular oscillation, lasting sometimes from three to five minutes, and varying in duration from one to twenty-four hours. He had no difficulty in explaining the general rise and fall of the lakes, as they were merely the reservoirs for the drainage of the country of the surplus water, which passes thence by the St. Lawrence as a general opening to the sea. Mr. Whittlesey read a variety of statistics in reference to the range and extent of the two first named fluctuations, and said he was unable to find in these, or in the examinations he had made, any confirmation of the popular belief that there is a seven years rise and fall of water in the Lakes. He then directed attention to cause of the third phenomenon—the irregular fluctuations which occur without any particular known cause. Although these pulsations, as they might be termed, were the first to attract notice, they were the last to have received any attention. They occur in all conditions of the atmosphere, but whether produced by electro-magnetic influence or not he could not say, although he thought it not unphilosophic to look in that direction for their cause."

SUCCESSION OF FOSSILS IN BRITISH ROCKS.

Prof. Ramsay presented an elaborate paper on the succession of life in British rocks, illustrated by a diagram exhibiting the number of species and genera of fossils in each formation, and the number common to each pair of successive formations. The subject is a large one, even in the facts relating to a single limited area. It is still more difficult if we attempt to extend our view to the world; and in reasoning on the facts attained, defects in the data appear at every step. Above all we are as yet quite uncertain as to the relative value in point of time of geological formations, or of the intervals which may separate them, nor do we know the proportion of species lost and preserved in any one epoch. Prof. Ramsay, however, took a firm hold of his subject, and pointed out some very remarkable facts indicated by his comparisons of British formations.

"Professor Ramsay said the subject to which he intended to direct the attention of the Association was one which had necessarily engaged the attention of Geologists ever since it became an established fact that there was such a thing as order in the superposition of strata, each formation being characterised by its peculiar suite of organic remains. It was found that genera and species had long succession, and had several times been extinct on the face of the earth. It was an easy way of accounting for this to suppose that each great extinction was marked by some great catastrophe which swept all clean from the face of the earth, and then there was a new creation. Few geologists now believed this, and some assert that as one species died out another was created, so that had we all the links perfect there would be found a gradual dovetailing—a perfect passage of one formation into the other. The diagram before them he had constructed to aid himself in investigating this subject. It was constructed purely with reference to the formations in the British islands, and the various fossils found in these various formations. But the same general laws would be found to obtain, in a modified manner, in other localities. The first division in the diagram is the Slandeilo flags, where we have the first development of organic life. In these we have twenty species and fifteen genera. Eight of these are trilobites. Apparently the succeeding Lower Silurian rocks rested upon them with perfect conformity. There is no appearance of a break in the series; yet we find only find five genera and one species pass into the next strata. What was the reason for this extinction of species and the sudden appearance of a great number of others, he could not say. He brought this subject before the Association to hear, if possible, some suggestions as to the illustration of this important question. In the Lower Silurian we have 445 species and 150 genera; in the Upper Silurian 464 species and 150 genera, while 14 genera pass from the Lower into the Upper, and 43 species. There is here a considerable link, yet the break is remarkable, and is marked by strong physical unconformity. In the Devonian we have 415 species and 131 genera. There is apparently a much more gentle passage from the Upper Silurian to the Devonian than from the Lower to the Upper Silurian, yet only 8 species and 60 genera pass into the Devonian. In the Carboniferous we have 1646 species and 302 genera. The passage from the Devonian to the Carboniferous is easy, yet only 58 species and 43 genera pass into this formation. It is a remarkable circumstance that there is here a great decrease in the development of life. In the Permian we have only 157 species and 78 genera, while only 37 genera and 5 species pass from the Carboniferous into the Permian. When we reach the bunter sandstone formation we have no fossils at all in Britain, so that there the break is complete. In the Keuper we have 18 species and 15 genera. In the Lias 454 species and 129 genera; of these there pass into the Oolite 62 genera and 6 species. In the Lower Oolite we have 994 species and 224 genera, 89 genera and 36 species of which pass into the Middle Oolite. The Middle Oolite yields 107 genera and 264 species, and the Upper Oolite 130 genera and 218 species. From the Middle to the Upper Oolite there pass 30 genera and 9 species, while 36 genera and 5 species pass from the Oolite to the Cretaceous; 49 genera and 16 species pass from the Lower Cretaceous to the Upper Cretaceous. In the Upper Cretaceous times we have a great development of life, viz., 1275 species and 314 genera. In the Middle Eocene we have 977 species and 274 genera. We have no Miocene in Britain. In the Pliocene we have 631 species and 202 genera; and from the Pliocene there pass 50 genera and 236 species to the Pleistocene. With respect to physical breaks in the foregoing formations, the Permian rocks lie quite unconformably on the Carboniferous, and the New Red on the Permian; and though in any one locality where the marine Cretaceous beds lie direct on the Oolite, they appear conformable; yet the local occurrence of intervening breaks in the Purbeck and Wealden beds shew the enormous lapse of time that lay between; and it was argued that between other strata similar lapses of time may have intervened, possibly marked by the occurrence of great rivers, the deposits of which have not been preserved. The most perfect sequence of formations, even over large areas, was only a collection of fragments. Mr. Ramsay then referred at some length to the Glacial Epoch. It was generally believed that the whole of the British territory, if we except perhaps some of the mountains in the north part, had been submerged during the Glacial Epoch. We find marine shells of an Arctic type at 1,300 feet above the level of the sea. This of itself would not be a demonstrative proof that our country had a cold climate during that time; but proof is quite perfect of glaciers having existed at that period. He had recorded it as his opinion that the chief causes of the extinction of species, and of the changes of the species, in the different formations, were to be found in the great changes in the physical geography, such as large tracts of land being for a length of time out of water, and being again submerged; and also from climatal changes, which might be due to changes in physical geography."

FORMATION OF CONTINENTS.

A very remarkable paper was read by Prof. Pierce, on the origin of the great lines of land and water on the surface of our globe. The author went back to the supposed fluid condition of our planet, and attempted to show that the diurnal solar action on a cooling sphere would establish a tendency to the production of lines of cleavage along great circles tangental to the arctic circle, these directions being actually those of the principal lines of our existing continents. This view, though probably not current with most of the geologists present, points to at least a curious coincidence, which in its connection with the direction of the earliest dry land and our modern coast lines, merits attention.

" Professor Pierce remarked that the principal lines of the continents were great circles, tangent to the polar circle. This was especially the case with the coasts of the Pacific ocean. He illustrated this on the terrestrial globe. He then pointed out the same fact as regarded the eastern coast of Africa, the eastern coast of Hindostan, the eastern coast of Asia, the eastern coast of North America, the western coast of Hindostan, the line of the eastern Archipelago, the western coast of America, and (perhaps) the western coast of Africa. Any one might perceive these remarkable facts by elevating the pole of the terrestrial globe twenty-one and a-half degrees above the horizon and then causing the globe to revolve. The northern line of South America, a portion of the coast of Africa, a portion of the Central American coast, most of the Pacific Islands, &c. were portions of great circles, tangent to the tropics. Prof. Pierce said this seemed to indicate that the sun had someting to do with the formation of continents. Indeed the sun had very great influence even now, and when, at the formation of the earth the mass was in a fluid state, the difference of one or two degreess might make all the difference whether congelation should take place at one time during the day or not. And the action of the sun, in allowing the mass to cool or grow warm, to congeal or solidify, would cause a tendency to the formation of lines of cleavage in the mass or crust of the earth. These lines of cleavage were all that geologists required to enable them to account for the formation of chains of mountains and lines of coasts. The solidifying of certain portions of certain continents would account for the formation of ocean currents.

PHYSICAL GEOGRAPHY OF AFRICA.

Professor Guyot read an interesting paper on the little known and hitherto apparently exceptional physical geography of Africa, basing his conclusions on the discoveries of Barth, Livingstone, and other late travellers. *We are sorry that we cannot give an abstract of this paper.*

DIRECTION OF THE CURRENTS OF DEPOSITION AND SOURCE OF THE MATERIALS OF THE OLDER PALÆOZOIC ROCKS.

Glimpses of large views on this subject have been given at various times by Prof. Hall and his brother Geologists of the United States. In the present paper Prof. Hall gave a large extension to our previous conceptions of the subject, assigning in the formation of mountains an influence to sedimentary deposition which geologists have not hitherto attributed to it. Prof. Hall's view on this subject, may be overstrained, but it embraces important general truths, not to be neglected in any attempt to explain in detail the formation of our continents.

"He said that in treating of the elevation of mountains, sufficient consideration had not been given to the distribution of the material forming these mountain chains, in its unaltered condition. All the materials they knew of were stratified, and had been metamorphosed more or less. He proposed to occupy a few moments in following the direction of the ancient currents, and to show their parallelism with the mountain chains in the Laurentian Mountains, north-east of them, which are nearly parallel to the Appalachian chain. The Geological Survey would show whether these sediments were thicker to the eastward than to the westward; but he thought the direction of the currents, which deposited the materials forming the Appalachian chain, was from the north-east. They had certainly good evidence from the fact that the strata are of the same age, and are much thicker from the north-easterly direction than from the south-west. They gradually thin in that direction, and, as he believed they were deposited by water, the further from the source they would be the thinner. They had reason to believe that in the south-west these strata were much thinner than in the north. Taking the Hudson River group which consists of sediments stretching to the south west, with a thickness of 1000 feet to the north east of us, it thins down to 600 feet in Pennsylvania, and finally in the Mississippi valley the thickness is not more than 100 feet. Passing from the Hudson river group and over a lapse of time, to the Oriskany Sandstone we find the deposits from the north east. At Gaspé the thickness is 7000 feet, in New York it is reduced to a few hundred feet and the stata thin out in a westerly direction. The conclusion he had arrived at was that along these lines of deposit where the greatest accumulation of sediment has been made, and where we have the greatest elevation of mountain chains, this merely coincides with the direction of the ancient currents, and that the Appalachian mountain range has not been more uplifted than the other portions of the country, or than the plain between these and the Atlantic. In New York and Pennsylvania they got to the Potsdam Sandstone, and, therefore, there was no uplifting of any previously existing rocks before the Appalachian chain. The folding and plication had commenced at an early period—at a period before the upper Silurian Rocks were formed, and we find these strata plicated and uplifted and had metamorphosed in a considerable degree. We get no lower than the Potsdam Sandstone in any part of the Appalachian chain, and we can demonstrate that no lower mass has had anything to do in giving us the elevation of this mountain chain. The Prof. then referred to his examination into other formations in confirmation of his hypothesis that elevating forces had not caused uplifting of these mountain chains. On the contrary, if there had been no folding and plication, this range of mountains, he thought, would have been twice as high as they now are.

ORIGIN OF COAL.

Mr. Whittlesey who presented a paper on this subject, is in this matter a sort of geological heretic, who maintains a view long since exploded, and now not seriously entertained by any geologist familiar with the decided proofs of vegetable origin presented by all our beds of coal, even by those that have by metamorphic processes been converted into anthracite. Views of this character constantly make their appearance in Scientific Associations, and are usually listened to with patience, though regarded, in the words of one of the speakers on this paper, as "going backward in the progress of geological science."

GRAPTOPORA.

A new genus of polyzoa, allied to the curious silurian fossils known as graptolites, was characterised under this name by Mr. Salter. There appears some reason, however, to believe that this proposed new genus is identical with the *Dictyonema* of Prof. Hall.

We were so unfortunate as not to hear the papers of Prof. Emmons on the remarkable fossils recently found by him in North Carolina, and by Prof. Hitchcock on the much controverted question of the age of the Red Sandstone of Connecticut, nor have we obtained any detailed report of them.

GEOLOGICAL SURVEY OF GREAT BRITAIN.

On the last day of the Session, Prof. Ramsay gave a verbal explanation of the mode of conducting this great survey. The American geologists present were very much interested in the subject; and spoke in terms of admiration of the thorough manner in which the work is carried on. Prof. Ramsay was requested to prepare his remarks for publication. In the mean time, therefore, we do not publish an abstract, hoping to have the paper *in extenso* for our next number.

GEOLOGICAL SURVEY OF MISSOURI.

Prof. Swallow followed Prof. Ramsay with an account of the survey of this and the neighboring States. The principal feature referred to was the enormous extent of the coal fields in the West, and the remarkable subdivision of parts of their margins into isolated patches or basins.

Several other important papers were on the list; but time failed to read them, and they will probably appear in the published proceedings of the Association.

SUBSECTION OF ETHNOLOGY AND STATISTICS, &c.

This was a vigorous off shoot from Section B; and under the able management of Prof Wilson, Prof. Anderson, and other men of kindred spirit, entered actively into those great questions that affect the natural history of Man. The work of this section was of great popular interest, and of no little scientific importance. It will go far to rescue American ethnology from the opprobrium that has fallen upon it, in consequence of the crude and rash speculations that characterise some recent publications on this subject. We can give but a few fragments indicating the topics that were disscussed.

The first paper in this sub-section was that by Mr. Lesley on the word "*Celt.*" It was full of ingenuity and erudition; but we confess that, after all, we prefer to follow the ingenious author as a guide in the complexities of the structure of coal fields rather than in philological niceties. The paper, besides, is one that cannot be reduced to the form of an abstract.

THOUGHTS ON SPECIES.

No subject is of greater interest in Natural History than the investigation of the real nature and limits of species, and no American naturalist is better fitted to grapple with it than Prof. Dana. The following report does no justice to his argument.

According to Prof. Dana, and we think the view most philosophical, our idea of a species should consist of certain essential properties common to all the individuals, and in the organic world the power of invariable transmission of the properties; but, whether in the inorganic or organic world, we should regard variations within fixed limits as a law of every species under the influence of external agencies. This view of species, and we might indeed add any intelligible view of the subject, leads inevitably to the doctrine of the common origin of all the individuals of any species capable of continuous reproduction.

"Professor Dana said it might be well perhaps to examine the question of species synthetically, comparing the results of observations with the utterings of science, and he proposed the three following questions:—1st. What is a species? 2nd. Are species permanent? 3rd. What is the basis of variations in species?

And first he said, that the idea of a group which is the common definition, was not essential, and indeed tended to confusion. Looking first at inorganic nature they learned that each element was represented by a specific amount or law of force. Thus taking the lightest element as a unit, oxygen would be found expressed by 8, and was of the same value in all its compounds. The resultant molecule was still equivalent to a fixed amount. Hence the essential idea of a species is that it corresponds to a specific amount or condition of centrated force defined in the act or law of creation. In the organic world the individual was involved in the germ, which possessed powers of developement to a completed result, and this also corresponded to a measured quota or specific law of force, though there was no unit by which to measure it, and though there might be different kinds of force. The same definition of a species would apply here, and thus species was in the potential value of the individual whether one or many existed, and the precise nature of the potentiality in each was expressed by its whole progress from the germ to its full expansion. 2nd. As to the permanence of species, it was found in the inorganic world that the element was always the same: oxygen was always 8, and all nature was characterised by fixed numbers. This being so for inorganic nature, must be so everywhere, for the principles which pervaded nature were not of contrariety; but of unity and universality. If the kingdoms of life were not made from the units which exhibited themselves in their simplest condition—if these units were capable of blending, they would not be units, and life would be but a system of perplexities. It might be seen, too, that the purity of species was guarded in nature. Both in the animal and vegetable kingdom, hybrids were her aversion as far as yet observed. Least of all was it to be expected that the law of permanence, so rigid among plants and the lower animals, should have its main exception in man. Yet if there were more than one species of man, the number of species must become indefinite by intermixture. It would have been a clumsy mode of giving man the control in all the zones of the earth, to have made him of many species capable of hybridization in opposition to the general law of nature. It would have been using for the propagation of the human race, a process which produces impotence among animals. It is true that different inorganic species continue to form new units ; but it is not by indefinite blendings, but by a definite law ; and if such a law existed in organic nature, it would also be in general an essential part of the system, easy of discovery. But there were variations in species, though they could never extend to the obliteration of the fundamental characteristics of the species. No substance could be independent of any other. The law of mutual sympathy was one of the most universal in nature. The planets where modified by each other, and one chemical substance by the other. Each body had its own fundamental force, and the relation of this to others was a part of the idea of the species; and this process of variation was a law of universal nature acting on the law of a special nature and compelling the latter to reveal its qualities. This was one of the richest sources of truth which was open to research, and hence we should not regard the individuals which were conspecific as constituting a species ; but each one, as an expression of the species in its potentiality, and under some one phase of its variations. The system of nature must be conceived of as a system of units continually adding to the number of representative individuals by self reproduction ; and all adding to their varieties by mutual sympathetic reaction."

CRANIAL TYPE OF THE AMERICAN RACE.

The clever though not over scrupulous writers of the so-called "American School of Ethnology," have built largely on the researches of Dr. Morton, a man of great industry and ability, but not fully aware of the use which would be made of the materials he had collected. Professor Wilson has been going over some of Morton's ground, and is surprised to find his general statements not borne out by facts. The statements of this paper would seem to show that the whole subject of American crania requires re-investigation.

" Prof. Wilson spoke on the supposed uniformity of Cranial Type throughout the American race, and recommended inquiry on this question so frequently forced on the attention of the Association, and in the meantime not to come into collision with theologians ; There was a great variety in forms of the head, colour of the hair, and the osteological structure of the human frame. It was a question not only whether all human beings agreed in form, but whether they had always agreed ; and in order to that discovery the search must be made in ancient tombs and tumuli. By ethnologists of the American school important results had been built upon the ground of the observations made by the celebrated Dr. Morton, and it was not to be wondered at that that gentleman was taken as authority, for he possessed a scientific mind and was a very careful observer. But, without disparaging that great writer, he thought his deductions ought to be tested by farther researches. The Doctor's conclusion was that a universal type of cranium pervaded all the American family, which he divided into the two classes of Toltec and Barbarous, though he regarded the division as intellectual rather than physical. The form which he found to be general in the skulls of all these tribes was marked by much greater breadth from side to side than from the frontal to the occipital bone, differing in that respect from the European and African races; and in the American races he found that the forehead was not arched as in the others. All this had been reiterated by most subsequent American writers, and particularly by Agassiz. Here the learned Professor read several authorities to show the generally strong affirmation on the part of American writers, of the unity of race throughout the Continent, always with the same type. Now, in England he had paid a great deal of attention to the forms of heads found in the ancient tombs of the old country and in Northern Europe, and had noticed the shortness of the longitudinal section in those heads, which, when he came to this country, he wished to compare with the same characteristic which he had believed was to be found in the American crania. He had therefore procured a number of Indian heads, in the full expectation of finding this form; but was entirely disappointed in the result of his investigation. He found very few of the heads of the type described by Morton; yet so strong had been the impression on his mind that it was long before he became convinced that the variety was general. He had examined, however, in all twenty-eight heads, from the country south of the Ottawa and north of Lakes Erie and Ontario, and of these twenty-five essentially differed from the characteristics described by Morton. It was true that Morton had examined two hundred skulls, and he only twenty eight; but taking Dr. Morton's collection even as it now existed, with all the additions since made to it, there were in it only sixteen skulls of any one tribe. Therefore his twenty-eight all coming from a small section of country, afforded as good *data* to work from. However, Dr. Morton made an exception from his type of the Esquimaux, which he regarded as analogous to the Mongols, though he admitted that philologically the Esquimaux did not differ from the other American tribes, so far as generalization could be made of so many different dialects. He here pointed out a drawing of the skull of a Scioto Indian, which he showed by quotations from the writers of Morton's school, was to be considered as the most perfect type of the American head. It differed from the heads of the modern European inhabitants of the country ; but it seemed to him to differ as much from that of the northern Indians.—Besides, as the form of the northern Indian differed from the southern Indian, it approached that of the Esquimaux. The Seminole, again, as drawn by Morton, approximated to the Peruvian head, and differed from the accepted type. He then gave several measurements of heads, from Morton's book, to show that even these did not bear out the theory of Morton. He then mentioned a head found near Barrie, in which the peculiar characteristic noticed by Morton—the flat occiput—was so remarkable, that the skull would stand better on that than on any other side ; but this was so large a deviation from other heads that it was in all probability an example of formation by artificial means, which indeed he thought might probably be the cause of the peculiarities which had been looked upon as ethnological, but were really archaeological facts. He mentioned, moreover, that the pyramidal form, another great feature in the heads observed by Morton, was most strikingly developed in the Esquimaux head.

CLASSIFICATION OF THE HUMAN RACE.

A further caution to this school was administered by Prof. Anderson, who addressed the Section on this subject, with a view of showing the importance of some comprehensible classification of the varieties of the human race, in order to the correct observation of those facts upon which one school of ethnologists founded their opinion that mankind consisted of several species, or of one species planted in several centres of creation. "To illustrate the difficulties in the way of such classification, he mentioned that Viréy divided the race into two species—the white and the yellow ; the black and the brown. But he found all sorts of difficulties in this classification. Take, for instance, the Arabians—the purest of the Semitic races—and he found the Arab in one place with light hair and blue eyes, while in the hot regions of the desert the Arab very nearly approached the Negro. The same changes occurred in the Hindoos and great Iranian races, as they descended from the mountains to the hot deltas of the rivers and to the sea coast. This was also to be remarked in Africa; so that the distinction into white and yellow, black and brown, formed no really useful classification. Jacquenot spoke of three species of men; Dumoulin of eleven, of which the first was the Celto-Scyth-Arab, the meaning of which he could not divine. Colonel St. Vincent made eleven species; and Luke Bird, the editor of the *Ethnologist*, sixty-three; while Dr. Morton's posthumous works made twenty families, each of which the doctor plainly looked on as a distinct species. These could not all be right. Again, Agassiz considered that there were at least eight, and perhaps a thousand centres of creation, though there was but one species; but there were many difficulties about that theory, as it would require a new miracle of creation for each supposed centre; and it was a good rule in physics not to allow new creations except where they were absolutely required. He concluded by saying that he thought the proper attitude for Ethnologists to assume was to hold all theories as provisional, keeping themselves ready to be convinced by any new facts whenever they appeared.

A lengthy exposition of the arrow-headed characters of Assyria was given by Rev. Dr. McIlvain; and a paper by Prof. Reid was read, advocating the use of English as a universal language. These papers we cannot do justice to in our remaining space, nor do they properly belong to our field.

ANCIENT MINING ON THE SHORES OF LAKE SUPERIOR.

"Professor Charles Whittlesey read a paper on the Ancient Mining Operations of Lake Superior. After describing the geography of the copper region of Lake Superior, he said that throughout the country indications appeared of mining operations carried on by an ancient people. The works of these people were mere open mines like quarries, never descending more than about thirty feet below the surface. These mines had a peculiarity which distinguished them from all others, that the metal was found in pure masses. These masses the ancient miners seemed unable to deal with, and they appeared merely to have sought for pieces of copper perhaps of 2 lbs. weight, which they hammered out cold. They seemed not to have known anything of the art of smelting, though that discovery seemed the simplest thing in the world, since they made use of fire to soften the stone, and so to separate the ore. When they got a large mass they used stone hammers to break off the projections. They had no means of raising the very large masses, nor had they any way of clearing out the water from the bottom. It seemed that the miners had been accustomed constantly to throw back the rubbish into the mine, so that there were now no traces on the surface. These works extended through one hundred or one hundred and fifty miles on the south side of Lake Superior. Sometimes there were cavities of thirty feet, as large as that room; in other cases they made excavations in the bluffs, which were now occupied by porcupines, bears, &c. The stone hammers employed were nothing but boulders of green stone or trap, having a groove round them, into which a wythe was twisted. Some had no such groove, and the mode of swinging them was unknown. Wooden shovels were also employed, and spear heads with a socket. There were, besides, tools like knives and chisels, all made of copper. Timber had also been found with hatchet marks on it. From these marks he judged that the people who worked these mines had a connection with the ancient Mexicans, known as Toltecs or Aztecs. It appeared from the works of Squier and Davis on the Mounds of Ohio, that in those places there had been found tools which would have made marks like those noticed on the timber found in the Superior mining region. Again, the connection between these inhabitants of Ohio, and the miners of Lake Superior seemed to be established from this fact—that in the Lake Superior mines alone were to be found pure copper, having specks of pure silver in them. Now the tools found in Ohio were found to contain these specks of silver, and it was evident that these tools had been hammered out cold, because if they had been melted the silver specks would have disappeared. Then the Spaniards on their arrival found the Mexicans in occupation of fortifications, mounds and pyramids very much like those of Ohio. In this way it appeared to him that a connection was traced between the people of Mexico and the miners of Lake Superior. He considered from a comparison of the trees found upon the tops of the trenches, and of the extent of the works, with the difficulties which the miners must have had in working them, that it must have been 1200 years since the mines were abandoned, and 500 more during which they were occupied. His impression was that the miners resided in a warm country, and came to work these mines in the summer time, taking their produce home in the winter."

INDIAN PAINTINGS AND ANTIQUITIES.

"Professor Wilson read some remarks on the collection of Mr. Paul Kane of Indian paintings and curiosities. He stated that Mr. Kane had had opportunities of seeing Indian customs to an extent possessed by very few, inasmuch as he had travelled for five years through the north-west territory as far as the Russian boundary. The paintings exhibited by Mr. Kane related to the half-breed tribes round the Red River; the Chippewas; the Assineboines; the Blackfeet; and the Crees. He had also portraits of the Wallah-Wallah Indians, and Flat-heads. Among these was the picture of a woman whose head was reduced almost to a disc with the edge presented to the spectator, together with a child belonging to the same woman, going through the process of head flattening. There was also among the curiosities exhibited, a skull of a Flathead, illustrating a subject of very great importance, as bearing on the theories of Dr. Morton as to the type of the American head. There was another portrait of a distinguished Esquimaux, taken from that country where the Esquimaux and the Red Indians meet together, and seemed to blend, instead of showing that marked physical difference which Dr. Morton supposed he had discovered between the Americans and the Esquimaux. There was also a piece of carved ivory from the extreme North-Western region, which struck him as having a close conformity to Mexican sculptures. If there were really this conformity, it would have a great effect in establishing facts with respect to race and migration from north to south. Other objects consisted of pieces of slate cut into a double bas-relief, having that singular admixture of natural objects, with grotesque fancies, such as were seen in Gothic art of the fourteenth century. These objects were Babine pipes. In one of them the artist showed that the had observed the ships, &c., of the Europeans, and had reproduced these objects on his native pipe. This was interesting, as showing how slight were the grounds upon which some generalizations in archaeology were made. There were found in the Ohio mounds many pipes, deposited upon what were considered by Squier and Davis as altars, and the sculptures on these pipes were considered as establishing a certain degree of civilization among the people who built the mounds. Yet these Babine pipes proved that such objects might be produced by races still remaining in a state little removed from the lowest barbarism. He had been induced to make particular inquiries respecting these Indians, and he had ascertained from Mr. Kane that, though possessing the aesthetic faculty to a high degree, as shown by sculptures, they were in other respects far below other tribes, who were probably quite incapable of any such works of art. He had one other curious remark to make with respect to these Babine Indians, for it appeared that in their customs of sepulture they made a marked difference between the females and the males. The female bodies were all scaffolded, being placed in a canoe and then raised on a stage, while the male bodies were all burned. These facts might serve as useful indications to guide researches into the question of the origin and migrations of the inhabitants of the American continent. He had also been a good deal interested by the information afforded by Mr. Kane with respect to the Flatheads. He desired to know whether their custom of compressing the head into what seemed to be a degraded shape was accompanied by any degradation of intellect. On the contrary it appeared that these people were so superior to their neighbors, as to be capable of making slaves of the surrounding tribes. The flat head was considered a mark of aristocratic origin, and it was therefore prohibited to all slaves to give their children this peculiar formation of the skull."

LAWS OF DESCENT AMONG THE IROQUOIS INDIANS.

Mr. L. H. Morgan read a paper on this subject, describing the singular and complicated method of the descent of property and titles among the North American Indians, the inheritance always passing by the female instead of the male line. "He mentioned several causes, which might be considered to account for this peculiar institution; but one was probably paramount—the desire for independence, and the wish to prevent any family from becoming strong enough to attain to sovereignty—a thing altogether alien to the manners of the hunter state of mankind, and which had never in fact been discovered among the Indian inhabitants of the continent, all of whom were governed by oligarchies maintained, but limited in power by means of this form of inheritance, and by the confederacy of several tribes—a form of polity which existed everywhere in North America.—Mexico might be cited as an exception; but if the institutions of the Mexicans had been thoroughly investigated, it would probably be found that they were identical with those of the Iroquois. Institutions of this kind were remarkably permanent, and it would be very useful, in order to determine questions in ethnology, to ascertain what other sections had had institutions of the same kind. He had ascertained that they existed in south America, and in parts at least of the islands of the South Pacific."

ETHNOLOGICAL SPECIMENS FROM THE ISLAND OF ANEITEUM.

"Professor Dawson communicated some facts collected by a missionary to this Island, one of the new Hebrides. The people were of the Papuan or Austral negro race, perhaps with some intermixture of the Polynesian. Their colour a dark copper, their forms undersized and slender, and the hair crisp but round oval in its cross-section, and more smooth on the surface than that of the European, with the internal fibrous structure very strongly developed, and an intense brownish colour. It was trained by the chiefs in slender locks, bound together by vegetable fibre. He mentioned some facts relating to the religious observances of this race, apparently one of the most degraded on the globe. Travellers and even missionaries often did great injustice to barbarous people, by representing that they worshipped objects, which were in fact merely symbols of the spiritual beings to whom they rendered their devotion. Some tribes allied to these had even been represented as having no religious ideas. His friend Mr. Geddie, missionary in this island, had found on the contrary that these islanders believe in a number of spiritual beings called Natmasses, apparently identical with the Nats of Burmah, and with the genii and demi-gods of other mythologies. One of these superior to the rest had drawn up the island from the depths of the ocean when fishing. The others were the special deities of particular places and objects. They were worshipped by means of sacred stones. Some of these are pieces of vesicular trap in the cavities of which the spirits were supposed to reside; others were of rounded, conical and cylindrical forms, due to weathering and beach rolling. Another object of veneration was the decayed trunk of a tree, having a rude resemblance to the human form, and perforated by cavities apparently caused by decay, and in which the spiritual essence was believed to reside. It was unnecessary to point out the essential identity of this religious system with the prevalent mythologies of antiquity, though the rudeness of its appliances corresponded with the low state of civilization of the people.

He concluded by mentioning that these islanders apparently so degraded, had already received a considerable amount of civilization; a christian church had been organised among them, and he had a copy of the gospel according to St. John, which was printed from type set by them alone."

BANK NOTE COUNTERFEITS.

"Professor Silliman read a paper on the means adopted for the prevention of counterfeiting Bank Notes.

The first attempt of this kind was made by Mr. Syropian, an American gentleman. His plan was to print his note in colours, between which there was no photographic contrast. He therefore used for the print a blue of a bright colour, and a buff, covering the whole ground, except where there were white spots left for beauty or for the figures representing value. This prevented photographic imitations, and to guard against the anastatic or lithographic arts, he covered the whole face with an oleaginous matter which left no chemical contrast. The great objection to the plan was its want of beauty and its liability to spoil by finger marks and dust upon the oily material. In fact nothing was so good in an artistic point of view as carbon ink on white paper. Mr. Syropian, therefore, next attempted to make use of cycloidal lines drawn over the whole surface of the note, and printed in red, using for the design a black ink, which was fugitive in its character. The patent was for the use of two fugitive inks, the black being more fugitive than the red. He could not praise very highly this second experiment, for on holding one of the notes to the window the black was found to be transparent. A photograph made from this note was fair, not, however, good enough to answer the purpose of a counterfeit; but the great objection to it was that the black could be removed without removing the red, and the red without injury to the black, which opened the way at once to the counterfeiter. This Mr. Silliman illustrated by a great many changes which he had produced on one of these notes. In this difficulty then what was to be done? He held in this hand a note printed on a green tint, produced by sesqui-oxyde of Chromium—an invention which originated in this Province with Mr. Hunt; both colors here were unchangeable by anything which the chemist had at present at his disposal. At least, in practice, neither could be decomposed without destroying the paper as well. The usual plan of altering bills was to wash out the figures and insert others; but here were two colors both alike unmanageable. They were not so beautiful as white and black; but beauty must be sacrificed to safety.

While these notes were protected, therefore, against photographic imitations by the reasons he had mentioned, the fact that both inks were oleaginous, and that they presented no chemical contrast, made it impossible to subject them either to the anastatic or the lithographic process."

THE EXPEDITION IN SEARCH OF FRANKLIN.

On the closing day of the Session, the other sections were almost deserted, owing to the desire of members and others to listen to some remarks on this subject by the celebrated Arctic explorer, Dr. Rae. We postpone the publication of these, hoping to have a full report of them for our next issue.

It only remains, in closing this notice of the Association, to say a few words on the General Meetings and evening entertainments. We have already mentioned the opening meeting. The other general meetings were occupied with routine business, with the exception of one devoted to the address of Prof. Hall, the retiring President. This address, a long and able paper, related chiefly to the generalizations at which its author has arrived as the result of his protracted and successful labours in American geology. Its length and importance preclude any attempt to introduce it here. The closing meeting afforded an opportunity for the expression of much mutual good feeling, well worded on the part of our American guests, and well responded to by the representatives of Canada and Great Britain. We have rarely witnessed anything of the kind in better taste or more agreeable.

During the week of the meeting, private entertainments of the most pleasant and intellectual character abounded. Scientific men are usually good talkers, and easily entertained. A public entertainment was given, on the second evening of the meeting, by the Natural History Society. Its more prominent features were an address by the President of the Society, and a popular amplification of Prof. Hall's address; but its real essence consisted in the free intercourse and mutual introductions of members and their friends. An excursion to the beautiful island of St. Helen occupied Saturday afternoon. A second entertainment was given by the McGill College, in Burnside Hall. As became a collegiate re-union, it was marked by a quiet and scientific tone, but we have reason to know was quite as agreeable to the scientific strangers as any of the others. The closing evening was distinguished by a civic entertainment, affording an opportunity for a more full display of local oratory and fashion than any of the others. On Thursday, a charming excursion was organized to the rapids of the St. Lawrence and the localities of interest in their vicinity. Tastes differ, and these recreations of Science were as different as tastes; but each was eminently successful, in its own way.

ARTICLE XXV.—*On the Varieties and Mode of Preservation of the Fossils known as Sternbergiæ.* By J. W. DAWSON, F. G. S.

The fossils which have been named Sternbergiæ and sometimes Artisiæ, are usually mere casts in clay or sand, having a transversely wrinkled surface, and sometimes an external coaly coating and traces of internal coaly partitions. They are found in the coal formation rocks of most countries, and very abundantly in those of Nova Scotia. Until the recent discoveries of Corda and Williamson, they were objects of curious and varied conjecture to geologists and botanists, and were supposed to indicate some very extraordinary and anomalous vegetable structure. They are now known to be casts of the piths or internal medullary cavities of trees, and the genera to which some of them belong have been pointed out. Many interesting truths with respect to them, both in their geological and botanical relations, still, however, remain to be developed; and in the present paper I propose to offer some further contributions toward their history, and the geological inferences deducible from it.

In a paper communicated to the Geological Society of London, in 1846, to which Professor Williamson, in his able memoir in the Manchester Transactions,* assigns the credit of first suggesting that connection between these curious fossils and the conifers, which he has so successfully worked out, I stated my belief that those specimens of Sternbergiæ which occur with only thin smooth coatings of coal, might have belonged to rush-like endogens; while those to which fragments of fossil wood were attached, presented structures resembling those of conifers. These last were not, however, so well preserved as to justify me in speaking very positively as to their coniferous affinities. They

* Vol. ix., 1851.

were also comparatively rare; and I was unable to understand how casts of the pith of conifers could assume the appearance of the naked or thinly coated Sternbergiæ. Additional specimens affording well-preserved coniferous tissue, have removed these doubts, and in connection with others in a less perfect state of preservation, have enabled me more fully to comprehend the homologies of this curious structure, and the manner in which specimens of it have been preserved independently of the wood.

My most perfect specimen is one from the coal field of Pictou, (Fig. 1.) It is cylindrical but somewhat flattened, being one inch two tenths in its least diameter, and one inch and seven tenths in its greatest. The diaphragms or transverse partitions appear to have been continuous, though now somewhat broken. They are rather less than one tenth of an inch apart, and are more regular than is usual in these fossils. The outer surface of the pith, except where covered by the remains of the wood, is marked by strong wrinkles, corresponding to the diaphragms. The little transverse ridges are in part coated with a smooth tissue similar to that of the diaphragms, and of nearly the same thickness.

When traced around the circumference or toward the centre, the partitions sometimes coalesce and become double, and there is a tendency to the alternation of wider and narrower wrinkles on the surface. In these characters and in its general external aspect, the specimen perfectly resembles many of the ordinary naked Sternbergiæ.

On microscopic examination the partitions are found to consist of condensed pith, which, from the compression of the cells, must have been of a firm bark-like texture in the recent plant, (Fig. 2 and 3.) The wood attached to the surface, which consists of merely a few small splinters, is distinctly coniferous, with two and three rows of discs on the cell walls, (Fig. 4.) It is not distinguishable from that of *Pinites*, (*Dadoxylon*,) *Brandlingi*, of Witham, or from that of the specimens figured by Professor Williamson. The wood and transverse partitions are perfectly silicified, and of a dark brown colour. The partitions are coated with small colourless crystals of quartz and a little iron pyrites, and the remaining spaces are filled with crystalline laminæ of sulphate of barytes.

Unfortunately this fine specimen does not possess enough of its woody tissue to show the dimensions or age of the trunk or branch which contained this enormous pith. It proves, however, that the pith itself has not been merely dried and cracked transversely by the elongation of the stem, as appears to be the case in the Butternut, (*Juglans Cinerea,*) and some other modern trees; but that it has been condensed into a firm epidermis-like coating and partitions, apparently less destructible than the woody tissue which invested them. In this specimen the process of condensation has been carried much farther than in that described by Professor Williamson, in which a portion of the unaltered pith remained between the Sternbergia-cast and the wood. It thus more fully explains the possibility of the preservation of such hollow chambered piths, after the disappearance of the wood. It also shows that the coaly coating investing such detached pith casts is not the medullary sheath, properly so called, but the outer part of the condensed pith itself.

The examination of this specimen having convinced me that the structure of Sternbergiæ implies something more than the transverse cracking observed in Juglandaceæ, I proceeded to compare it with other piths, and especially with that of Cecropia Peltata, a West Indian tree, of the natural family Artocarpaceæ, a specimen of which was kindly presented to me by Professor Balfour of Edinburgh, and which I believe has been noticed by Dr. Fleming, in a paper to which I have not had access. This recent stem is two inches in diameter. Its medullary cylinder is three quarters of an inch in diameter, and is lined throughout by a coating of dense whitish pith tissue, one twentieth of an inch in thickness. This condensed pith is of a firm corky texture, and forms a sort of internal bark lining the medullary cavity. Within this the stem is hollow, but is crossed by arched partitions, convex upward, and distant from each other from $\frac{3}{4}$ to $1\frac{1}{4}$ inch. These partitions are of the same white corky tissue with the pith lining the cavity; and on their surfaces, as well as on that of the latter, are small patches of brownish large-celled pith, being the remains of that which has disappeared from the intervening spaces. Each partition corresponds with the upper margin of one of the large triangular leaf scars, arranged in quincuncial order on the surface of the stem. (Fig. 5.)

Inferring from these appearances that this plant contains two distinct kinds of pith tissue, differing in duration and probably in function, I obtained, for comparison, specimens of living plants of this and allied families. In some of these, and especially in a species labelled "Ficus Imperialis," from Jamaica, I found the same structure; and in the young branches, before the central part of the pith was broken up, it was evident that the tissue was of two distinct kinds—one forming the outer coating and transverse partitions opposite the insertions of the leaves, and retaining its vitality for several years at least; the other occupying the intervening spaces or internodes, of looser texture, speedily drying up, and ultimately disappearing, (Fig. 5, A.)

Another variety of the Sternbergia-like pith structure appears in a rapidly growing exogenous tree with opposite leaves, cultivated here, and I believe a species of Paullinia. In this trunk there are thick nodal partitions, and the intervening spaces are hollow and lined with firm corky pith, with its superficial portion condensed into a sort of epidermis, and marked with transverse wrinkles; a cast of which would resemble those Sternbergiæ which have merely wrinkles without diaphragms.

The trunks above noticed are of rapid growth, and have large leaves; and it is probable that the more permanent pith tissue of the medullary lining and partitions, serves to equalize the distribution of the juices of the stem, which might otherwise be endangered by the tearing of the ordinary pith in the rapid elongation of the internodes. A similar structure has evidently existed in the coal formation conifers of the genus Dadoxylon, and possibly they also were of rapid growth, and furnished with very large or abundant leaves.

I have no means of ascertaining to what extent this structure may characterise certain botanical families, nor what gradations it may present, between the mere transverse cracking observed in the trunks of the Butternut and other Juglandaceæ, and the perfect partitions developed in Cecropia. Prof. Gray states that the transverse pith structure is characteristic of the North American trees of the genus Juglans, but wanting in the closely allied genus Carya—a parallel case with its apparent restriction to one genus, or perhaps species, of extinct conifers. It is quite possible that some of the more rapidly growing and thicker-branched species of southern conifers, still present similar structures. The axes of cones also deserve study in this respect, since I have observed that the pith of the cone of Pinus Strobus shows, though obscurely, a tendency to the formation of transverse dissepiments.

Applying the facts above stated to the different varieties or species of sternbergia, we must in the first place connect with these fossils such plants as the Pinites Medullaris of Witham. I have not seen a longitudinal section of this fossil, but should expect it to present a transverse structure of the sternbergia type. The first specimen described by Prof. Williamson represents a second variety, in which the transverse structure is developed in the central part of the pith, but not at the sides. In my Pictou specimen the pith has wholly disappeared, with the exception of the denser outer coating and transverse plates. All these are distinctly coniferous, and the differences that appear may be due merely to age, or more or less rapid growth.

Other specimens of sternbergia want the internal partitions, which may, however, have been removed by decay; and these often retain very imperfect traces, or none, of the investing wood. In the case of those which retain any portion of the wood, sufficient to render probable their coniferous character, the surface-markings are similar in character to those of my Pictou specimen, but often vary greatly in their dimensions, some having fine transverse wrinkles, others having these wide and coarse. Of those specimens which retain no wood, but only a thin coaly investment representing the outer pith, many cannot be distinguished by their superficial markings from those that are known to be coniferous, and they occasionally afford evidence that we must not attach too much importance to the character of their markings. A very instructive specimen of this kind from Ohio, with which I have been favoured by Prof. Newberry, has in a portion of its thicker end very fine transverse wrinkles, and in the remainder of the specimen much coarser wrinkles. This difference marks, perhaps, the various rates of growth in successive seasons, or the change of the character of the pith in older portions of the stem.

I have not been so fortunate as to find any of the Sternbergia or Artisia casts associated with the wood of plants allied to Lepidodendron, as observed by M. Corda. There are, however, in the collection of Prof. Newberry, as well as in my own, specimens which present very considerable differences in their external characters from those of the varieties known to have been coniferous, and which may be the axes of such plants.

The state of preservation of the Sternbergia casts in reference to the woody matter which surrounded them, presents, in a geological point of view, many interesting features. Prof. Williamson's specimen I suppose to be unique in its showing all the tissues of the branch or trunk in a good state of preservation. More frequently, only fragments of the wood remain, in such a condition as to evidence an advanced state of decay; while the bark-like medullary lining remains. In other specimens the coaly coating investing the cast, sends forth flat expansions on either side, as if the sternbergia had been the mid-rib of a long thick leaf. This appearance, at one time very perplexing to me, I suppose to result from the entire removal of the wood by decay, and the flattening of the bark, so that a perfectly flattened specimen, like that in Fig. 6, may be all that remains of a coniferous branch nearly two inches in diameter. A still greater amount of decay of woody tissue is evidenced by those sternbergia casts which are thinly coated with structureless coal. These must, in many cases, represent trunks and branches which have lost their bark and wood by decay; while the tough, cork-like, chambered pith drifted away to be imbedded in a separate state. This might readily happen with the pith of Cecropia; and perhaps that of these coniferous trees may have been more durable; while the wood, like the sap wood of many modern pines, may have been susceptible of rapid decay, and liable, when exposed to alternate moisture and dryness, to break up into those rectangular blocks, which are seen in the decaying trunks of modern conifers, and are so abundantly scattered over the surfaces of coal and its associated beds in the form of mineral charcoal.

Some specimens of sternbergia appear to show that they have existed in the interior of trunks of considerable size. The best instance of this that I have found is that represented in Fig. 7, from the South Joggins, and which appears to show the remains of a tree a foot in diameter, now flattened and converted into coal, but retaining a distinct cast of a wrinkled sternbergia pith.

Are we to infer from these facts that the wood of the trees of the genus Dadoxylon was necessarily of a lax and perishable texture. Its structure, and the occurrence of the heart wood of huge trunks of similar character in a perfectly mineralized condition, would lead to a different conclusion; and I suspect that we should rather regard the mode of occurrence of sternbergia as a caution against the too general inference from the state of preservation of trees of the coal formation, that their tissues were very destructible, and that the beds of coal must consist of such perishable materials. The coniferous character of the sternbergiæ, in connection with their state of preservation, seems to strengthen a conclusion at which I have been arriving from microscopic and field examinations of the coal and carbonaceous shales, that the thickest beds of coal, at least in Eastern America consist in great part of the flattened bark of coniferous, sigillaroid and lepidodendroid trees, the wood of which has perished by slow decay, or appears only in the state of fragments and films of mineral charcoal. This is a view, however, on which I do not now wish to insist, until I have further opportunities of confirming it by observation.

The most abundant locality of sternbergia with which I am acquainted, occurs in the neighbourhood of the town of Pictou, immediately below the bed of erect calamites described in the Journal of the Geological Society (Vol. 7, p. 194). The fossils are found in interrupted beds of very coarse sandstone, with calcareous concretions, imbedded in a thick reddish brown sandstone. These gray patches are full of well preserved calamites, which have either grown upon them, or have been drifted in clumps with their roots entire. The appearances suggest the idea of patches of gray sand rising from a bottom of red mud, with clumps of growing calamites which arrested quantities of drift plants, consisting principally of sternbergia and fragments of much decayed wood and bark, now in the state of coaly matter too much penetrated by iron pyrites to show its structure distinctly. We thus probably have the fresh growing calamites, entombed along with the debris of the old decaying conifers of some neighbouring shore; furnishing an illustration of the truth that the most ephemeral and perishable forms may be fossilized and preserved, contemporaneously with the decay of the most durable tissues. The rush of a single summer may be preserved with its minutest striae unharmed, when the giant pine of centuries has crumbled into mould. It is so now, and it was so equally in the carboniferous period.

ARTICLE XXVI.—*On Parthenogenesis of Animals and Plants.* By Berthold Seemann, Ph. D., F. L. S.

(Read before the American Association for the Advancement of Science at Montreal, August 14, 1857.)

One of the most paradoxical questions lately brought before the tribunal of scientific opinion is that of the Parthenogenesis of Animals and Plants; and in venturing to submit it to this meeting

I trust to be the means of directing the attention of American Naturalists, in an increased degree, to this interesting subject, and induce them to co-operate with the leading physiologists of Europe, in lifting the thick veil of mystery still hanging over some portions of it.

The belief in a Parthenogenis or Lucina sine concubitu is by no means of recent growth, but has arrested the attention of mankind since the earliest ages. In diving into the writings of the Classics and studying the mythology of the Greeks, it will be found that, more than once, females are spoken of, who, in a state of absolute virginity, produced offsprings endowed with all the best qualities of our species. And in searching the pages of ancient naturalists of a subsequent period, the subject of a Lucina sine concubitu frequently meets our eye. These statements are sufficient to show the high antiquity of the belief in a Parthenogenesis; but the observations upon which they were founded, are not of such a nature as to exclude the possibility of a subjective deception; and, for the purposes of modern science, they have no other value, than to point out where productive experiments and observations might be made with advantage.

It is different with the publications that in more recent times have been forced upon our attention, and which, having been made with all the caution, circumspection and accuracy demanded by modern criticism, have in the opinion of many eminent naturalists, completelyestablished the fact, that there exist occasionally individual females of both animals and plants, which in a state of virginity are able to propagate in a sexual manner their respective species. We have no modern observations proving the existence of a Lucina sine concubitu in any of the higher animals, —at least I am not aware of any,—but few are inclined to doubt that Professor von Siebold's works, (the English version by Mr. W. S. Dallas.) "On Parthenogenesis in Moths and Bees," have set this question entirely at rest as regard Insects. It is well known that Professor Richard Owen, applied the term Parthenogenesis, some years ago, to the non-sexual reproduction observable in the genus Aphis, but that process being merely one of gemmation, a budding process, equivalent to what we see in the sprouting of a plant, it is now generally rejected, and Siebold and others always understand by Parthenogenesis the Lucina sine concubitu of ancient Naturalists, and, therefore, lay great stress upon the distinction of true Parthenogenesis and alternation of generation. Siebold by carefully investigating the observations on Parthenogenesis in Insects, made by former naturalists, arrived at the conclusion that these observers were not sufficiently guarded against possible deceptions, and that entymologists had better reject them as inconclusive. He then shows that a true Parthenogenesis does undoubtedly exist in Psyche Helix, Solenobia clathrella, and lichenella, in Bombyx Mori, and Apis mellifica, (the Honey-bee,) but is of opinion that it occurs among insects in a much greater degree than we are at present able to prove. He places in this cathegory the observations of Leon Dufour, that he never was able to obtain a male Diplolepis gallæ tinctoriæ, and alludes to the statement of Hartig, who examined 9,000 to 10,000 individuals of Cynips divisa, and about 4000 of Cynips folii, without even finding among them a single male. The peculiar kind of reproduction observable in the lower Crustaceæ, which some have attempted to explain as alternation of generation or gemmation, may prove on closer investigation to be a true Parthenogenesis. Amongst the Moluscs there are also certain phenomena, which may possibly be explained as phases of a true Parthenogenesis. These allusions sufficiently show that the catalogue of reproduction in animals by means of Parthenogenesis, may look forward to considerable additions; whilst the doctrine hitherto generally received, that the development of the ovum could take place solely under the direct influence of the male principle, has received a shock, from which it is not likely to recover.

In the vegetable kingdom, authentic proofs of the existence of a Parthenogenesis are much more abundant than they are in the animal. Spallanzani, seems to have been the first who, towards the close of last century, pointed out that the female hemp did produce ripe seeds without the aid of pollen; but his statement, though confirmed by the experiments of Bernhardi, met with so much opposition that it could not obtain the acknowledgment due to it; and it is only the recent observations of Naudin in Paris, which, by confirming it still more, have at last vindicated for it the character of an accurate and strictly correct observation. Nor is it to be wondered at, that a fact, opposed to so many theories looked upon as true laws of nature, should have been received with the greatest distrust, and been, ex-cathedra, absolutely denied. That subjective deception should somewhere have taken place was a thought that readily suggested itself, as a plausible excuse for disbelieving so astounding a fact. How easy for polygamous flowers to be hidden among the female ones! (as Mr. Masters has shown them to exist occasionally in the dioicious hop-plant)! How easy for pollen to be wafted to the stigmas! These and others were the objections of the unbelievers in the new discovery. To this must be added that the experiments of Koelreuter on hybrids, placed the sexuality of plants on a firmer footing than it formerly enjoyed, and that the concession that a dioicious plant could, under certain circumstances, develope its ovula without the aid of pollen, was looked upon as an absolute negation of sexuality.

The polemic on this subject was continued for many a year, but for the want of new observations began also to slacken, when on the 18th of June, 1839, Mr. John Smith, Curator of the Royal Botanic Gardens at Kew, announced before the Linnean Society of London that there existed in the Royal Gardens a female specimen of a Euphorbiaceous plant, Cælebogyne ilicifolia, J. Smith, from New Holland, which annually produced ripe seeds without the aid of pollen. Robert Brown Lindley, the two Hookers, myself and others subjected the Cœlebogyne to strict and repeated examinations but the result invariably was a confirmation of the case as stated by Smith; the Parthenogenesis of this plant was therefore generally accepted by the public of England, but on the Continent of Europe it was rejected as unworthy of credit, as the observations of Treseinus on Datisca cannabina, of Lecog on Spinacia oleracea of Tenore, on Pistacia narbonensis, (confirmed by Bocconi on this and other species of Pistacia), and of Ramisch on Mercurialis annua. All these observations were regarded as mere delusions, of which science ought to be purged as speedily and completely as possible; a fact which can take us the less by surprise when we reflect that the doctrine so ably and long maintained by the Horkelian school that the pollen contains the true origin of the embryo and that the ovulum is merely matrix—has only very recently become untenable through the experiments and observations of Hofmeister, Radlkofer and others.

A history of the embryo more in accordance with nature has opened a new and enlarged field for the Parthenogenesis question, and it is gratifying to find that it has already received the attention of various able observers; amongst others I mention Professor Alexander Braun, of Berlin, who favoured the last meeting of the German Naturalists and Physcians, at Vienna, with his observations on the Parthenogenesis of Chara crinita, a plant of which no males have ever been found in Germany, though all the females are bearing fruit in abundance. Of the utmost importance is a paper by Naudin, published first by the French Academy, and translated by me into English and German; in which will be found not only a confirmation of the observations of Ramish on Mercurialis annua, but also of those of Spallanzani and Bernhardi on Cannabis sativa, and some new observations on Bryonia dioica.

It had been mentioned by Wenderoth and others that the monœcious Ricinus communis, the Castor Oil plant, produced ripe seed without the aid of pollen; but the direct observations of Naudin show that such is not the case, and that so far from exhibiting any tendency towards Parthenogenesis, all the female flowers fell off the moment the male ones were removed; a similar effect was produced on Esbalium elaterium, another monœcious plant, all the female flowers of which faded after the male ones of the same specimen were taken off; observations which justify us in considering as doubtful the existence of a Parthenogensis in monœcious plants, but has established it in *nine* dioicious ones belonging to seven different natural orders: Chara crinita, Cannabis sativa Spinasia oleracea, Coelebogyne ilicifolia, Mercurialis annua, Pistacia narbonensis, and another species, Bryonia dioica, Datisca cannabina.

How this fact will clash with the existing theories on the origin and formation of the embryo, I will not attempt to discuss. Various explanations will, no doubt, be attempted, but the most common of all, and one that has already been promulgated, that of looking upon this reproduction as a kind of gemmation, must be rejected; for the seedlings raised from the ovula developed without the aid of pollen, are in most cases in which observations have been made, of both the female as well as the male sex; if they were always females, like the mother-plant, then the gemmation theory would have something to recommend it; but as the case stands it must be given up as untenable.

The existence of a Parthenogenesis in animals and plants throws more light upon the history of the embryo than the most able and valued physiological researches could possibly do; it shows more clearly than the most lucid explanation, that the origin of the embryo has not to be looked for in the pollen of plants, or the semen of animals, but in the ovula and ova themselves. And it is in this hint, science recognizes the real practical utility of this great question. That the Parthenogenesis occupies an important office in the economy of nature we can already perceive, but how it comes to pass that the ova and ovula are developed without the aid of the male principle, and what means are employed to make a sexual reproduction, under such anomalous circumstances, possible, is one of those riddles, the solution of which is reserved for future investigation.

ART. XXVII.—*Description of four Species of Canadian Butterflies.*

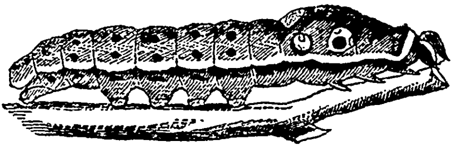
Having in our last number expressed an opinion that *P. troilus* was probably an inhabitant of the more southern portions of these Provinces, we were much gratified by receiving a specimen of that species from D. W. Beadle, Esq., of St. Catherines, Canada West. As it is therefore now proved to be a Canadian species, we subjoin a figure and description of it. We shall be greatly obliged if other entomologists follow Mr. Beadle's example, and forward us specimens of such species as may come under their notice, and which we may overlook in the course of our future papers on the Canadian Lepidoptera, together with such information regarding their larvæ, pupæ, food-plants, habitats, seasons, &c., as our correspondents can furnish, and if required we shall be happy to return the specimens, and defray the cost of conveyance.. We would also be glad of any useful and accurate observations on the Natural History of those species which we describe, and we especially desire notices of their occurrence in different localities, and whether common or rare. If Canadian Lepidopterists will respond to this appeal, we shall then have data upon which to found a more precise knowledge of the distribution of the various species; this is at present very vague, such words as North America, Canada, United States, &c., being employed in most scientific works to indicate the localities. A catalogue of all the Canadian Lepidoptera is a great desideratum, and numerous zealous observers, in different parts of the country, willing to communicate their observations, are the only means by which we can ever hope to arrive at such a much-to-be-wished for result.

Hitherto we have given figures of each of the species, but in future we shall engrave only one in each genus, except when circumstances render it advisable to figure more, and we shall endeavor to get through all the diurnal lepidoptera as speedily as possible. We shall frequently include species which inhabit New York and other Northern States, and which are likely to occur in Canada. As we know of no work exclusively devoted to Canadian species, we are compelled to adopt this course, as otherwise many Butterflies would be omitted, which doubtless inhabit those portions of this country with which we are unacquainted. We hope our correspondents will be able to set at rest any doubts respecting some, if not all such species, by sending us specimens, and all necessary information regarding them.

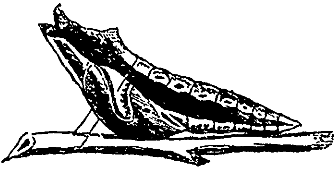
GENUS PAPILIO. (*Continued.*)

Species 3.—Papilio Troilus. The Laurel Swallow-Tail.

Plate iv., fig. 1.



a.



b.

a the Caterpillar. *b* the Chrysalis.

Papilio Troilus, Linnæus, Mus. Lud. Ulric. p. 187, n. 6, Holmiæ 1764. Syst. Nat. 11, p. 746, n. 6, Holmiæ 1765–67.

Papilio Troilus, Fabricius, Syst. Entom., p. 444, n. 7, Flensburgi 1775. Sp. Ins., t. 11, p. 3, n. 9. Hamburgi 1781 &c.

Papilio Troilus, Cramer, Pap. xviii, p. 25, pl. ccvii., fig. A. B. C. Utretcht 1779.

Papilio Troilus, Drury, Ins. 1, tab. 11, fig. 3–5. London 1770–1775.

Papilio Troilus, Godart, Encyclop, Meth. Ins., t. ix. pars 1, p. 62, n. 97, Paris 1819–1821.

Papilio Troilus, Boisduval and Leconte, Ico., &c., des Lépidopterès, &c., t. 1, p. 26, pl. 10. Paris, 1833.

Papilio Ilioneus, Smith and Abbott, Nat. Hist. of the Lepidopt. of Georgia, vol. 1, p. 3, tab. 11. London, 1798.

This species is about the size of P. asterias. Upper side, the wings denticulated, black, with the notches yellow; the anterior wings have on their hind margin a row of six or seven pale yellow spots, which gradually increase in size, from the costa to the inner margin. They have beyond this a spotted band of four or five small and obscure spots placed in a line, and formed of greyish atoms. The posterior wings have a marginal series of seven lunules, the first of which is orange, whilst the other six are of a greenish or bluish grey. Inside these marginal lunules is a broad bluish grey band, divided by the nervures; the lunule of the anal angle is triangular, orange on its inner margin, and greenish grey on its outer. The tail is black, very short, and a little swollen at its extremity. Under side, the wings brownish black at the base. Anterior wings, with the spots of the upper side much better defined, so that they here form two spotted bands; they have also two triangular yellow spots which are placed beyond the others. Posterior wings with two bands, each formed of six orange lunules, a little tinged with yellow on their edges. The anal spot fulvous, only tinged with grey on its outer edge. Between these two spotted bands there are seven glossy blue lunules, the third of which is partly covered by a verticle oblong spot, generally of a greenish grey. The body is black with some reddish dots on the front of the thorax, and a series of yellow spots on each side. The female differs from the male in the following particulars: the anterior wings are generally destitute of the marginal row of yellow spots, the second row being seldom or never indicated by any greyish atoms; the posterior wings have above the marginal lunules a sort of band badly defined, rather broad, and formed of shining blue atoms, whilst in the male this band is better defined, and of a bluish or greenish grey. The under side differs but little.

The caterpillar is green, with a yellow marginal band, which mixes itself a little with the green color. It has upon the sides two rows of blue dots, and upon the fourth segment two flesh colored spots, upon the third segment a flesh colored eye spot with a deep blue ocellus, and upon the first a black collar. The under side of the body and of the head are of a flesh-colour, a little tinged with ferruginous. All the feet are ferruginous, but at the base of the membraneous ones is a row of seven blue dots. It feeds on sassafras, (*Laurus sassafras*) and Mr. Beadle has observed it on spice wood, (*Laurus benzoin*). It also feeds on many other species of Laurel.

The chrysalis is a little gibbous, of a pale ferruginous colour, with stripes of a darker tint.

The larvæ which are found in autumn change to pupæ before the winter, and produce the imago at the beginning of the following summer; the others are hatched from the end of May all through the month of June and beginning of July.

This fine butterfly is very easily caught. It generally flies around the laurels, and loves to bask on the fragrant blossoms. It is common in Georgia and Virginia, and is found in the island of Jamaica. It is included in Dr. Harris' List of Lepidoptera inhabiting Massachusetts, and as before mentioned we have received it from St. Catherines, Canada West.

We now come to the second division of the Papilionidæ.

Sub-Family II. Pieridi.

Anal edge of the hind wings not concave, but grooved or formed into a gutter to receive the abdomen; the anterior tibiæ do not possess a spur in the middle, and the tarsal ungues are one or two dentate.

The caterpillers are not furnished with a nuchal fork. They are slightly pubescent, and rather slender at each end of the body.

It contains many genera, of which we believe only two occur in Canada, viz: *colias* and *pieris*. We do not know whether any species of the beautiful genera, *aporia*, *xanthidia*, *gonepteryx* and *callidryas*, which inhabit the Southern and middle, and the Southern parts of the Northern States, are to be met with any where in Canada, but we hope to learn that we may include some of them in our fauna.

Genus I. Colias.

Palpi short, much compressed, fringed with short and close hairs, the last joint much shorter than the preceding; antennæ straight, short, terminated by an obtuse gradually formed club

By some authors *Gonepteryx* and *Colias* are separated into a third sub-family called *Rhodoceridi*, but for the sake of simplicity we have adhered to the more general arrangement which includes them amongst the Pieridi.

which occupies about a fourth of their length, the head has no frontal tuft; forewings sub-triangular, and the posterior rounded; the discoidal cell of the hind wings closed; thorax thick; body shorter than the wings; tarsal ungues bifid; fore legs alike in both sexes. Their flight is very rapid, and they are difficult to capture. The caterpillars naked, elongate, cylindric, very finely setose and tubercled. The chrysalides rather short, sub-angular, gibbous, slightly beaked in front, attached by the tail, and by a girth behind the thorax.

The larvæ feed on leguminous plants.

This is one of the most natural genera of diurnal lepidoptera; the color is always some shade of yellow or orange, more or less bright, and frequently tinged with green. All have a portion of the wings marked with black; the forewings also exhibit a black discoidal spot, and the posterior a central spot, which is orange above, and generally silvery beneath. The palpi and antennæ are always reddish or rosy.

The general resemblance between the species and some being extremely subject to variation, has led to much confusion in their synonomy. The species are not very numerous, and none of them, even of the exotic kinds, beyond the middle size. This genus is found in all the temperate parts of the globe, but they are not known to inhabit the equatorial regions of the two continents. All those which are known come from Europe, Siberia, Cape of Good Hope, Barbary, North America, Mexico and New Holland. Six or seven species inhabit North America, of which two are found in Canada, viz:—*C. edusa* and *Philodice*. We also describe a third, *C. chrysotheme* which occurs in the State of New York. Two or three species inhabit Labrador and the Hudson's Bay Territories, and the remaining one the Southern States.

Species 1.—Colias Edusa. The Clouded Yellow.

Colias Edusa, Boisduval and Leconte, Ico. &c., des Lépidopteris, &c., de l'Amerique Sept. t. 1, p. 59. Paris, 1833.

Colias Edusa, Duncan, Brit. Butterflies, p. 103, pl. v, fig. 2. Edinburgh, 1835.

Colias Edusa, Kirby, Fauna Bor. Amer., (Insects) p. 287. Norwich, 1837.

Colias Edusa, Westwood and Humphrey, Brit. Butterflies, p. 15, pl. 11, fig. 1–4. London, 1841.

Papilio Edusa, Fabricius, Mant. Ins., t. 11, p. 23, n. 240. Hafniæ, 1787, &c.

Papilio Edusa, Borkhausen, Europ. Schmett, pars i, p. 119 et 254, n. 3, pars ii, n. 213, Frankfort, 1788–1795.

Papilio Hyale, Cramer, Pap. p. 119, pl. cccii, fig. E. H. Utretcht, 1781.

Le Souci, Ernst, Pap. d'Europe, vol. ii, p. 226, pl. liv, n. 111, A. D. Paris, 1780.

VARIETIES.

Papilio Helice, var Hubner, Pap. tab. lxxxvii, fig. 440–441.

Colias Myrmidone, Hubner, Europ. Schmett, tas. lxxxvi., fig. 432, 435.

Colias Myrmidone, West, and Hump Brit. Butterflies, 130, t. 42, f. 1–3.

Colias Chrysotheme, Step. Haust, 1, 11, t. 2, f. 1, 2.

Colias Aurora, Meig. Schmett, 1, 26, 2, t. viii, f. 1.

Also described by a very large number of other authors.

Male;—Antennæ, rose-colored, with the club somewhat embrowned. Upper side; anterior wings, deep orange or saffron colour, with a broad, deep blackish brown margin, a little indented internally with the nervures which are finely but distinctly marked with yellow, and divide the black band, the fringe rose-colour; a black oblong spot marks the disk nearer the costa than the inner margin; costa, paler than the rest of the wing. Posterior wings shaded with green, and on each a round deep orange discoidal spot; the margin is also deep blackish brown, the brown colour terminating in a point short of the anal angle, which is paler than the rest of the wing. Under side; anterior wings paler than on the upper side, and all that part of the wing corresponding to the border, greenish yellow, seperated from the ground colour by a row of minute spots about six in number, increasing in size as they approach the inner margin, and placed parrallel to the hind margin, the three first very indistinct and ferruginous, the other three black. The black discoidal sub-marginal spot has a minute white pupil, and there are also two small ferruginous spots on the costa near the tip. Posterior wings, entirely pale yellow, in the centre is a compound eyelet, the exterior circle of which is composed of ferruginous scattered scales, which to form the iris are more condensed, and the two pupils, of which the outer one is the largest, are silvery. They have also a curved row of indistinct ferruginous spots placed parallel to the hind margin, and at the base a spot of rose-colour; the abdomen is greenish yellow, with the back black: thorax covered with rosy hairs; expansion of the wings 2 to 2½ inches. The female differs from the male in having the black marginal band of the anterior wings broader, more deeply dentated internally, and divided by a series of large greenish yellow spots.

Some varieties of the male have only one pupil to the eyelet on the posterior wings, and are smaller than that described. Examples of the female sometimes occur, in which the parts usually yellow are greenish white, a circumstance which has led some authors to describe it as distinct under the name of *Helice.* American specimens differ but slightly from European, but are not of quite so deep a tint as the latter.

The caterpillar is green, with a lateral stripe varied with white and yellow, and with an orange dot on each segment. It feeds (in Europe) on *medicago lupulina*, *cytisus austriacus*, various species of *trifolium* and other leguminous plants.

The chrysalis is green, with a lateral yellow line, and several ferruginous dots.

This handsome species appears in spring, and a second time in autumn. It is not a common species in this country. We took a very fine female on Montreal Mountain, September 10th, 1856. It was flying in a very sluggish manner, and we caught it under a hat. Boisduval says it is found in Europe, Egypt, the coast of Barbary, Nepaul, Cachemere, Siberia and North America. In England, it occurs in the southern counties in considerable plenty, in certain years, while in others, scarcely an example is to be met with. It seems to prefer the vicinity of the sea, having been found more copiously along the south-eastern coast, particularly in the neighborhood of Dover than elsewhere.

Species 2.—Colias Chrysotheme. The small clouded yellow.

Colias Chrysotheme, Godart, Encyclop. method. Ins., t. ix, pars 1, p. 103, n. 42. Paris, 1819–1821.

Colias Chrysotheme, Boisduval and Leconte, Ico. &c., des Lépidopterés de l'Amer., Sept. t. 1, p. 63. Paris, 1838.

Papilio Chrysotheme, Hubner, Europ. Schmett, tab. lxxxv, f. 426–428. Augsburg, 1796–1835.

This species resembles Edusa a little, but it is much paler, with the margin browner, divided on the anterior wings by fine yellow nerves; the fore wings have, moreover, the costa broadly yellow. The discoidal spot is narrower, transverse, slightly marked, and edged with a little red. The under side of the anterior wings nearly as in *Edusa* and the allied species, except that the discoidal spot of the fore wings has the centre rather pupilled with silver The female is much paler than the female of *Edusa*, and the yellow orange colour only occupies the disk of the fore-wings, the yellow spots which divide the dark margin are larger, more marked, and of a much paler yellow colour.

In Europe this pretty Colias is always smaller than *Edusa*, it is the contrary in North America, where it is rather larger than the latter. Boisduval says that this genus is divisable into two groups, C. Edusa belonging to the first, in which the males are provided with a glandular space or sac at the anterior edge of the hind wings near the base, whilst in the second group, to which C. Chrysotheme belongs, they are destitute of this sac. This species is found in Hungary, Styria, and Southern Russia. According to Boisduval it is more numerous about New York than *Edusa*; it appears in spring and in autumn, the second brood being most numerous. We have never met with a description of the larva or pupa.

Species 3.—Colias Philodice. The clouded sulphur.

Plate iv. fig. 2.—*a*, female; *b*, male; *c*, male underside.

Colias Philodice, Godart, Encyclop. method. Ins., t. ix, pars 1, p. 100, n. 35. Paris, 1819–1821.

Colias Philodice, Boisduval and Leconte, Ico., &c., des Lépidoptéres, &c., de l'Amer. Sept. t. 1, p. 64, pl. xxi, fig. 1, 2, 3. Paris 1833.

Colias Philodice, Emmon's Agri., N. Y. Insects, p. 204, pl. xxxv, fig. 1, 2, 4, 9. Albany, 1854.

Papilio Anthyale, Hubner, Pap. exot., &c. Augsburg, 1806, &c.

Male, the upper side of the wings sulphur yellow, with a rather broad black border, sinuated internally and drawn to a point on the posterior wings, a little before the anal angle. The anterior wings have besides this an oblong black discoidal spot, and the posterior a pale orange spot about the centre of the wing. Under side, anterior wings fine yellow, very pale on the inner margin, and powdered with blackscales on the costa. The black discoidal submarginal spot has a white pupil, and there is a row of indistinct black spots parallel to the hind margin; posterior wings of a deeper tint than the anterior, with two coalescing, central ocelli having a ferruginous iris and silvery pupil; they have also a curved row of ferruginous spots parallel to the hind. margin, a ferruginous spot at the basal angle, and another in the middle of the costal edge; all the wings strongly fringed with rosy; the body, antennæ, &c., as in other species of the genus. The female differs from the male in the following manner:—General colour slightly paler; the black band of the fore-wings is not so well defined, browner, and interrupted by a series of yellow spots; the corresponding band on the hind wings is almost obsolete, and underneath these wings are of a dirty yellow colour instead of being fineorange as in the male.

The caterpillar is stated to be green, with yellow lines and black dots, and feeds on the various trefoils; we have never seen it.

This butterfly is one of our most abundant species. In September we have seen more than twenty pitched at the same time on a bush of Michaelmas daisy, and in some parts of Canada the fields look almost yellow with their dancing forms. It is fond of pitching in muddy spots on roads, sometimes assembling in such places in considerable numbers. It is much more numerous at Sorel than about Montreal, but is very generally distributed over the whole of North America. It appears at the beginning of June, and having several broods during the season, worn individuals linger on to the end of October, even to the confines of our desolate winter.

NOTE.—Since writing the above, we have taken near Laprairie a curious variety of the female *Colias Philodice*. It is only about half the usual size, and the ground colour of the wings is dirty white, with scarcely any tinge of yellow. The marginal black band on the anterior wings is very broad, but pale and unbroken by yellow spots. The central discoidal spot on the underside of the posterior wings has three pupils—the third rather indistinct.

MISCELLANEOUS.

OBITUARY.—In our last number we had the melancholy duty of announcing the death of Mr. W. C. Redfield, the meteorologist; and before another month had elapsed, two more men from the ranks of science, highly esteemed for their excellence of character as well as successful labors, had passed away,—Prof. BAILEY of West Point, and Prof. TUOMEY of Alabama.

Prof. Bailey had long been failing under a relentless consumption, and finally died on Thursday, the 26th of February last. For many months his voice had been reduced to a whisper; yet his mind was active, and as late as our last number (March,) we published a contribution to science from him, as the result of his recent microscopic researches. Feebleness of health prevented his being present at the meeting of the American Association at Albany in July 1856; but the Association in view of his high attainments and valuable researches elected him President for the following year,—an honor well merited; for few men in the land have exerted a wider and more beneficial influence on the science of the country.

Prof. Bailey, although a proficient also in chemistry, mineralogy, and botany, had been especially devoted to microscopic research, and with the exception of what Ehrenberg has done, the microscopic geology or "micro-geology" of this country has been mainly worked out by him. His first communication to this Journal, was published in 1837, and although chemical, it indicated that delicacy of manipulation which fitted him for microscopic researches. It related to the use of grasshoppers' legs as a substitute for frogs in galvanic experiments. In volume xxxv. (1839,) commence his papers on fossil Infusoria, which were continued through many of the following volumes, down to the current year, and are too well known and appreciated to require remark at this time. The Continent along its Atlantic and Pacific borders and over its interior has passed under his microscope, and delighted him with many beautiful forms of life which had never before greeted a human eye. And lately, the ocean's bottom in the Atlantic to a depth of 1200 feet, and about the North Pacific to 16000 feet, has devleoped wonderful facts before his investigations. Prof. Bailey has also done a vast deal towards raising the standard of microscope manufacture through his discriminating use of tests, and his influence. His scale for microscopic slides by which the positions of the invisible specimens are exactly noted, is a happy thought well carried out. In these and various other ways, microscopy is vastly indebted to his labors. Mr. Bailey at his death was Professor of Chemistry, Mineralogy and Geology in the U. S. Military Academy at West Point. His life without reproach, his gentleness and modesty, his earnestness for truth rather than self, his untiring energy even when his physical system seemed to be dissolving away from his spirit, make a character that excites love as well as admiration.

Prof. TUOMEY.—Prof. M. Tuomey died at Tuscaloosa on the 30th of March last. He had been one of the active geologists of the Southern States, and among them had taken the lead through his researches and publications. In 1844 he was put in charge of the Geological Survey of South Carolina, and four years afterward published his final Report in a large quarto volume. The Report treats of the various crystalline rocks and their metalliferous veins or ores, and dwells at length on the Cretaceous and Tertiary beds which had been with him more special subjects of study. In his survey, he brought out many facts of prominent interest, illustrating important principles in the geology of the continent and the history of seashore deposits.

The state of South Carolina is remarkable geologically for containing nothing of the carboniferous formation (unless metamorphosed ;)excepting the middle secondary red sandstone, which he traced from North Carolina to a distance of four or five miles into South Carolina where it is associated with trap dykes as in the Connecticut valley, there are no stratified rocks, yet observed between the metamorphic bed and the Cretaceous.

Subsequently, Prof. Tuomey was appointed to the Chair of Geology of the university of Alabama at Tuscaloosa and to the charge of the Geological Survey of that State, which positions he held when he died. He has been actively engaged in his explorations during the year past, and both the State and the University have experienced a great loss in his decease. In connection with Dr. F. S. Holmes he has had in hand the publication of a splendid work on the Fossils of South Carolina, which has not been surpassed in the country for the beauty of its palæonto logical illustrations. Geological science is greatly indebted to Prof. Tuomey's zeal and fidelity, and has occasion for mourning that his labors have ceased.—"*Sillimans Journal.*"

DR. SCORESBY, the veteran of Artic enterprise, died at Torquay, England, on the 21st of March last, after a lingering illness.

MONTHLY METEOROLOGICAL REGISTER, SAINT MARTIN'S, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF JUNE, 1857.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day	Barometer corrected and reduced to 32° F. (English inches.) 6 a. m.	2 p. m.	10 p. m.	Temperature of the Air. F. 6 a. m.	2 p. m.	10 p. m.	Tension of Aqueous Vapour. 6 a. m.	2 p. m.	10 p. m.	Humidity of the Atmosphere. 6 a. m.	2 p. m.	10 p. m.	Direction of Wind. 6 a. m.	2 p. m.	10 p. m.	Mean Velocity in Miles per hour. 6 a. m.	2 p. m.	10 p. m.	Amo'nt of Rain in inches.	Amo'nt of Snow in inches.	Weather, Clouds, Remarks, &c., &c. [A cloudy sky is represented by 10, a cloudless one by 0.] 6 a. m.	2 p. m.	10 p. m.
1	29·522	29.344	29·439	51·1	80·1	60·0	·361	·648	·499	·93	·64	·95	N. E. by E.	S. by E.	S. S. W.	0·40	0·43	8·27	0·200		Clear.	C. C. Str. 6.	C. Str. 8.
2	454	254	433	60·1	75·5	58·0	·467	·607	·354	·89	·71	·73	S. W. by S.	S. S. E.	W. S. W.	0·01	2·16	12·50			Cirr. Str. 3.	" 4.	Clear.
3	352	314	359	57 0	66·0	58·6	·345	·416	·345	·72	·65	·84	W. S. W.	W. S. W.	S. W.	12·10	10·50	4·02	Inapp.		" 2.	C. Str. 6.	C. Str. 4.
4	414	502	626	51·0	57·0	44·5	·293	·355	·234	·77	·74	·74	W.	W. N. W.	W. by S.	0·53	16·57	9·00			Clear.	" 8.	Clear F. Aurora Bore
5	661	612	560	40·5	62·3	46·6	·227	·397	·226	·85	·71	·70	N. W. by W.	W, by S.	W. b[illegible]	2·08	12·22	10·11			"	" 6.	C. Str. 4.
6	528	514	437	52·2	62·3	46·2	·304	·397	·251	·76	·72	·89	W. S. W.	W. by S.	W.	1·32	5.60	8·90	0·366		"	" 4.	Rain.
7	469	420	535	50·0	72·1	54·1	·304	·473	·326	·81	·61	·76	W.	W. S. W.	S. by W.	·91	0·48	0·21	0·266		"	" 4.	Clear.
8	650	714	796	57·0	75·1	67·5	·376	·498	·366	·79	·58	·55	W. S. W.	S.	S.	0	0·00	0·00			"	Clear.	C. Str. 2.
9	712	764	793	55·7	78·5	62·0	·351	·498	·421	·79	·52	·75	E.	S. S. E.	S. S. E.	0·00	7·56	5·40			C. Str. 4.	C. C. Str. 4.	" 6.
10	656	546	515	64.1	85·5	66·5	·504	·692	·544	·84	·58	·85	S. by W.	S.	S.	0·10	0·45	0·20	1·733		C. C. Str. 6.	Cirr. 2.	Str. 2.
11	348	211	28·937	60·0	62·0	58·0	·494	·528	·472	·94	·94	·96	S. S. E.	E. S. E.	S. S. E.	0·22	0·75	3·73	0·583		Rain.	Rain.	Rain.
12	29·017	168	29·259	57·5	66·1	58·5	·447	·464	·437	·94	·72	·89	W. N. W.	W. N. W.	S. W. by W.	5·85	18·76	8·12	0·331		Rain.	C. C. Str. 6.	Str. 8.
13	317	395	399	54·3	73·4	52·5	·349	·541	·373	·81	·67	·93	S. S. E.	W. by S.	N. W.	1·98	5·10	6·03			C. Str. 10.	C. Str. 4.	Clear, Thunder.
14	520	639	751	51·0	62·5	50·1	·515	·421	·301	·82	·75	·81	W. N. W.	N. W.	N. by W,	15.22	19·77	11·17			Str. 4.	" 6.	"
15	793	734	745	48·7	67·7	54·2	·281	·431	·319	·80	·65	·81	N. W. by W.	W. by S.	N. E. by E.	2·80	3·01	7·70			Clear.	Clear.	"
16	813	713	.720	51·0	65·1	53·6	·293	·425	·361	·76	·68	·87	N. E. by E.	W. by S.	W.	1·67	0·27	0·33			Str. 2.	C. C. Str. 8.	Str. 4.
17	692	705	707	51·0	58·1	53·0	·337	·462	·386	·87	·94	·93	E. by W.	S. S. E.	S. E.	0·13	12·12	0·30	0·478		C. Str. 10.	Rain.	C, Str. 8.
18	630	629	625	53.5	59·7	55·5	·394	·452	·432	·96	·89	·94	E. S. E.	E. S. E.	E. S. E.	5·47	7·05	3·55	0·389		Rain.	Rain.	C. Str. 10.
19	565	540	634	57·3	72·1	60·9	·449	·638	·511	·94	·82	·94	S. S. E.	S. by W.	S. S. W.	2·77	3·23	8·47	Inapp.		C. Str. 4.	C. Str. 10.	" 8.
20	656	669	221	65·0	78·1	65·7	·560	·578	·555	·90	·61	·85	W. by N.	W. S. W.	E. N. E.	1·13	1·02	1·05	0·136		" 10.	Cum. 1.	" 9.
21	563	818	656	62·0	72·3	61·4	·445	·555	·450	·79	·71	·84	W. by S.	W. by S.	S. W.	10·22	6·72	3·41	0·186		Cum. 4.	C. C. Str. 2,	Clear Aurora Borealis.
22	565	514	444	56·9	72·5	59·0	·449	·550	·479	·96	.71	·95	E. by S.	E. by S.	N. E. by N.	0·01	4·01	3·03	0·183		C. Str. 10.	" 4.	Rain.
23	425	597	663	56·5	63·1	55·6	·432	·461	·371	·94	.79	·84	N. N. W.	N. W. by W.	N. W. by W.	15·75	19·00	15·70	1·230		Rain.	C. Str. 8.	C. Str. 10.
24	625	714	729	50·0	71·6	63·1	·314	·532	·461	·83	·70	·79	N. W. by W.	N. W. by W.	W. by N.	14.96	8·36	17·32			Clear.	Clear.	Clear.
25	624	622	627	60·0	71·7	64·5	·416	·588	·504	·79	·98	·84	S. W. by S.	N. by S.	N. W.	8·10	1·96	24·07	Inapp.		C. C. Str. 6.	Cirr. Str. 6.	Cirr. 4. Dist. Thunder.
26	612	615	701	62·0	74·8	81·5	·445	·532	·362	·79	·64	·66	N. N. W.	N. W.	N. W. by W.	0·30	8·80	9·98			Clear.	Clear.	Str. 4.
27	695	680	812	57·0	83·3	65·0	·376	·681	·527	·79	·61	·85	N. W.	S. W.	S.	0·87	8·72	1·52			"	"	Clear.
28	831	787	779	60·6	83·4	64·6	·416	·617	·466	·79	·56	·79	E. S. E.	S. E. by E.	S. E.	2·13	3·26	0·46			"	"	"
29	655	608	640	60·1	78 9	61·0	·381	·578	·476	·73	·61	·79	E.	E.	E. N. E.	4·85	8·81	8·17			"	Str. 4.	C. Str. 4.
30	709	646	567	63·0	64·0	57·5	·435	·476	·447	·75	·79	·93	S. S. E.	S. S. E.	S. E. by E.	5·47	7·43	1·21	0·130		C. Str. 8.	C. Str. 10.	" 10.

REPORT FOR THE MONTH OF JULY, 1857.

Day	Barometer 6 a. m.	2 p. m.	10 p. m	Temperature 6 a. m.	2 p. m.	10 p. m.	Tension 6 a. m.	2 p. m.	10 p. m.	Humidity 6 a. m.	2 p. m.	10 p. m.	Wind 6 a. m.	2 p. m.	10 p. m.	Velocity 6 a. m.	2 p. m.	10 p. m.	Rain	Snow	Weather 6 a. m.	2. p. m.	10 p. m.
1	29·670	29·712	29·846	77·3	70·0	58·0	·447	·623	·462	·94	·86	·94	S. E. by S.	S. S. E.	S. S. E.	2·86	1·40	2·68	0·066		C. Str. 10.	C. Str. 4.	C. Str. 8.
2	29·941	30·000	29·948	63·0	80·0	60·0	·461	·681	·467	·79	·68	·88	S. S. E.	S. by E.	S.	0·27	2·00	0·23			" 2.	Clear.	" 2.
3	909	29·814	728	59·0	80·0	60·8	·426	·588	·456	·84	·58	·84	N. W. S. W.	S. by W.	S. by W.	0·10	2·97	1·71			Clear.	C. Str. 2.	" 2.
4	726	712	862	60·5	78·9	52·0	·441	·492	·304	·84	·52	·76	W. N. W.	N. N. W.	N. W.	1·76	6·26	6·33			Cirr. 2.	Clear.	Clear.
5	912	885	994	44·6	80·5	61·5	·241	·588	·456	·79	·58	·84	S. S. E.	W.	S. W.	0·07	0·06	0·07			Clear.	"	"
6	883	872	755	50·8	85·1	66·5	·349	·628.	·544	·93	·53	·85	S. W.	W. by S.	S. W. by S.	0·01	0·22	0·67			C. C. Str. 4.	C. Str. 2.	"
7	638	615	667	65·8	74·1	62·9	·499	·681	·445	·80	·82	·79	W. S. W.	S. W. by W.	N. by E.	3·13	12·20	8·91	Inapp.		Light Cirr.	" 10.	"
8	862	794	738	55·5	81·7	62·0	·331	·638	·397	·74	·61	·71	N. W. by W.	N. W. by N.	S. W. by W.	7·73	1·83	8·40			Clear.	Clear.	"
9	956	934	968	60·9	84·5	64·4	·371	·638	·504	·71	·56	·84	S. W.	S. W.	S W.	0·20	0·15	1·80			"	C. C. St 4.	Str. 4.
10	853	905	967	60·0	85·5	68·5	·494	·692	·613	·90	·58	·85	S. by E.	S. W.	S. S. E.	0·22	2·83	0·01			C. Str. 6.	Cum. Str. 8.	Cirr. 1.
11	29·898	885	802	64·9	93·4	73·6	·527	·854	·628	·85	·53	·78	W. S. W.	W. S. W.	S. W. by S.	0·23	0·85	4·43			Clear.	Clear.	Clear Ft. Aurora Borealis.
12	805	744	777	94·1	90·0	72·4	·648	·776	·670	·78	·56	·85	S. W. by W.	W.	E.	0·63	0·77	1·23			"	C. Str. 9.	C. C. Str. 4. Dist. Thun.
13	772	725	730	77·6	88·6	76·0	·681	·925	·727	·74	·71	·82	S. S. W.	S. S. W.	S. by W.	0·12	1·38	0·41			Fog.	C. C. Str. 8. Dist. Thun.	Clear.
14	828	772	697	74·0	97·6	73·4	·681	·936	·692	·82	·51	·86	S. S. W.	S. by W.	S. by W.	0·10	2·43	0·32			Clear.	C. Str. 4.	"
15	714	666	702	77·1	94·3	73·5	·648	1·136	·692	·71	·68	·86	S. W.	S. by E.	S. W. by W.	0·12	3·13	4·40			"	" 4.	C. Str. 4. Light in N. E.
16	711	709	740	75·1	90·0	67·8	·670	·896	·646	·78	·65	·94	S. by W.	S. by W.	S.	0·08	0·89	3·10	0·180		"	C. C. Str. Thunder.	" 10.
17	711	704	725	69.5	86·0	71·6	·668	·955	·715	·94	·78	·94	S. E. by E.	W. S. W.	N. E. by W.	0·83	0·83	7·83	0·499		Rain.	C. Str. 10.	" 9.
18	666	570	607	66·4	92·3	73·6	·605	·896	·727	·94	·59	·90	S.	W. by S.	S. S. W.	0·80	0·13	1·80			C. Str. 9.	C. C. St. 4.	Clear.
19	526	518	471	73·0	70·3	70·4	·692	·715	·715	·86	·94	·93	S. W.	N. by W.	S.	1·10	3·05	4·40	1·036		" Thunder.	Rain.	Str. 3.
20	438	431	492	74·2	79·0	68·8	·715	·763	·646	·86	·78	·91	S. W. by W.	S. W. by W.	S. by W.	6·66	1·03	0·10			" 10.	C. Str. 10.	C. C. Str. 4.
21	29·476	514	475	66·1	73·0	67·0	·574	·327	·626	·89	·90	·94	N. E. by E.	E. S. E.	E. N. E.	0·52	4·12	1·06	0.300		" 10.	" 9.	" 4. Thunder.
22	556	640	782	68·0	71·8	58·0	·650	·588	·712	·96	·78	·84	E. N. E.	E. N. E.	E. N. E.	7·16	12·92	15·40			" 10.	" 4.	" 9.
23	820	826	814	57·0	86·4	59·0	·376	·698	·778	·79	·53	·95	N. E. by E.	N. E. by E.	E. by N.	20·56	13·70	12·56	1·106		" 10.	C. C. Str. 8.	Cirr. Str. 10.
24	786	787	747	60·7	65·5	63·0	·411	·578	·546	·84	·96	·94	E. by N.	N. W. by W.	S. E. by E.	5·47	2·07	1·48	0·991		Cirr. Str. 4.	Rain.	Str. 4.
25	812	793	849	62·2	81·0	68·0	·528	·739	·613	·94	·71	·89	S.	W. S. W.	S. W.	1·17	5·92	2·12	0·170		C. Str. 9.	C. Str. 4.	Str. 4. Thunder.
26	882	787	864	69·5	89·0	70·6	·634	·868	·628	·90	·65	·86	S. W. by W.	W. S. W.	S. W. by S.	5·25	7·17	2·22			Str. 2.	" 4.	Clear.
27	843	754	704	68·6	92·0	72·7	·613	·670	·704	·89	·44	·90	S. W. by S.	S. W.	S. S. W.	0·55	2·36	0·28			Clear.	" 2.	C. Str. 4.
28	557	612	726	75·5	79·7	66·7	·739	·628	·574	·86	·64	·89	S. W. by S.	S. W. by S.	S. W. by S.	3·45	6·40	12·73	Inapp.		C. Str. 6.	" 4.	C. C. Str. 4.
29	754	799	963	59·3	74·1	64·8	·478	·617	·534	·93	·74	·89	N. N. W.	N. W.	S. W.	5·92	3·25	0·01			Clear.	" 2.	Clear.
30	947	836	855	62·0	83·0	64·0	·528	·617	·534	·93	·56	·89	S. E.	S. S. E.	S.	1·14	4·22	3·07			"	C. C. Str. 4.	Cirr. Str. 4.
31	734	614	548	63·0	79·9	63·6	·516	·715	·546	·89	·71	·94	S. S. E.	S. by E.	S. by E.	6·12	0·47	9·31	·902		C. C. Str. 8.	C. Str. 6.	Cirr. Str. 10.

REMARKS FOR JUNE, 1857.

Barometer. { Highest, the 21st day, 29·818 inches. Lowest, the 11th day, 28·937 " Monthly Mean, 29·615 inches. Monthly Range, 0·881. "

Thermometer. { Highest, the 10th day, 85°9. Lowest, the 6th day, 39°2. Monthly Mean, 61°44. Monthly Range, 46°7.

Greatest intensity of the Sun's rays, 121°9.
Lowest point of Terrestrial radiation, 36°1.
Mean of Humidity, ·786.

Amount of Evaporation, 3·430 inches.
Rain fell on 16 days, amounting to 6·212 inches; it was raining 61 hours and 58 minutes, and was accompanied by Thunder on 2 days.
The most prevalent wind was the W. by S. The least prevalent wind was the E.
The most windy day was the 23rd day; mean miles per hour, 16·81.
Least windy day, the 8th day; miles per hour, 0·00.
Aurora Borealis visible on the 2nd night.
The Electrical state of the Atmosphere has indicated moderate intensity.
Ozone was in moderate quantity.

REMARKS FOR JULY, 1857.

Barometer. { Highest, the 2nd day, 30·000 inches. Lowest, the 20th day, 29·431 " Monthly Mean, 29·754 inches. Monthly Range, 0·569 "

Thermometer. { Highest, the 14th day, 98°7. Lowest, the 8th day, 46°8. Monthly Mean, 71°57. Monthly Range, 41°9.

Greatest intensity of the Sun's rays, 122°0.
Lowest point of Terrestrial radiation, —44°6.
Mean of Humidity, ·800.

Amount of Evaporation. 2·85 inches.
Rain fell on 1[illegible] days amounting to 65·785 inches; it was raining 29 hours 57 minutes and was accompanied by Thunder on 7 days.
Most prevalent wind the S. W. Least prevalent wind the E.
Most windy day, the 23rd day; mean miles per hour, 15·60.
Least windy day, the 5th day; mean miles per hour, 0·06.
Aurora Borealis was visible on 1 night.
The Electrical state of the atmosphere has indicated constant and high tension.
Ozone was in rather small quantity.