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AQUARIA STUDIES.

Part I.

By A. S. Ritchie.

The rage for aquaria has somewhat subsided in the fashionable world; still fashion reigns to a certain extent, and exerts an influence even in the zoological world. There has been a *furore* for sponges such as the beautiful Venus' Flower Basket (*Euplectella speciosa*), from the Philippines, for novelties in shells or in insects, and at fashionable prices.

All are not votaries of fashion,—though, in the minds of some, the fickle goddess may fan some latent spark of " Nature's fire " into a flame. While aquaria, in countless numbers, are being sacrificed by the auctioneer, the student of nature watches with intense interest the various productions of animal and vegetable life in his minature fish-pond, and sees, with admiration, their perfect adaptation to their place in the economy of nature.

A well-known naturalist writes: " The graceful fish, the brilliant reptiles, the shining insects, that people this rare world, whilom hermetically sealed up from our yearning view, are now displayed in the aquarium,—sporting, feeding, slumbering—pursued and pursuing,—leaping into life, and falling into dissolution,—each in its natural haunts, and yet 'all at home in these crystal palaces.' "

The fresh water aquarium with us, constructed and stocked on scientific principles, should represent faithfully a Canadian pond or stream. Nothing mars the effect more than to see marine shells, gay corals, madrepores, and echinoderms, however beautiful and interesting in themselves, in a fresh water aquarium. Even gold-fish are out of place among our Canadian fishes there, and detract from the truthfulness of the representation of a local fauna. Our waters contain the beauties of the Creator's hand just as much as those of a foreign shore, and the object of all lovers of aquaria should be to correctly illustrate the habits of native species.

The bottom of the tank ought to resemble the bed of a pond or river, with pieces of rock-work here and there, having their tops standing out of the water, to allow those creatures which prefer *out-door exercise* to breathe the fresh air at pleasure.

The principles on which an aquarium should be constructed are the following. The vessel should be either oblong or square, but not globe-shaped, on account of its distorting the image of whatever is contained in it. This should contain animal and vegetable life, in fresh or salt water, which, like the water of a river or sea, need never be changed. The vitalization of the water, without its being changed, constitutes the main principle of the aquarium; this principle we shall now endeavour to explain.

Living animals absorb oxygen, and give off carbonic acid gas. Plants, on the contrary, exhale oxygen, and inhale carbonic acid. What the one accepts the other rejects; that which would suffocate the one if it was not removed, the other would die from exhaustion if it could not obtain.

In stocking an aquarium, judgment and discretion are required, so as to have an equal proportion of animal and vegetable life. It should also be remembered that the more rock you introduce the fewer fish must be put in. A little experience in the keeping of aquaria will soon make people aware of any disproportion in the balance of animal and vegetable life. If plants are in excess, this is shown by the particular clearness of the water and by the restlessness of the fish. Their motions are spasmodic; they swim backwards and forwards in darts and jerks, as if trying to escape from something. If, on the other hand, there is too little vegetation, the fish swim lazily, with their mouths out of the water, panting for oxygen.

Our aquarium is three feet six inches long, by two wide, and twenty inches in depth. It has a glass top or roof-shaped covering; this is to keep out dust, and to prevent some of the inmates going from home, also for the purpose of fern growing. The bottom is covered with about two inches of sand or gravel, having rock-work at each end, with the tops of the stones standing out of the water. These last have cups cut in them for the reception of mosses and ferns, while the portion above water gives the reptiles and crustaceans the opportunity of a short stroll at pleasure.

We have grown *Anacharis alsinastrum* and *Vallisneria spiralis* with comparative success, the great enemy to their entire success being the cray-fishes, which browse on the plants, and destroy them after a time. We dispense with the larger plants altogether now. The aquarium stands in a darkish corner, and the water is as clear, and smells as sweet, as when put in two years ago. A little water must be added now and then to compensate for evaporation. We never clean the glass on the side next the wall, which is covered and grown over with confervæ and other lowly plants of various kinds. This, and not crowding too much animal life into the vessel, is the secret of success.

We shall now introduce the reader to some of our favourites, and first some odd fishes which possess many and varied traits of character.

That dapper little fellow, with his coat shining with scarlet and green, and armed with spines, is the little Stickleback (*Gasterosteus* *). He is the prince of gallants, and will fight for his lady-love to the death. A peculiarity in the economy of individuals of this species is, that they build a nest, the male watching and following the young until they can fish for themselves. We have had the nest built in the aquarium of several pieces of weeds that were introduced, but saw no young ones; if they ever had any the other fish must have devoured them. The female kept possession of the nest, which was in a corner of the tank, while the male kept watch outside. Woe to the unwary minnow, or sun-fish, that comes near his domicile,—his coat becomes more brilliant, his little eyes redden and flash, and with spines erected, he rushes at his enemy and charges him with his numerous bayonets.

Our next example is rather a handsome fish, which always swims along the bottom, moves by jerks, and darts to and fro; from

* The scientific names of the fishes mentioned in this article, have been altered in accordance with the latest nomenclature.—J.F.W,

his peculiar style of motion, he is named the Darter (*Boleosoma tesselatum.*) He is said to have no air bladder, which accounts for the difficulty he has in rising to the surface. He is a quiet retired character, but always manages to be on hand at feeding time.

The Striped Minnow (*Rhinicthys atronasus*) is the dandy of the tribe,—always sporting himself in the fore-ground. He is a little forward at times, and sometimes makes mistakes, such as rushing at a fly that has alighted on the outside of the glass, and only knows his real position (a dandy in prison) when his nose comes in contact with the glass.

We have a tyrant in our colony, the common Sun-fish (*Pomotis auritus.*) He must be king, and his rule is despotic. None are allowed to eat until he has finished, and even after getting the lion's share he chases all who dare to attempt to help themselves. One day he nearly fell a victim in consequence of his bad temper. A fine Cray-fish (*Astacus Bartonii*) had his home in the corner of the aquarium; at the close of feeding time he would sally forth to pick up anything that was left; the sun-fish made a dash at the antennæ of the cray-fish (which are always in motion when on a purveying expedition); like lightning the claws of the crustacean were thrown up in self-defence. He caught our finny friend above the tail, and only our timely interposition saved the sun-fish's life. After this we made a close prisoner of him in one of the corners of the tank, by placing a square of glass against the side and end.

The most graceful fish in our family is the American Perch (*Perca flavescens*), his proportions are so elegant, and his shape is so well adapted for swimming. He has a powerful stroke-oar in his tail, and few can match him on a trip round his domain. His powers of eating are extraordinary. Many a poor minnow pays the penalty of being a little too small for his company. Still, when regularly fed, he behaves himself as well as a respectable perch ought to do.

A very pretty Black Basse (*Centrarchus fasciatus*), is our next friend; we were not long favoured with his company,—he was too good for such a station. The waters of the St. Lawrence or the Ottawa were his home, and he pined for their gravelly bottoms and rippling waves. His retiring manner was our admiration; he always loved the shade of the rock-work. Many a stray fly was quietly dropped into his corner, which he never took without a look of recognition and thankfulness; but death!—inexorable death!!—called him away.

The Cat-fish (*Amiurus catus*) is one of the hardiest fishes we possess. His chief end is to eat,—which he does almost to suffocation. He refuses nothing. As he roots with whiskered mouth among the gravel at the bottom, he heeds neither the attacks of the stickleback, cray-fish, nor sun-fish. When annoyed he merely gives a shake of his head with the greatest nonchalance and keeps his nose at work, picking up all the rejected bits left by his patrician relations. He is of great use as a scavenger, and two or three specimens are a great acquisition to all aquaria.

The Pond Sucker (probably a small species of *Catastomus*) is a shy fish, and extremely reserved. In form, its body, from the dorsal fin to the tail, is rather tapering, and in swimming the body appears bent;—it is covered with beautiful silvery scales. He sometimes, though erroneously, gets the name of "Shiner." He has no teeth in the upper jaw, and is, therefore, unable to bite at his food, which is drawn into the mouth by suction, hence the name.

The Black Minnow (*Umbra limi*) is also of retiring habits, and is easily startled. He asserts his dignity, however, at feeding time, as he moves about with a graceful air, and is one of the first to help himself when there is anything in the way of meat to be had.

We have kept the Golden Carp, or Gold-fish (*Cyprinus auratus*) in the tank to please the ladies, but we objected to his presence on account of his being a stupid fish, and not indigenous (although introduced into gentlemen's ponds in Massachusetts, where it thrives well); besides, while along with the representative fishes of our waters, our aquarium carried a falsehood on its face. This will never do for science, we said, and were going to turn him out, but all we could find of him was the backbone and the eyeless head floating on the top of the water. The other fish knew he was a stranger,—perhaps they did not like the colour,—at any rate every one was against him, from the perch to the striped minnow. Whenever he attempted to come to the front to feed, there was a general charge at the poor gold-fish. Being thus prevented from feeding, he got so weak as to allow himself to be caught, and thus fell a victim to his cowardice and stupidity. We say cowardice, for he was as large as any fish in the tank, and a great deal larger than most. The smallest minnow would make him beat a hasty retreat. The old-fashioned fish globe is the place for the golden carp.

This concludes our remarks on the fishes of our aquarium, which contains ten species. At the time we write there were thirty-one specimens in the tank.

We shall now pass on to another class:—Reptiles. First in point of size comes our friend the Painted Turtle (*Chrysemys picta*). He is about four inches long, and a very lively specimen,—sporting now in the water, now on the rocks. In the water he is at home, and like all the rest of our family, he loves good eating. He devours his food voraciously, and swallows it by a series of gulps. We kept him about six months. He died from disease, as a *post-mortem* examination proved; the viscera were overgrown with a black fungus, and now the shell is all that remains of the poor turtle.

The Water Newt (*Triton millepunctatus*) is a great acquisition to the aquarium. At first we had a number of this species, but on account of the depredations of the fish our stock got reduced to two specimens. They liked the water, and would lie quietly on the top of it until the fish made war on their toes—biting a toe off this one, and part of a leg off another one, until only two remained unscathed. They took to the rocks and the moss in self-defence, taking an occasional dip, which they accomplish as quickly as possible. They have cast their coats twice with us. Their motions and positions in the water are very grotesque, yet very graceful at times. No aquarium is complete without them. They went the way of all newts, however, after a two years' sojourn with us. We always have them replaced by fresh ones.

The next in order is a veteran Frog (*Rana halecina*). When first introduced into our tank he preferred the water; he would lie carelessly floating on the surface until some of his finny allies would make a dash at his toes with open mouth, to his great disgust and annoyance. He had the advantage of them, however, and took up his residence on the moss in one of the cups of the rock-work at the edge of the water. He sometimes took a bath, which he only partially enjoyed, as he well remembered the propensity of his friends the fish. He is an adept at fly-catching, which he effects by his tongue as he lies on the moss.

Fancy his feelings as he lies under the influence of chloroform on the stage of the microscope, while we examine the circulation of the blood in the membrane between his toes. At first he disliked thus being bandaged up like a mummy; but frogs, like ourselves, can accommodate themselves to circumstances. He has figured before the public, under the microscope, during two winters, but has since died.

We shall now glance at a creature of a different order and class—a crustacean—the American Cray-fish (*Astacus Bartonii*), and a curious creature he is; almost every thing suits his palate. He is very provident, and lays up what he is unable to eat in the holes under the rock-work. He is a good gymnast, and can stand on his head, or on his tail, or can walk as it suits him,—as fast the one way as the other,—backwards, forwards, or sideways,—it matters not. He hid himself for a time, as his coat was getting shabby and too small for him. He came forth at last with a complete new suit; roamed about for some time, but has again vanished, with no ostensible reason. This is the first instance of this creature changing his shell in our aquarium.

With the exception of a few species of water beetles, *dytiscus, acilius*, and *colymbetes*, which the fish gradually mastered—notwithstanding the hardness of their elytra,—the curtain falls on the denizens of our aquarium.

We intend, in continuation of our aquaria studies, to lift the curtain once more, and, with the assistance of the microscope, to illustrate some forms of animal and vegetable life which cannot be well seen by the unassisted eye.

ON LAURENTIAN ROCKS IN EASTERN MASSACHUSETTS.

By Dr. T. Sterry Hunt, F.R.S.*

In a paper read before the American Association for the Advancement of Science at Washington in April, 1854, and published in this Journal for September in the same year, (vol. xvii, page 193,) I noticed the crystalline limestones of north-

* From Silliman's Journal for January, 1870.

eastern Massachusetts, which were described by the late Dr. Hitchcock as enclosed in the great gneissic and hornblendic formation stretching through that portion of the state. These limestones, which are met with at various points from Bolton by Chelmsford on to Newburyport, present a close mineralogical resemblance to those of the Adirondacks and Laurentides, and also to those of the Highlands of New York and New Jersey. a resemblance which extends to the gneissic rocks which in these various regions accompany the crystalline limestones. I, at that time, accepted without examination the view maintained by Mather and H. D. Rogers, that these limestones in southern New York and New Jersey were altered Silurian strata, although mineralogically identical with those farther north of undoubted Laurentian age. Led by this conclusion to attach comparatively little importance to mineralogical and lithological resemblances, and guided by other considerations given in the paper just referred to, I then suggested that the crystalline limestones and their accompanying rocks in north-eastern Massachusetts might probably be of Devonian age. The subsequent investigations of Hall, Logan and Cooke in the Highlands of New York and New Jersey have however left no doubt that these supposed altered Silurian rocks are really of Laurentian age, and led me to suspect that the same might be the case with those of eastern Massachusetts. This view, which was shared by Prof. James Hall, I ventured to put forward at the meeting of the American Association for the Advancement of Science at Salem in August, 1869, when I showed that it was probable, not only on lithological grounds, but from the fact that the Laurentian rocks appear to the southward of the great palæozoic basin in New Brunswick and Newfoundland, which are geologically but a north-eastern prolongation of New England, and moreover from the outcropping of the lowest Silurian strata at Braintree, near Boston. A few days later I visited Newburyport, and in company with Dr. Henry C. Perkins of that place, had, for the first time, an opportunity of observing the gneisses and limestones in question. Their aspect confirmed my suspicion of their Laurentian age, and led me to suggest to him the propriety of searching for *Eozoon Canadense* in the limestone which there occurs mingled with serpentine. Specimens of it were thereupon placed in the hands of Mr. Bicknell of Salem, well known as a skilled microscopist, and shortly after it was announced by Dr. Perkins that Mr. Bicknell had discovered in them the Eozoon. This notice, which appeared in September in a Newburyport journal, is reproduced in the American Naturalist for November. My own specimens collected in August last near Newburyport, at the locality known as the Devil's Den, did not, however, furnish any traces of Eozoon, and I may here remark that I had already, so long ago as 1864, caused slices to be made of a specimen of limestone from that locality, which were then examined by Dr. Dawson with negative results. In November, however, Mr. Bicknell visited Newburyport and got from a quarry, about a quarter of a mile distant from the place just mentioned, specimens of a serpentinic limestone in which he again found Eozoon. Slices which he has kindly sent me have also been examined by Dr. Dawson, who confirms Mr. Bicknell's observation, and finds in them *Eozoon Canadense*, though fragmentary and not very well preserved. The tubuli, as in the specimens from Grenville, are injected with serpentine, and may be seen on etched surfaces as well as in transparent slices. A crystalline mineral is however abundantly disseminated in the limestone, and unskilled observers might have difficulty in recognizing the fossil.

Another locality, about twenty-eight miles to the south-westward of Newburyport, has however, afforded me much better specimens. In company with Mr. L. S. Burbank of Lowell, a zealous and successful teacher of geology and mineralogy, I visited in October last the limestone quarries of Chelmsford, some five miles from Lowell. This limestone and its accompanying gneiss closely resemble the Laurentian rocks of other regions, and scapolite, apatite and serpentine occur as associated minerals, though the latter was rare in the quarries then visited. A few days afterward Mr. Burbank kindly sent me specimens of a mixture of limestone and yellowish-green serpentine from another quarry in the vicinity, which I had been unable to visit, and these have proved to be rich in *Eozoon Canadense*. The continuous and complete calcareous skeleton of the fossil does not appear in these specimens, which seem like some portions of the rock from Grenville, as described by Sir W. E. Logan, to be made up of fragments of the calcareous shell of Eozoon, mingled with grains of serpentine, and cemented by crystalline carbonate of lime. In the specimens from Grenville, and from most other localities, the mineral matter replacing the sarcode and filling up the canals and tubuli in the calcareous Eozoon skeleton, is generally serpentine or some other silicate. Both Dawson and Carpenter, however, it will be recollected, found that in the fragmentary Eozoon from Madoc, and in some small portions from Grenville, the injected mineral was, like the shell itself, pure carbonate of lime, though readily distinguishable by differences in texture and transparency from the shell. Such is also the case with all the Chelmsford specimens yet examined, which abound in fragments of shell exhibiting in a very beautiful manner the cylindrical diverging and branching tubuli. The accompanying serpentine is disseminated in grains, but has no connection with the organic forms, so that, unlike the specimens in which it is the injecting mineral, the structure of these cannot be brought out by etching with acids.

These specimens from Chelmsford, it shouldbe said, have been examined and satisfactorily identified by Dr. Dawson. The argument from mineralogical resemblances in favor of the Laurentian age of the limestone in question is therefore now supported by the undoubted presence in them of *Eozoon Canadense*. In this connection it should be said that the crystalline rocks of Newburyport and Salisbury, though separated in Hitchcock's geological map from the gneisses to the south-west, and united to the syenites of Gloucester and Rockport, seem to me very unlike the latter, and closely related lithologically to the gneiss of Chelmsford, which encloses the crystalline limestone. The crystalline limestones occurring with gneissic rocks near Providence, Rhode Island, merit a careful examination for Eozoon, inasmuch as from their lithological characters they may with probability be supposed to be of Laurentian age.

Montreal, Dec. 12, 1870.

METEOROLOGICAL RESULTS FOR MONTREAL FOR THE YEAR 1869.

By C. Smallwood, M.D., LL.D., D.C.L.

The following Meteorological Report is condensed from the records of the Montreal Observatory, lat. 45° 31 N., long. 4h. 54′ 17″ West of Greenwich. The cisterns of the barometers are 182 feet above the mean sea level.

The readings are corrected for any instrumental errors, and those of the barometer have been reduced to 32 F.

Atmospheric Pressure.—The highest reading of the barometer occurred at 7 A.M. 1st January, and indicated 30.390 inches. The lowest reading was at 6 A.M. on the 4th February, and was 28.841 inches, giving an annual range of 1.549 inches.

The following table shows the highest and lowest reading for each month in inches:—

	January.	February.	March.	April.	May.	June.
Highest............	30.390	50.251	30.201	29.967	29.812	30.201
Lowest	29.129	29.841	29.100	29.042	28.842	29.298

	July.	August.	September	October.	November	December
Highest............	30.000	30.352	30.375	30.249	30.462	30.643
Lowest	29.275	29.650	29.549	29.349	29.151	29.375

Temperature of the Air F.°—The highest reading of the thermometer during the year was on the 26th July, when it was 84°4. The lowest reading was on the 1st March, and was —9°9 (below zero), giving a range or climatic difference of 94°3, which shows a difference minus of 26°8 compared with the observations of 1868.

The mean temperature for the year was 42°93, which is nearly four-tenths of a degree higher than the mean annual temperature for Montreal.

Below is a table showing the monthly mean, also the highest and lowest temperature for each month, with the amount of rain and snow:—

Months.	Mean Temper'ture in F.°	Highest Temper'ture	Lowest Temper'ture	Rain. Depth in Inches.	Snow. Depth in Inches.
January	20°13	45°9	—4°0	0.233	28.07
February	19°44	38°9	—5°4	None	73.76
March	24 06	53°2	—9°9	1.118	14.07
April	41°00	66°2	29°0	1.107	1.93
May	52°96	78 9	32°6	2.855	3.14
June..........	58°84	81°0	45°2	4.000	....
July	68.51	84°4	52°0	4.995	....
August.......	65.66	85°7	51°0	8.675	....
September	65°55	76°1	55°9	4.096	Inapp.
October	46°13	82°0	24°7	6.827	6.49
November...........	30°28	66 2	11°1	0.655	13.96
December...	22°88	40°7	—2°3	1.004	25.95

The following table shows the mean temperature and the amount of precipitation for each quarter :—

Quarter	Months.	Temper'ture		Rain.	Snow.
Winter Quarter.	December	16°00	....	Inapp.	27.96
	January	20°13	....	0.223	28.07
	February	19°44	....	None	73.76
	Mean	18.52	Amount	0.223	129.79
Spring Quarter.	March	24°06	....	1.118	14.07
	April	41°00	....	1.107	1.93
	May	52°96	....	2.855	3.41
	Mean	39°34	Amount	5.080	19.11
Summer Quarter.	June	58°84	....	4.000	....
	July	68°31	....	4.995	....
	August	65°66	....	8.675	....
	Mean	60°93	Amount	17.670	....
Autumn Quarter.	September	65°53	....	4.096	Inapp.
	October	46°13	....	6.827	6.49
	November	30°25	....	0.655	13.96
	Mean	47°30	Amount	11.578	20.48

Rain fell on 86 days, amounting to 35.545 inches. A very heavy storm, accompanied by loud thunder and vivid lightning, occurred on the night of the 19th-20th of August, and the large amount of 3-782 inches of rain fell in 6 hours 15 minutes.

Snow fell on 76 days, amounting to 167.37 inches. This large amount includes the heavy fall of February. The first snow of autumn fell on the 27th September, in inappreciable quantity. Winter fairly set in on the 4th of December.

Wind.—The most prevalent wind during the year was the N.E. The next in frequency, the W. The least prevalent wind was the S.E.

There were 128 clear nights suitable for astronomical purposes. This is about the usual average.

The Aurora Borealis was visible frequently during the year, but was not accompanied by any grand display.

The meteoric shower of 13th-14th November was rendered invisible by cloudy weather.

The partial eclipse of the moon on the 27th January could not be well observed, owing to clouds and hazy weather.

The solar eclipse of the 7th August, which was only partial at Montreal, was visible, and furnished some interesting phenomena.

ON THE GRAPHITE OF THE LAURENTIAN OF CANADA.

By J. W. Dawson, LL.D., F.R.S., F.G.S.

(From the Quarterly Journal of the Geological Society for Feb., 1870.)

In my paper of 1864, on the Organic Remains of the Laurentian Limestones of Canada, as a sequel to the description of *Eozoon Canadense,* I noticed, among other indications of organic matters in these limestones, the presence of films and fibres of graphitic matter, and insisted on the probability that at least some of the lower forms of plant life must have existed in the seas in which gigantic Foraminifera could flourish. Dr. Hunt had previously, on chemical evidence, inferred the existence of Laurentian vegetation*, and Dana had argued as to the proba-

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* "American Journal of Science" (2). xxxi. p. 395. From this article, written in 1861, after the announcement of the existence of laminated forms supposed to be organic in the Laurentian, by Sir W. E. Logan, but before their structure and affinities had been ascertained, I quote the following sentences:—" We see in the Laurentian series beds and veins of metallic sulphurets, precisely as in more recent formations; and the extensive beds of iron-ore, hundreds of feet thick, which abound in that ancient system, correspond not only to great volumes of strata deprived of that metal, but, as we may suppose, to organic matters which, but for the then great diffusion of iron-oxyd in conditions favourable for their oxydation, might have formed deposits of mineral carbon far more extensive than those beds of plumbago which we actually meet in the Laurentian strata. All these conditions lead us then to conclude the existence of an abundant vegetation during the Laurentian period."

Since the above note was printed in the Quarterly Journal, I have ascertained that it is innacurate as to dates: Dr. Hunt having, in May 1858, before the discovery of *Eozoon Canadense*, asserted, in an article in the Amer. Journal of Science (xxv. 436), that " the presence of iron ores, not less than that of graphite, points to the existence of organic life even during the Laurentian or so-called Azoic period." The same argument will be found in more detailed form, in his papers Quar. Jour.

bility of this on various grounds*; and my object in referring to these indications in 1864, as well as to the supposed burrows of annelids, subsequently described by me †, was to show that the occurrence of *Eozoon* was not to be regarded as altogether isolated and unsupported by probabilities of the existence of organic remains in the Laurentian, deducible from other considerations.

Now that the questions which have been raised regarding *Eozoon* may be considered settled, not only by the adhesion of the greatest authorities in palæontology and zoology, but by the discovery of similar organisms in rocks of the same age elsewhere, by specimens preserved in such a manner as to avoid all the objections raised to the mineral condition of the fossil ‡, and by the discovery of such modern analogies as that furnished by *Bathybius*, it may be proper to invite the attention of geologists more particularly to the evidence of vegetable life afforded by the deposits of graphite existing in the Laurentian.

The graphite of the Laurentian of Canada occurs both in beds and in veins, and in such a manner as to show that its origin and deposition are contemporaneous with those of the containing rock. Dr. Sterry Hunt states § that "the deposits of plumbago generally occur in the limestones or in their immediate vicinity, and granular varieties of the rock often contain large crystalline plates of plumbago. At other times this mineral is so finely disseminated as to give a bluish-gray colour to the limestone, and the distribution of bands thus coloured, seems to mark the stratification of the rock." He further states.—"The plumbago is not confined to the limestone; large crystalline scales of it are occasionally disseminated in pyroxene rock or pyrallolite, and

Geol. Society, 1859, p. 493, Amer. Jour. Science, July 1860 (xxx., 134, as well as in the last-named Journal for May 1866, as quoted above.—J. W. D.

* Manual of Geology. I may also be permitted to refer to my own work "Archaia," p. 168, and Appendix D, 1860.

† Quart. Journ. Geol. Soc. vol. xxii. p. 608.

‡ I cannot, after examination of the specimen, and of others subsequently obtained by Sir W. E. Logan, attach any value to the supposition of Messrs. Rowney and King, that the Tudor specimen has been produced by infiltration of carbonate of lime into veins. The mechanical arrangement of the laminæ and their microscopic structure forbid such a supposition, as well as the comparison of them with the actual calcareous veins occurring in the same rock.

§ "Geology of Canada," 1863, p, 529; and Report for 1866, pp. 218–223.

sometimes in quartzite and in feldspathic rocks, or even in magnetic oxide of iron." In addition to these bedded forms, there are also true veins in which graphite occurs associated with calcite, quartz, orthoclase, or pyroxene, and either in disseminated scales, in detatched masses, or in bands or layers "separated from each other, and from the wall rock by feldspar, pyroxene, and quartz." Dr. Hunt also mentions the occurrence of finely granular varieties, and of that peculiarly waved and corrugated variety simulating fossil wood, though really a mere form of laminated structure, which also occurs at Warrensburgh, New York, and at the Marinski mine in Siberia. Many of the veins are not true fissures, but rather constitute a net-work of shrinkage cracks or segregation veins traversing in countless numbers the containing rock, and most irregular in their dimensions, so that they often resemble strings of nodular masses. It has been supposed that the graphite of the veins was originally introduced as a liquid hydro-carbon. Dr. Hunt, however, regards it as possible that it may have been in a state of aqueous solution* at a heat approaching ignition; but in whatever way introduced, the character of the veins indicates that in the case of the greater number of them the carbonaceous material must have been derived from the bedded rocks traversed by these veins, while there can be no doubt that the graphite found in the beds has been deposited along with the calcareous matter or muddy and sandy sediment of which these beds were originally composed.

The quantity of graphite in the Lower Laurentian series is enormous. In a recent visit to the township of Buckingham, on the Ottawa River, I examined a band of limestone believed to be a continuation of that described by Sir W. E. Logan as the Green Lake Limestone. It was estimated to amount, with some thin interstratified bands of gneiss, to a thickness of 600 feet or more, and was found to be filled with disseminated crystals of graphite and veins of the mineral to such an extent as to constitute in some places one-fourth of the whole; and making every allowance for the poorer portions, this band cannot contain in all a less vertical thickness of pure graphite than from 20 to 30 feet. In the adjoining township of Lochaber Sir W. E. Logan notices a band from 25 to 30 feet thick, reticulated with graphite veins to such an extent as to be mined with profit for the mineral. At another

* "Report of the Geological Survey of Canada,' 1866, p. 233.

place in the same district a bed of graphite from 10 to 12 feet thick, and yielding 20 per cent. of the pure material, is worked. When it is considered that graphite occurs in similar abundance at several other horizons, in beds of limestone which have been ascertained by Sir W. E. Logan to have an aggreate thickness of 3500 feet, it is scarcely an exaggeration to maintain that the quantity of carbon in the Laurentian is equal to that in similar areas of the Carboniferous system. It is also to be observed that an immense area in Canada appears to be occupied by these graphitic and *Eozoon*-limestones, and that rich graphitic deposits exists in the continuation of this system in the state of New York, while in rocks believed to be of this age near St. John, New Brunswick, there is a very thick bed of graphitic limestone, and associated with it three regular beds of graphite, having an aggregate thickness of about five feet.*

It may fairly be assumed that in the present world and in those geological periods with whose organic remains we are more familiar than with those of the Laurentian, there is no other source of unoxidized carbon in rocks than that furnished by organic matter, and that this has obtained its carbon in all cases, in the first instance, from the deoxidation of carbonic acid by living plants. No other source of carbon can, I believe, be imagined in the Laurentian period. We may, however, suppose either that the graphitic matter of the Laurentian has been accumulated in beds like those of coal, or that it has consisted of diffused bituminous matter similar to that in more modern bituminous shales and bituminous and oil-bearing limestones. The beds of graphite near St. John, some of those in the gneiss at Ticonderoga in New York, and at Lochaber, Buckingham, and elsewhere in Canada are so pure and regular that one might fairly compare them with the graphitic coal of Rhode Island. These instances, however, are exceptional, and the greater part of the disseminated and vein graphite might rather be compared in its mode of occurrence to the bituminous matter in bituminous shales and limestones.

We may compare the disseminated graphite to that which we find in those districts of Canada in which Silurian and Devonian

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* Matthew in "Quart. Journ. Geol. Soc.," vol. xxi. p. 423. "Acadian Geology, p. 662."

† Granby, Melbourne, Owl's Head, &c., "Geology of Canada," 1863, p. 529.

bituminous shales and limestones have been metamorphosed and converted into graphitic rocks not dissimilar to those in the less altered portions of the Laurentian.† In like manner it seems probable that the numerous reticulating veins of graphite may have been formed by the segregation of bituminous matter into fissures and planes of least resistance, in the manner in which such veins occur in the modern bituminous limestones and shales. Such bituminous veins occur in the Lower Carboniferous limestone and shale of Dorchester and Hillsborough, New Brunswick, with an arrangement very similar to that of the veins of graphite; and in the Quebec rocks of Point Levi, veins attaining to a thickness of more than a foot, are filled with a coaly matter having a transverse columnar structure, and regarded by Logan and Hunt as an altered bitumen. These palæozoic analogies would lead us to infer that the larger part of the Laurentian graphite falls under the second class of deposits above mentioned, and that, if of vegetable origin, the organic matter must have been thoroughly disintegrated and bituminized before it was changed into graphite. This would also give a probability that the vegetation implied was aquatic, or at least that it was accumulated under water.

Dr. Hunt has, however, observed an indication of terrestrial vegetation, or at least of subaerial decay, in the great beds of Laurentian iron-ore. These, if formed in the same manner as more modern deposits of this kind would imply the reducing and solvent action of substances produced in the decay of plants. In this case such great ore beds as that of Hull, on the Ottawa, 70 feet thick, or that near Newborough, 200 feet thick *, must represent a corresponding quantity of vegetable matter which has totally disappeared. It may be added that similar demands on vegetable matter as a deoxidizing agent are made by the beds and veins of metallic sulphides of the Laurentian, though some of the latter are no doubt of later date than the Laurentian rocks themselves.

It would be very desirable to confirm such conclusions as those above deduced by the evidence of actual microscopic structure. It is to be observed, however, that when, in more modern sediments, Algæ have been converted into bituminous matter, we cannot ordinarily obtain any structural evidence of the origin of such bitumen, and in the graphitic slates and lime-

* "Geology of Canada," 1863.

stones derived from the metamorphosis of such rocks no organic structure remains. It is true that, in certain bituminous shales and limestones of the Silurian system, shreds of organic issue can sometimes be detected, and in some cases, as in the Lower Silurian limestone of the La Cloche mountains in Canada, the pores of brachiopodous shells and the cells of corals have been penetrated by black bituminous matter, forming what may be regarded as natural injections, sometimes of much beauty. In correspondence with this, while in some Laurentian graphitic rocks, as, for instance, in the compact graphite of Clarendon, the carbon presents a curdled appearance due to segregation, and precisely similar to that of the bitumen in more modern bituminous rocks, I can detect in the graphitic limestone occasional fibrous structures which may be remains of plants, and in some specimens vermicular lines, which I believe to be tubes of *Eozoon* penetrated by matter once bituminous, but now in the state of graphite.

When palæozoic land-plants have been converted into graphite, they sometimes perfectly retain their structure. Mineral charcoal, with structure, exists in the graphitic coal of Rhode Island. The fronds of ferns, with their minutest veins perfect, are preserved in the Devonian shales of St. John, in the state of graphite, and in the same formation there are trunks of Conifers (*Dadoxylon ouangondianum*) in which the material of the cell-walls has been converted into graphite, while their cavities have been filled with calcareous spar and quartz, the finest structures being preserved quite as well as in comparatively unaltered specimens from the coal-formation.* No structures so perfect have as yet been detected in the Laurentian, though in the largest of the three graphitic beds at St. John there appear to be fibrous structures, which I believe may indicate the existence of land-plants. This graphite is composed of contorted and slickensided laminæ, much like those of some bituminous shales and coarse coals; and in these there are occasional small pyritous masses which show hollow carbonaceous fibres, in some cases presenting obscure indications of lateral pores. I regard these indications, however, as uncertain, and it is not as yet fully ascertained that these beds at St. John are on the same geological horizon with the Lower Laurentian of Canada, though they certainly underlie the Primordial series of the Acadian

* "Acadian Geology," p. 535. In calcified specimens the structures remain in the graphite after decalcification by an acid.

group, and are separated from it by beds having the character of the Huronian.

There is thus no absolute impossibility that distinct organic tissues may be found in the Laurentian graphite, if formed from land-plants, more especially if any plants existed at that time having true woody or vascular tissues; but it cannot with certainty be affirmed that such tissues have been found. It is possible, however, that in the Laurentian period the vegetation of the land may have consisted wholly of cellular plants, as, for example, mosses and lichens; and if so, there would be comparatively little hope of the distinct preservation of the forms or tissues, or of our being able to distinguish the remains of land-plants from those of Algæ.

We may sum up these facts and considerations in the following statements:—First, that somewhat obscure traces of organic structure can be detected in the Laurentian graphite; secondly, that the general arrangement and microscopic structure of the substance corresponds with that of the carbonaceous and bituminous matters in marine formations of more modern date; thirdly, that if the Laurentian graphite has been derived from vegetable matter, it has only undergone a metamorphosis similar in kind to that which organic matter in metamorphosed sediment of later age has experienced; fourthly, that the association of graphitic matter with organic limestone, beds of iron ore, and metallic sulphides greatly strengthens the probability of its vegetable origin; fifthly, that when we consider the immense thickness and extent of the Eozoonal and graphitic limestones and iron-ore deposits of the Laurentian, if we admit the organic origin of the limestone and graphite, we must be prepared to believe that the life of that early period, though it may have existed under low forms, was most copiously developed, and that it equalled, perhaps surpassed, in its results, in the way of geological accumulation, that of any subsequent period.

In conclusion, this subject opens up several interesting fields of chemical, physiological, and geological inquiry. One of these relates to the conclusion stated by Dr. Hunt as to the probable existence of a large amount of carbonic acid in the Laurentian atmosphere, and of much carbonate of lime in the seas of that period, and the possible relation of this to the abundance of certain low forms of plants and animals. Another is the comparison already instituted by Professor Huxley and Dr. Carpenter, between the conditions of the Laurentian and those of the deeper parts of the modern ocean. Another is the possible occurrence of other forms of animal life than *Eozoon* and Annelids, which I have stated in my paper of 1864, after extensive microscopic study of the Laurentian limestones, to be indicated by the occurrence of calcareous fragments, differing in structure from *Eozoon*, but at present of unknown nature. Another is the effort to bridge over, by further discoveries similar to that of the *Eozoon bavaricum* of Gümbel, the gap now existing between the life of the Lower-Laurentian and that of the Primordial Silurian or Cambrian period. It is scarcely too much to say that these inquires open up a new world of thought and investigation, and hold out the hope of bringing us into the presence of the actual origin of organic life on our planet, though this may perhaps be found to have been Prelaurentian. I would here take the opportunity of stating that, in proposing the name *Eozoon* for the first fossil of the Laurentian, and in suggesting for the period the name "Eozoic," I have by no means desired to exclude the possibility of forms of life which may have been precursors of what is now to us the dawn of organic existence. Should remains of still older organisms be found in those rocks now known to us only by pebbles in the Laurentian, these names will at least serve to mark an important stage in geological investigation.

NOTE ON THE GENUS EOPHYTON.

Until within a few years, the oldest known land plants were a few Lycopodiaceans, forms from the upper part of the Upper Silurian. Recently Barrande and Geinitz have announced land plants probably Lycopodiaceans from olden Silurian beds. Still more lately Torell has described, from Cambrian or Primordial rocks in Sweden, a plant, or supposed plant, which he has named *Eophyton Linnæanum.* The drawings and descriptions, however, render it very doubtful whether this is not merely a cast of scratches or workings of unknown origin, similar to those which are very abundant on Carboniferous and Silurian rocks in Eastern America, and which have often been described as fucoids. Mr. Hicks has, however, recently described in the *Geol. Magazine*, Dec., 1869, a fossil from the Lower Arenig rocks of Wales. This plant is a striated stem, showing a very coarse tubular tissue, comparable with that of *Nematoxlu* or *Prototaxites* of the

Devonian, and perhaps indicates a plant of somewhat high organization. Whether it has any affinity with the *Eophyton* of Torell is more than doubtful. It is thus described by Mr. Hicks :—

"As none of the figures hitherto given of the genus *Eophyton* show either its internal structure or articulations of its stems, and as I am in possession of a specimen from the Lower Arenig rocks of Ramsey Island, near St. David's, which resembles in some respects the *Eophyton Linnæanum* Torell, but which shows both articulations of the stem, and an internal vascular structure, a description of the species may probably be useful, and may tend to elucidate the true nature of *Eophyton*, concerning which so much doubt seems to exist at present.

"There can be no reasonable doubt of the vegetable nature of this fossil, and I think its affinity to the vascular Cryptogams is most clearly shewn.

"These Lower Arenig rocks, from whence the specimen was obtained, rest apparently quite conformable on Upper Lingula-flags,* and underlie the true Arenig or Skiddaw rocks. Nearly all the species obtained from these beds are new, and they indicate a fauna intermediate between Tremadoc rocks and the true Arenig rocks. Indeed, in the report to the British Association, by Mr. Salter and myself, in 1866, they were classed as Tremadoc rocks; but I have since thought it advisable to separate them and to place them in an intermediate position. The Brachiopoda from these rocks have been described by Mr. Davidson (*Geol. Mag.*, Vol. V. p. 303), but all the other species are yet undescribed.

"*Eophyton* (?) *explanatum*, n.sp.—A raised, moderately convex stem, about four lines in breadth; widening, however, and becoming somewhat compressed at the joints. The surface is ribbed, and furrowed along its whole length. At the lower joint the ribs bend outwards, evidently to form a branch. The joint is obliquely placed, widened out, and its course distinctly marked by a deep sulcus. The cortical substance is very thin, and can be removed to shew the internal structure. The internal

* So marked in the Geological Survey Maps. I am inclined, however, to think that they are representatives of the Tremadoc rocks, for *Ling. Davisii*, which is the only fossil present, is equally characteristic of Tremadoc rocks, and reaches here also into these Lower Arenig rocks.

structure is made up of compressed columns, running the whole length from joint to joint, evidently of a tabular nature, and bound together by very thin tissue. At the base of the stem, the broken ends are visible.

" Unless *Eophyton Linnæanum* is proved to have a jointed stem and an internal structure similar to our specimen, it will probably be necessary to make a generic distinction; but at present it is better to retain this under Dr. Torell's generic name."

CONTRIBUTIONS TO CANADIAN METEOROLOGY.

Compiled from the Records of the Isle Jesus and Montreal Observatories.

By CHARLES SMALLWOOD, M.D., LL.D., D.C.L., Professor of Meteorology in the University of McGill College, Montreal.

The following table has been drawn up for the purpose of showing the respective dates of the setting in and of the breaking up of our Canadian winters for the past twenty-one years, and for illustrating the climatology of Montreal and its vicinity.

The first column gives the years from 1849 to 1869 inclusive; The second shows the time of the first fall of snow in autumn in however small quantities. This amount, as a general rule, does not exceed a quarter of an inch in depth on the surface, and invariably disappears, lasting but a very short time, and, in some cases, only a few minutes. The third column shows the date, and the fourth the amount in inches of the heavier snow fall. This snow very seldom entirely disappears; traces may be seen in sheltered places and on the hills and mountains. The dates in the fifth and sixth columns shows the days of the first frost of autumn, and the earliest date that the thermometer marks 32° F. These dates may seem somewhat anomalous, inasmuch as the descent of the thermometer to 32° F., (the freezing point,) and the first frost of autumn, do not in all cases coincide. This difference is owing to several causes, such as terrestrial radiation, amount of clouds, direction and velocity of the wind, and the humid state of the atmosphere. The effect of the first frost of autumn is generally perceived on the leaves and flowers of plants, and although, in some cases, the thermometer has marked 32° F., frost has not perceptibly affected vegetation, owing to some of the causes above mentioned. The seventh column gives the date of the last fall of snow, without reference to quantity, which is sometimes very small. The eighth column shows the respective dates at which the thermometer stood at 32° F. for the last time in spring, and is a near approximation to the last frost, but as vegetation is not so prolific in spring, the effects on flowers and plants are not so well marked as in the autumn, although occasionally late frosts have proved very injurious to fruit trees and early vegetables. The ninth column is intended to show the dates when winter may be said to have fairly set in, for the ground is then frozen to some depth, and may also be covered with some snow. The ditches are then full from the previous autumnal rains, and are frozen over, as well as the small rivers, and loads are crossing on the ice, all out-door work is, consequently, suspended. The tenth and last column gives the date at which the ice left the River St. Lawrence, in front of the city, the river being clear of ice. The arrival of steamers and small sailing vessels generally occurs in a very short time afterwards,—sometimes the same day.

1	2	3	4	5	6	7	8	9	10
Years.	First Snow of Autumn in comparatively Inappreciable Quantities.	First Snow of Autumn in Appreciable Quantities.	Depth in Inches.	First Frost of Autumn.	Date of First Descent of Thermometer to 32° F.	Last Snow of Spring.	Date of Last Descent of Thermometer to 32° F.	Winter fairly set in.	Date of the Ice leaving the St. Lawrence in Front of the City of Montreal.
1849	Nov. 27	Dec. 1	2.00	Oct. 15	Oct. 6	Apr. 13	Apr. 18	Dec. 10	Apr. 7
1850	" 17	Nov. 18	2.14	" 14	" 14	" 14	" 20	" 7	" 9
1851	Oct. 25	" 15	1.50	" 2	" 16	" 8	" 14	Nov. 21	" 9
1852	" 17	" 11	1.20	Sept. 17	Sept. 29	" 16	" 24	Dec. 18	" 19
1853	" 24	Oct 24	2.00	" 12	" 30	" 14	May 1	" 17	" 24
1854	" 15	Nov. 17	1.10	" 11	" 11	" 30	" 7	" 4	" 25
1855	" 24	" 17	2.74	Aug. 9	" 29	" 11	" 10	" 23	" 28
1856	Nov. 1	" 25	1.30	" 26	Oct. 4	May 31	" 6	Nov. 29	" 24
1857	Oct. 20	" 16	2.01	Sept. 7	Sept. 30	Apr. 27	" 14	Dec. 21	" 18
1858	Nov. 4	" 13	3 25	Aug. 25	Oct. 23	" 22	" 14	" 20	" 9
1859	Oct. 20	Oct. 21	2.30	Oct. 7	" 8	" 23	Apr. 27	" 10	" 4
1860	Sept. 29	" 15	1.10	Sept. 3	Sept. 29	May 20	May 20	" 2	" 10
1861	Oct. 23	Nov. 3	0.32	" 5	Oct. 21	Apr, 17	" 4	" 21	" 24
1862	Nov. 10	" 26	1.84	Aug. 24	" 10	May 7	Apr. 27	" 19	" 23
1863	" 11	" 26	1.94	Oct. 24	" 27	" 2	" 21	" 9	" 25
1864	Oct. 8	" 5	3.10	Sept. 26	" 29	Apr. 18	" 5	" 12	" 13
1865	" 28	Oct. 29	0.66	Oct. 21	" 23	" 20	" 19	" 22	" 10
1866	" 4	Dec. 6	0.80	Sept. 16	Sept. 24	May 3	May 2	" 16	" 19
1867	Nov. 5	Oct. 14	1.60	" 23	Nov. 3	" 2	" 4	" 1	" 22
1868	Oct. 17	" 21	4.92	Oct. 4	Oct. 17	Apr. 23	" 1	" 7	" 17
1869	Sept. 27	" 22	6.47	Sept. 28	" 20	May 3	Apr. 29	" 4	" 23

NOTES ON SOME OF THE PLANTS IN THE HERBARIA OF LINNÉ AND MICHAUX.

By DANIEL C. EATON, M.A., Professor of Botany in Yale College.

Prof. Eaton, of New Haven, U. S., the eminent American Pteridologist, when in Europe on a visit in 1866, examined many of the standard herbaria, and made notes on the American plants contained in them. He has most liberally placed a series of these notes on the North American Filices in my hands for perusal, has allowed me to take copies of them, and to print such selections from them as I might deem of sufficient interest: those relating to the collections of Linné, now in London, and of Michaux, in Paris, are here given. The herbarium name of each plant is placed within quotation marks, as is also such notes (of habitat, etc.) as were deemed of sufficient interest to be copied from the sheets to which the respective specimens were attached. Mr. Eaton's observations follow. I have not printed these *verbatim*, as, not being intended for publication, they were, more or less, made up of indications and signs which I have attempted to write out with exactness. One or two observations of my own are placed within brackets, and bear my initial. For convenience of reference I have arranged the species in the order of their occurrence in the Species Plantarum, and in the Flora Boreali-Americana. D. A. WATT.

THE LINNÆAN FILICES.

Notes made in the hall of the Linnean Society, London, August 7, 1866:—

"ONOCLEA SENSIBILIS"—one sterile frond and one fertile frond of the true plant.

"OSMUNDA PENSYLV."—a short sterile leaf of perhaps Struthiopteris or probably of *Osmunda Claytoniana;* veinlets once and twice forked, segments broad and round, the lowest pinnæ long as any. (It cannot be Struthiopteris, and perhaps is not Osmunda, but some Aspidium. D.C.E., anno 1870.)

"OSMUNDA LUNARIA"—consists of two fronds of our *Botry. lunarioides* and one frond *B. rutæfolium* (A. Braun)—the latter very much like the former, and (by its ticket) from Petropolis. There is no true Lunaria in the herbarium.

[It must be borne in mind that the ancients were very careless about their plants, and very careful about their books.

The Lunaria of the Sp. Pl. p. 1519 is unquestionably the species we now call by that name. It is, however, not a little singular that Linné should have had both the American and European forms of the *O. ternatum* of Thunberg without recognizing them as distinct from his Lunaria.—W.]

"OSMUNDA VIRGINIANA"—is the true *Botrychium virginianum*, one frond from Kalm (being marked "K") and one from Clayton (?) marked "Lunaria matricariæ-folio Clayt. n. 706."

OSMUNDA REGALIS—one unnamed frond from Kalm is put next to another that is marked *O. regalis*.

"OSMUNDA CLAYTONIANA"—two fronds of this species in which the fructification is *not terminal*, but the upper sterile pinnæ are unexpanded, as noted by Dr. Gray long ago, and recently by Dr. Milde.

"OSMUNDA CINNAMOMEA"—one fertile and one sterile frond from Kalm; very good.

"ACROSTICHUM POLYPODIOIDES"—is the *Polypodium incanum* of Swartz.

"ACROSTICHUM AUREUM"—very good.

ACROSTICHUM AREOLATUM—Sp. Pl. p. 1526, not found; the *Woodwardia angustifolia* of Smith is the plant described.

ACROSTICHUM PLATYNEURON—p. 1529, not found; the plant described is *Asplenium ebeneum*.

"ACROSTICHUM ILVENSE"—is our North American *Woodsia obtusa*.

[Here Linné appears to have confounded our particularly distinct *Woodsia obtusa* with his Ilvense, and to have missed describing another good North American species. There is no doubt that the Ilvense of his writings is that of modern botanists.—W.]

"ACROSTICHUM EBENEUM"—is *Gymnogramme calomelanos* small form, or possibly *G. tartarea*; a West Indian fern.

"PTERIS AQUILINA"—very good.

"PTERIS CAUDATA"—one frond, very delicate, is good caudata; one with very broad segments is a caudate but not uncommon form of aquilina.

"PTERIS ATROPURPUREA"—one frond from Kalm of our *Pellæa atropurpurea*.

"ASPLENIUM RHIZOPHYLLUM"—is Camptosorus from Kalm; three fronds from one root, and one frond with auricles 1½–2½ inches long.

"ASPLENIUM TRICHOMANES"—very good.

"ASPLENIUM RUTA MURARIA"—very good.

POLYPODIUM VIRGINICUM—not found.

"POLYPODIUM LONCHITIS"—is *Aspidium Lonchitis.* Not a North American specimen, as indeed are not several of the following:

"POLYPODIUM AURICULATUM"—three fronds, one of which may be *Aspid. auriculatum* of Asia, one marked "Pennsylvania" is certainly our *Asplenium ebeneum,* and one marked "K" (Kalm) our *Aspidium acrostichoides.*

[Of all Prof. Eaton's notes this is the most remarkable, as showing a confusion of perfectly distinct species. The specimen of *Aspl. ebeneum* probably belongs to the *Acros. platyneuron* above quoted, while the distinction between *Aspid. auriculatum* and *A. acrostichoides* is very clear, although Swartz said of the latter, "nimium affine præcedenti."—W.]

"POLYPODIUM PHEGOPTERIS"—three fronds of the true plant, and one of *Aspidium Thelypteris* marked "Pennsilv."

"POLYPODIUM FRAGRANS"—is *Aspidium fragrans;* very good.

"POLYPODIUM FONTANUM"—is *Woodsia glabella,* 1½ inches high.

[It is indeed remarkable that Linné should have possessed this little fern so interesting to American botanists, known as European only within the last few years, and still more recently as Asiatic. In the Sp. Pl., p. 1550, he gives two localities:—Siberia, where *W. glabella* occurs; and Provence, in the south of France, whence the *Asplenium Halleri* of continental botanists (to which species his *P. fontanum* is commonly referred) might well have come. Although Linné's description indicates an Asplenium, we may, perhaps, hereafter have to write *Woodsia fontana! Asplenium Halleri* is confined to south Europe; *W. glabella* is circumpolar, and, while it scarcely occurs south of latitude 45°, has been found in Baffin's Bay nearly thirty degrees further north.—W.]

"POLYPODIUM CRISTATUM"—is *Aspidium cristatum,* fruiting.

"POLYPODIUM FILIX MAS"—is one frond of very good *Aspidium Filix-mas,* and one, not marked, of *A. molle.*

"POLYPODIUM FILIX-FŒMINA"—is very good *Asplenium Filix-fœmina.*

"POLYPODIUM ACULEATUM"—is very good *Aspidium aculeatum.*

"POLYPODIUM NOVEBORACENSE"— one frond having the lower part gone; it is not Thelypteris, but is probably our *Aspid. noveboracense;* it has simple veins, and is slightly pubescent.

"POLYPODIUM MARGINALE"—one frond of *Aspid. marginale.*

"POLYPODIUM BULBIFERUM"—one frond of *Cyst. bulbifera* marked "galley fer," a note quite inexplicable.

"POLYPODIUM FRAGILE"—is *Cyst. fragilis.*

"ADIANTUM PEDATUM"—two good fronds, "K" (Kalm).

MICHAUX'S FILICES.

Notes made in Paris, May 22, 1866. The species are arranged in the order in which they occur in the Flora Bor.-Amer. vol. ii., pp. 260–280. The names in the Flora sometimes differ from those of the Herbarium:—

"PTERIS LINEATA—sur les bords de la riv. Aisa-hatcha le 1er Avril Floride," is a Vittaria—the *V. angustifrons* of p. 261.

"PTERIS ATROPURPUREA—Am. septentrionale;" is our *Pellæa atropurpurea.*

"PTERIS GRACILIS—Rochers pres la Malbaye" is our *Pellæa gracilis.*

"PTERIS AQUILINA—Canada;" is the true plant.

ADIANTUM PEDATUM—not noticed.

"BLECHNUM BANISTERIANUM—Pluckn. tab. 179, fig. 2. Hab. in montib. Carolinæ" is a fragment of a sterile frond of *Osmunda cinnamomea;* it is the *Woodwardia B.* of page 263.

"BLECHNUM ONOCLEOIDES—Osmunda caroliniana *Walt.* in Carolinæ, Georgiæ;" is *Woodwardia angustifolia.*

BLECHNUM SERRULATUM—not noticed.

"ASPLENIUM RHIZOPHYLLUM—New Jersey" is *Camptosorus rhizophyllus.*

"ASPLENIUM TRICHOMANES — Canada, Pennsylv. Caroline hautes montag;" three small fronds of the true plant.

"ASPLENIUM TRICHOMANOIDES—hautes montagnes de Caroline, Pluckn. t. 89, fig. 8 et t. 287, fig. 2;" is *Aspl. ebeneum.*

"ASPLENIUM ANGUSTIFOLIUM—Moris. iii., § 14, t. 2, fig. 25, ad ripas Ohio;" one fertile frond of the true plant.

ASPLENIUM THELYPTERIOIDES—not noticed.

"ASPLENIUM ADIANTHUM NIGRUM—an varietas? minor, in montium rupibus Carolinæ septentrionalis;" is *Aspl. montanum.*

"ASPLENIUM RUTA MURARIA—in fissuris rupium montium excelsorum Carolinæ septentrionalis;" small specimens of the true plant.

"POLYPODIUM ACROSTICHOIDES—Pennsylvania, Carolina, Tennessee et Carol. maritim" is *Aspidium acrostichoides.*

"POLYPODIUM THELYPTERIOIDES—montibus Allegeni a Canadâ; Hab. in Canada et ad Carolinanum; Lac Champlain;" is *Aspid. Thelypteris*; a very small sterile frond on same page is doubtful, it may be *Asplenium Filix-fœmina.*

"POLYPODIUM MARGINALE—Kentucky, Pennsylvania, Nectoux;" is *Aspidium marginale.*

"POLYPODIUM PUNCTILOBULUM—Canada;" one frond of *Dicksonia punctilobula.*

"POLYPODIUM BULBIFERUM—in Canada;" two fronds of *Cyst. bulbifera.*

"POLYPODIUM FILIX-FŒMINA?—in Canadâ, a rapporter a son esp." is *Asplenium Filix-fœmina,* and

"POLYPODIUM ASPLENIOIDES—a Novâ Angliâ ad Carolinam;" is the same species.

"POLYPODIUM CRISTATUM—Montib. Carolinæ? et certe in Canada;" is one rather small frond of *Aspidium spinulosum.*

"POLYPODIUM TENUE—Quebec;" is one frond of *Cyst. fragilis.*

"POLYPODIUM RUFIDULUM—Hab. in rupibus Canadæ, Novæ Angliæ, et Novæ Cæsareæ;" is *Woodsia Ilvensis.*

"POLYPODIUM LANOSUM—Hab. in excelsis montibus saxosis Tennessee et Carolinæ septentrionalis;" is *Cheilanthes vestita* of Gray's Manual, five medium-sized fronds.

[Michaux's appears to be the earliest publication of this species; the next (with some doubt as to whether he does not refer to *Ch. tomentosa*) is that of K. Sprengel in Anleitung zur Kenntniss der Gewachse vol. iii. (1804) p. 122, who describes his species as follows:—

"Adiantum vestitum nenne ich eine Art, die Bosc d'Antic in Carolina fand. Sie hat einen 3-fath gefiederten Wedel, der über und über mit feinem wolligtem Haare bedeckt ist. Die Blättchen der iüii. Ordnung sind ei-lanzettförmig, die der letzten Ordnung sind linienförmig gekerbt und schlagen sich um die Samenhäufchen zurück. Bosc nannte diesen Farn Acrostichum hispidum." Where "Bosc named this fern" I have not been able to find out, nor can I see any reason why hispidum should have been changed into vestitum, for if Lamarck (the friend and biographer of Bosc) and Swartz be right, Sprengel did not even alter the genus. Bosc botanized in the Southern States between 1798 and 1800, Michaux more than ten years earlier, though his flora was not published until 1803. There is no good reason why the latter's name should not be restored, and the plant called *Ch. lanosa* (Michx), though long usage may justify a continuance of error.* It is remarkable that this somewhat common fern, which ranges from New York west to Illinois and south to the Carolinas and Georgia, should have been omitted from Sir Wm. Hooker's Species Filicum, the *Ch. vestita* of that work being the *Ch. gracilis* of Fée and Mettenius—the *Ch. lanuginosa* of Gray's Manual.—W.]

" POLYPODIUM DRYOPTERIS—juxta L'Assomption in Canada legi;" three fronds of the true plant.

" POLYPODIUM VULGARE—Moris. sect. 14, t. 2, f. 3, P. Virginiense minus, Hab. in arborib. a Canadâ ad Floridam;" one frond of the true plant.

" ACROSTICHUM POLYPODIOIDES—Pluckn. t. 89, fig. 9, in arboribus Floride;" is the *Polypodium incanum* of Swartz, the *Polyp. ceteraccinum* of p. 271.

" POLYPODIUM HEXAGONOPTERUM—Pluckn. t. 284, fig. 2, Hab. in Virginiâ, Carolinâ, terrestre;" one good average-sized frond of our *Phegopteris hexagonoptera*.

" POLYPODIUM CONNECTILE—Hab. in Canadâ;" one good frond of *Pheg. polypodioides* with the lowest pinnæ *free*. [Polyp. Phegopteris *Linn.* Pheg. polypodioides *Fée*, Pheg. vulgaris *Metten.* or more correctly Pheg. connectile (*Michx*).—W.]

" ACROSTICHUM AUREUM—sur la riv. Aisa-hatcha Floride;" part of a fertile frond of the true plant.

" ONOCLEA SENSIBILIS—Hab. a Novâ Angliâ ad . . . " and on a second sheet " Onoclea an sensibilis ?—? Connecticut;" both are that species.

" ACROSTICHUM ? NODULOSUM—Canada, juxta Montreal, legi;" is *Struthiopteris Germanica*.

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* The synonyme of this plant is as follows:—

Polypodium lanosum *Michx* Herb.
Nephrodium lanosum *Michx* Flora ii. p. 279.
Adianthum ? hispidum *Bosc* ex *Lamarck* et *Swartz*.
Acrostichum ? hispidum *Bosc* ex *Sprengel*.
Adiantum vestitum *Sprengel* Anleit. iii. p. 122 ?
Aspidium lanosum *Swartz* Synopsis Filicum, p. 58, et
Cheilanthes vestita *Swartz* Syn. Fil. p. 128 ; *Schkuhr* Krypt. t. 124 ; *Gray's* Manual ed. 1st, p. 625 ; *Mettenius* Cheilanthes No. 27 ; *Hooker* and *Baker* Synopsis Filicum p. 134 ; etc.

"OSMUNDA REGALIS—Hab. a Novâ Angliâ ad Carolinum, Pluckn. tab. 181, f. 4;" is the true plant.

"OSMUNDA CINNAMOMEA—Baise Caroline;" is the true plant.

"OSMUNDA INTERRUPTA—Kentucky" and a second specimen with the same name marked "Canada;" are *O. Claytoniana.*

"OSMUNDA VIRGINICA—Moris. iii., sect. 14, tab. 4, fig. 5, a Canada ad Virginiam et in montibus Carolinæ;" is *Botrychium virginianum.*

"OSMUNDA LUNARIOIDES — in pascuis sabulosis juxta Charleston;" one specimen of the ordinary form *Botry. lunarioides;* a very small two-fronded specimen on another sheet is marked "Osmunda lunarioides? innominata au bord de monte a peine."

"CTEISIUM PALMATUM—Hab. in occidentalibus Virginiæ, Carolinæ septentrionalis ad Kentucky, Tennessee;" a good specimen of *Lygodium palmatum;* a second specimen is marked "Sur Obed river, Dady's creek et plusi. creeks a 25 miles de West Point sur Clinch river."

"OPHIOGLOSSUM VULGATUM—New Jersey;" the true plant.

"OPHIOGLOSSUM BULBOSUM—in sabulosis Carolinæ;" two small specimens slightly bulbous, one of them 2—3-fronded.

POLYPODIUM PLUMULA—One frond of this species is in the herbarium bearing no label.

These comprise all the Filices which are shewn as Michaux's, and kept separate from the general herbarium.

PURSH'S FILICES.

[I have Prof. Eaton's very full notes on the North American ferns contained in the Hookerian herbarium at Kew. from which I extract the following relating to one or two of Pursh's more obscure species. The references are to his Flora Americæ Septentrionalis, vol. ii. London, 1814.—W.]

"WOODSIA HYPERBOREA"—(p. 660) is the normal form of *W. Ilvensis.*

"ASPIDIUM NOVEBORACENSE"—(p. 661) is *A. Thelypteris;* it was contained in the species cover of *Asplenium thelypteroides.*

"ASPIDIUM FILIX-MAS"—(p. 662) was included in the species cover of *Aspidium Goldieanum,* and consisted of a mixture of that species and *A. cristatum.*

"ASPIDIUM ASPLENIOIDES"—(p. 664) is good *Asplenium Filix-fœmina,* and

"ASPIDIUM FILIX-FŒMINA"—is the same species mixed with *Cyst. bulbifera.*

"WOODWARDIA VIRGINICA"—(p. 670) is the true plant from New Jersey.

"WOODWARDIA THELYPTERIOIDES"—(p. 670) consists of a smallish frond of *W. Virginica*, and one of *Aspidium Thelypteris.*

ON NORITE OR LABRADORITE ROCK.

By T. STERRY HUNT, LL.D., F.R.S.

[Read before the American Association for the Advancement of Science, at Salem, August, 1869.]

(*From Silliman's Journal for March*, 1870.)

The various rocks composed essentially of a triclinic or anorthic feldspar, with an admixture of hornblende, pyroxene, hypersthene or diallage, have by lithologists been designated by the names of diorite, dolerite diabase, hypersthenite and gabbro, among others. The latter name has by many been regarded as synonymous with euphotide. I, however, pointed out many years since that the true euphotide is not a feldspathic rock, but consists of a mixture of diallage with saussurite, a white heavy silicate apparently identical with zoisite. By an admixture of labradorite or an allied feldspar, however, euphotide passes into the so-called gabbro, which I have defined as a diallagic diabase, and which is closely related to norite. The name of hypersthene rock or hypersthenite (sometimes contracted into hyperite), was given by MacCulloch* to a rock consisting of labradorite, or a related feldspar, and hypersthene, found by him in the Western Islands of Scotland, and subsequently recognized by Emmons in the Adirondack Mountains of Northern New York. By both of these observers it was regarded as an erupted rock. In 1851, I detected it among the Laurentide hills of Canada, where, as in New York, it extends over considerable areas. Farther examinations of this rock in place showed that though hypersthene, generally in very small proportion, is a frequent element, it is often replaced by a green granular pyroxene, and still more often both of these are wanting, so that we have a

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* MacCulloch, Geology of the Western Islands, i. 385-390.

rock composed almost entirely of a triclinic feldspar, whose composition is generally near that of labradorite, but varies in different examples from that of andesine to near that of anorthite. To these rocks I provisionally applied the name of anorthosites, the pure feldspathic type being regarded as normal anorthosite; associated with which, however, were to be found hypersthenic and pyroxenic varieties. Red garnet, epidote, a black mica, and more rarely dichroite and quartz, are all occasionally found sparingly disseminated in these anorthosites of New York and Canada, which cannot be distinguished from those first observed by MacCulloch in the Isle of Skye, as I have convinced myself by an examination of the specimens there collected by him, and now preserved in the collections of the Geological Society of London. Titaniferous iron ore (menaccanite) also occurs in grains and masses frequently in these rocks, both in Skye and in North America, where it sometimes forms beds or masses of considerable size. Details as to the chemical and mineralogical characters of these rocks, will be found in the L. E. & D. Philos. Magazine for May, 1855, and in the Geology of Canada, 1863, pages 588-590.

The subsequent investigations of Sir William Logan have shown that these anorthosites in Canada belong to a great series of stratified crystalline rocks, which by the Geological Survey of Canada have been designated the Labrador or Upper Laurentian series, and which repose unconformably upon the older or true Laurentian gneiss and limestones. The area of the Labrador formation most examined lies in the counties of Argenteuil and Terrebonne, to the north and northwest of Montreal, and has a breadth of more than forty miles. It is, however, met with on the north-east shore of Lake Huron, according to Dr. Bigsby,* and at several points below Quebec, notably in the parish of Château-Richer, at Bay St. Paul and around Lake St. John on the Saguenay, where it occupies a large area. Proceeding north-eastward along the left bank of the St. Lawrence, Mr. Richardson has lately observed it at the mouth of Pentecost River, about 160 miles below the entrance of the Saguenay, and I have found it forming the shore of the Bay of Seven Islands, forty miles farther down. This area is probably connected with the wide extent of this rock observed by Prof. Hind on the River Moisie. In all of these regions it appears to be surrounded and limited by the

* Geology of Canada, 1863, page 480.

ordinary Laurentian gneiss. Bayfield, moreover, describes a rock with a base of labradorite as forming the coast for several miles toward Mingan. Finally, it is widely spread on the coast of Labrador, where its characteristic mineral was first found, and from whence it takes its name.

Prof. A. S. Packard, Jr., has given us valuable information with regard to the occurrence of labradorite rocks at some points on the Labrador coast.* One of its localities is at Square Island, just north of Cape St. Michel, were the rock consists chiefly of crystalline labradorite, smoky-gray in color, translucent, and opalescent, with greenish reflections. This feldspar often shows cleavage planes two inches broad, and is associated with a little vitreous quartz, and with coarsely crystalline hypersthene, which appears in relief on the weathered surfaces. This labradorite rock, according to Prof. Packard, is surrounded by and probably rests upon Laurentian gneiss. At Domino Harbor he found domes or bosses of a similar labradorite resting upon strata which consist in great part of a slightly schistose quartzite, having for its base a granular vitreous quartz, and enclosing grains of black hornblende, or more rarely hypersthene, black mica, and red garnet. Feldspar is generally wanting, but in some parts these quartzites become gneissic, and they where nowhere seen in uncomfortable contact with the Laurentian gneiss of the vicinity. These quartzose strata Prof. Packard refers, with some doubt, to the Huronian system. The minerals which they contain are not, however, met with, so far as known, in the Huronian quartzites; and, on the contrary, are very characteristic of the quartzites of the Laurentian system, which attain a great thickness in many parts of its distribution. The overlying domes of labradorite rock, which Prof. Packard was inclined to regard, in this case, as erupted through Huronian quartzites, are probably nothing more than outlying portions of the newer Labrador formation resting upon the Laurentian strata, as already observed by him at Square Island. Along the western coast of the island of Newfoundland Mr. Jukes observed, at Indian Head and at York Harbor, dark colored rocks composed of labradorite and hypersthene and others on albite (?) and hypersthene, which may probably be found to belong to the Labrador series.

* On the Glacial Phenomena of Labrador and Maine. Mem. Bost. Acad. Nat. Hist., vol. I., part ii., pp. 214-217.

Rocks composed chiefly of labradorite or a related feldspar greatly predominate in the Labrador series, but these, at least in the area near Montreal, which is the one best known, are interstratified with beds of a kind of diabase, in which dark green pyroxene prevails, with crystalline limestone similar in mineralogical character to that of the Laurentian system, and more rarely with quartzites and thin beds of orthoclase gneiss. I have more than once insisted upon the rarity of free quartz, and the general basic character of the rocks of this series, an observation with which I am credited in Dana's Manual of Geology (p. 139), where it seems to be applied to the whole of the rocks there classed as Azoic, including the Laurentian, Labrador and Huronian systems. It is, in fact, remarkable that the silicated rocks of the latter two consist chiefly of labradorites, diorites and diabases, gneissic and granitic rocks being exceedingly rare among them, though quartzites abound in the Huronian. In the Laurentian system, on the contrary, though basic silicated rocks are not wanting, orthoclase gneisses, often granitoid in structure, and abounding in quartz, predominate.

The anorthosite rocks of the Labrador series present great variations in texture, being sometimes coarsely granitoid, and at other times finely granular. They not unfrequently assume the banded structure of gneiss, lines of pyroxene, hypersthene, garnet, titanic iron-ore or mica marking the planes of stratafication. Probably three-fourths of the anorthosites of this series, in Canada, whether examined in place, or in the boulders which abound in the St Lawrence Valley, consist of pure or nearly pure feldspar rocks, in which the proportion of foreign minerals will not exceed five hundredths. Hence we have come to designate them by the name of labradorite rock. The colors of this rock are very generally some shade of blue, from bluish black or violet to bluish-gray, smoky-gray or lavender, more rarely purplish passing into flesh-red, greenish-blue, and occasionally greenish or bluish-white. The weathered surfaces of these labradorite rocks are opaque white. The anorthosites, which occupy a considerable area in the Adirondack region, as described by Emmons in his report on the Geology of the Northern District of New York, and as seen by me in hand-specimens, closely resemble the rocks of the Labrador series in Canada.

In all of these localities the coarse or granitoid varieties often hold large crystalline cleavable masses, generally polysynthetic macles, and frequently exhibiting the peculiar opalescence which belongs to labradorite. Although rocks composed of labradorite or similar feldspars, with hornblende or pyroxene, occur in various other geological formations, both as indigenous greenstones and as erupted masses, they never, so far as my observation in North America goes, exhibit the peculiar character just described; namely, that of a granular or granitoid rock composed of nearly pure labradorite or some closely related feldspar, frequently opalescent, and generally of a bluish color, often violet, smoky-blue or lavender-blue. This type of rock seems in North America to characterize the Labrador series.

It may here be remarked as an interesting fact bearing on the distribution of the Labrador series, that two large boulders of labradorite rock, one of the beautiful dark blue variety, are found on Marblehead Neck, on the coast of Massachusetts.* It does not seem probable that these masses could have been derived from any of the far-off localities already mentioned, and the fact that the gneiss of eastern Massachusetts is, as I have recently found, in part of Laurentian age, suggests that an outcrop of the Labrador series may exist in some locality not far removed. In this connection it may be added that I have lately found characteristic labradorite and hyperite rocks in southern New Brunswick, a few miles east of St. John, occupying a position between the Laurentian and the Huronian or Cambrian rocks, which there make their appearance, accompanied by Lower Silurian strata, to the south of the great carboniferous basin of the region. This interesting locality was recently pointed out to me by Mr. G. F. Matthew of St. John, to whom we are indebted for a great part of our knowledge of the geology of southern New Brunswick. Chester and Bucks counties, in Pensylvania, and the Wachita Mountains, in Arkansas, are cited in Dana's Mineralogy as localities of labradorite, but as I have never examined specimens from these places, I am unable to say whether they resemble the characteristic anorthosites of the Labrador formation already described.

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* Specimens of these rocks, correctly determined and labelled, are found in the collections of the Essex Institute at Salem. To these my attention was called at the time of the meeting, in August last, by Prof. C. Hitchcock, after which, in company with Dr. G. B. Loring and Prof. Packard, I visited the locality at Marblehead Neck, and collected farther specimens of the characteristic labradorite rock.

The name of norite, in allusion to Norway, was given by Esmark to a rock composed chiefly of labradorite, which is found in several localities in that country.* I had already remarked the close resemblance between two specimens of norite obtained from Krantz of Berlin, and the labradorite rocks of North America just noticed, when, in 1867, I had the opportunity of examining, at the Universal Exhibition at Paris, a collection of Norwegian rocks selected for ornamental purposes, exhibited by the Royal University of Christiania. Prominent among these was a series of the norites, which could not be distinguished from the labradorite rocks of the Upper Laurentian or Labrador series of this continent. In a printed note, accompanying this collection from the University, it is said that the numerous varieties of rocks consisting of labradorite with hypersthene, diallage and bronzite, have been, in the geological map of Southern Norway published at Christiania in 1866, designated by the common name of gabbro. This note at the same time suggests that the "name of norite should be preserved for certain varieties of gabbro rich in labradorite, which varieties may in great part with justice be called labradorite rock, since labrador feldspar is their predominent element." With this excellent suggestion I heartily concur, remarking, however, that the name of gabbro, as an ill defined synonym for certain anorthosite rocks, including in part diorite, diabase, hyperite, and even confounded with the non-feldspathic rock, euphotide, may very well be dispensed with in lithology.

By referring to the geological map just mentioned, it will be seen that these so-called gabbros occupy considerable areas in the Laurentian gneiss region of Norway. By the authors of the map, Messrs. Kjerulf and Dahl, the gabbros are regarded as eruptive, though they are described at the same time as often assuming the character of stratified rocks. It should, however, be noticed that the geologists go so far as to regard the whole of the granitic gneiss of the region as unstratified and of plutonic origin.

The specimens of these norites exhibited in Paris were in blocks, polished on one side, and as was observed in the note accompanying them, presented a curious resemblance to certain varieties of marble. It is worthy of remark that Emmons, in his report on the Geology of the Northern District of New York,

* See, farther, Zirkel, Petrographie III., 131.

suggested the application of the labradorite rocks of Essex County as a substitute for marble (pages 29, 418). An ornamental vase of the same rock, turned in a lathe with the aid of a black diamond, has been in the Museum of the Geological Survey of Canada since 1856.

Of the collection of norites from Norway the specimens from Sogndal and Egersund presented fine varieties of grayish or brownish violet tints, while a dark violet norite came from Krageroë, and also from the islands of Langoë and Gomoë, and a white granular variety from the gulf of Laerdal in the diocese of Bergen.

It is only in rare cases that the cleavable feldspar of these norites exhibits the peculiar opalescence which distinguishes the finer labradorite found in some parts of the coast of Labrador. Opalescent varieties of this feldspar are, however, occasionally met with in the area near to Montreal and in northern New York. In the Paris Exhibition of 1867 there were exhibited from Russia, large polished tables of a beautiful violet colored granitoid norite, portions of which exhibited a fine opalescence. This rock, I was informed, comes from a mountain mass in the Government of Kiew, but of its geognostical relations I am ignorant.

These peculiar labradorite rocks, presenting a great similarity in mineralogical and lithological character, have now been observed in Essex County, New York, and through Canada, at intervals, from the shore of Lake Huron to the coast of Labrador. They are again met with in southern New Brunswick, in the Isle of Skye, in Norway, and in south-western Russia, and in nearly all of these localities are known to occur in contact with and apparently reposing, like a newer formation, upon the ancient Laurentian gneiss. Geikie in his memoir on the geology of a part of Skye,* appears to include the norites or hypersthenites of that island with certain syenites and greenstones, which he describes as not intrusive, though eruptive after the manner of granites (loc. cit., p. 11–14). The hypersthenites are represented in his map as occurring to the west of Loch Slapin. Specimens in my possession from Loch Scavig, a little further west, and others in MacCulloch's collection from that vicinity, are, however, identical with the North American norites, whose stratified character is undoubted. I called attention to these resemblances in the Dublin

* Quar. Jour. Geol. Soc., xiv., p. 1.

Quarterly Journal for July, 1863,* and Haughton, who in 1864 visited Loch Scavig, has since described and analysed the rock of that locality, which consists of labradorite, often coarse grained, with pyroxene and menaccanite, and is evidently, according to him, a bedded metamorphic rock (Dublin Quar. Jour., 1865, p. 94). He, it may be remarked, designates it as a syenite, a term which most lithologists apply to rocks whose feldspar is orthoclase.

I desire to call the attention of both American and European lithologists to this remarkable class of rocks, of which the norites may be regarded as the normal and typical form, in the hope that they may be induced to examine still farther into the question of the age and geognostical relations of these rocks in various regions, and to determine whether the mineralogical and lithological characters which I have pointed out are geological constants.

NOTES ON THE BIRDS OF NEWFOUNDLAND.

By Henry Reeks, F.L.S., &c.

The following article, on the Zoology of a part of British America as yet but little explored, is taken from the "*Zoologist*" (London, England,) for 1869. The close similarity between the birds of Newfoundland and those of the Province of Quebec, will be very apparent to Canadian ornithologists.—Ed.

Before commencing a systematic list of the avi-fauna of Newfoundland, it will perhaps be necessary to say a few words on the island itself. Newfoundland, as my readers are probably

* I, at the same time, called attention to the Laurentian aspect of the crystalline limestones of Iona, which I found in MacCulloch's collection. Limestones not unlike these occur in Skye, intermixed with serpentine, and are, according to Mr. Geikie, associated with the protruded syenites of that region. With all deference to the authority of that eminent geologist, I cannot help suggesting that a re-examination of the district would show that the highly-inclined metamorphic crystalline limestones, holding serpentine, and associated with syenitic rocks, belong to an older system (probably Laurentian), and are thus distinct from the nearly horizontal fossiliferous liassic limestones near by, which are only locally altered by intrusive rocks. American geologists will at once recall the misconception which led most of our best observers during many years to look upon the old Laurentian limestones of New York and New Jersey as altered portions of the overlying paleozoic strata.

aware, forms one of the valuable British colonial possessions on the coast of North America. Its geographical position lies between lat. 46° 37′ and 51° 40′ north, and long. 52° 41′ and 59° 31′ west: it is bounded on the north by the Straits of Labrador, on the west by the Gulf of St. Lawrence, and on the south and east by the Atlantic Ocean, and has a seaboard of nearly two thousand miles. There is a chain of mountains, or rather in many places high table-land, running almost throughout the island in a N.E. and S.W. direction. The low land is made up of vast savannas, intersected by extensive woods, lakes and rivers—one inland lake alone being sixty-five miles long, and containing an island as large as the Isle of Wight, and which seems to have been the last stronghold of the Red Indians. Since the extermination of this persecuted race (which probably took place not more than thirty years ago) the whole of the interior of the country has been uninhabited. Several "histories" of Newfoundland have appeared from time to time, and among the best of these I may mention one by Chief Justice Reeves, published in 1793, another by Anspach in 1820, and the last by the Rev. C. Pedley in 1863; but, strange as it may appear, none of these authors give any reliable information on the natural history of this extensive island, which, besides being rich in its fauna and flora, will, I have no doubt, prove equally so in minerals. In some places I have also seen as good a surface-show of petroleum oil as in the well-known oil-regions of Pennsylvania. A two years' residence, under the most favourable circumstances, in a country nearly as large as England, and where the forests are still primitive and in many places almost interminable, is scarcely sufficient time to warrant anything like a correct list of the animals or plants; but when impeded by such a severe accident as I sustained from frost, which kept me a prisoner to the house for several months, no other apology is necessary for the incompleteness of these "Notes," which none can possibly regret more than the writer. There are few inhabited countries, perhaps, on the face of the globe, where the naturalist gets less assistance in the oological department than in Newfoundland. The whole and sole occupation of the settlers on the north-west coast is fishing and furring,—the former in summer and the latter in winter,—and upon their success entirely depend the stock of provisions they will be enabled to obtain, by barter with the traders, for the long period of nine months, when no vessels visit the unsafe harbour of Cow Head. Of course the postal arrangements there are not exactly A 1—never exceeding *one* delivery a day, and this at intervals of from one month to six weeks in June, July, and August, and usually *not at all* between the first of September and 1st of the following June. During the nesting season the assistance of a man worth anything could scarcely be obtained under a sovereign a day, and then, for want of knowledge of those birds not used as food, he may bring you a lot of eggs unknown and unidentified, and consequently worthless. My plan was probably better: I offered a fair reward for all eggs with which I was tolerably familiar; and although I got but few, I ran a far less risk of paying for worthless articles. Although I am answerable for all statements in these "Notes," except when otherwise expressly stated, my friend, Prof. Newton—than whom no one is more competent—has kindly undertaken to look through the list previously to publication, for the purpose of calling my attention to any passages which may require further verification or particularizing, and thereby enhance their value. I have much pleasure in addressing these "Notes" to Mr. Spencer F. Baird, of the Smithsonian Institution, and Mr. G. N. Lawrence, of New York, in remembrance of their kindness to me during my stay in the United States. The classification and nomenclature of the authors of "Birds of North America" has been adopted in the following list.

FALCONIDÆ.

Pigeon Hawk (Falco columbarius, *Linn.*)—This beautiful little hawk, so closely resembling the merlin (*F. Æsalon*), is a summer migrant to Newfoundland, and is tolerably common: its food consists chiefly of small birds, especially some of the smaller species of Tringæ, which abound on the coast in the fall of the year. Since my return I have compared specimens of this species with others of F. Æsalon, and, although I cannot find any material or reliable difference in *size*, the species are easily separated by examining the tails. Both sexes in F. columbarius have *four distinct* black bars—three exposed, and one concealed by the upper tail-coverts. In F. Æsalon the female *only* has the tail-bars distinct, and they are *six* in number—five exposed and one concealed. The bars on the tail of the adult male F. Æsalon, although *six* in number, are only partially defined, and consequently very indistinct. The bill of F. Æsalon is slightly more compressed laterally, but not so much so horizontally as that of F. columbarius. The tibiæ in my adult male specimens of the American bird (F. columbarius) are darker ferruginous, with narrower longitudinal lines, than in my English specimens of F. Æsalon; but this distinction may not be constant. I had almost forgotten to state that the inner webs of the tail-feathers of F. columbarius are white, except where crossed by the black bars —in this respect differing from F. Æsalon, which has scarcely any variation in either web, both being bluish ash.

Greenland Falcon (F. candicans, *Gmelin*).—This is the "white hawk," of the Newfoundland settlers. It is pretty regular in its periodical migrations, especially in the fall of the year. I was not successful in obtaining specimens; I do not think it breeds in any part of Newfoundland.

American Sparrow Hawk (F. sparverius, *Linn.*)—A summer migrant to Newfoundland, but not so common as F. columbarius.

The following species of Falco may reasonably be expected to occur (and probably do so) in Newfoundland occasionally:—The duck hawk (*F. Anatum*) and the Iceland falcon (*F. islandicus*).

American Goshawk (Astur atricapillus, *Wilson*).—I have only the authority of the settlers for including the "goshawk" in my list of Newfoundland birds. I have no reason to doubt their accuracy, as the more enlightened on Ornithology recognised the plate of this species in Faun. Bor. Am., where the scientific name only is given.

Cooper's Hawk (Accipiter Cooperi, *Bonap.*)—A summer migrant; not uncommon.

Sharpshinned Hawk (A. fuscus, *Gmelin*).—A summer migrant, and about equally common with the preceding. I have not seen the young of this species, but the adult very closely resembles our sparrow hawk (H. Nisus) both in flight and plumage. I have not, however, compared specimens, but hope to do so before the conclusion of these "Notes," and give the result.

Redtailed Hawk (Buteo borealis, *Gmelin*).—A summer migrant, but not so common as on the mainland. I only examined one specimen, shot in Newfoundland.

The following species of Buteo probably occur on the island: The redshouldered hawk (*B. lineatus*, Gmel.) and the broadwinged hawk (*B. Pennsylvanicus*, Wilson). I think I have seen the latter on wing, but obtained no specimen.

Black Hawk (Archibuteo Sancti-Johannis, *Gmelin*).—Common;

more especially in the immature plumage, in which state some specimens so closely resemble A. lagopus that it is hard to distinguish between the species. I had an individual of the former species—A. Sancti-Johannis—which agreed so well with descriptions of A. lagopus that I named it as such in my note-book. I kept this specimen alive for upwards of two months, and fed it almost entirely on trout (*Salmo fontinalis*), to which it seemed particularly partial, but invariably refused smelts (*Osmerus viridescens*), either dead or alive, and fresh from the water. I never tried any other specimens of fish, and cannot account for the bird's dislike to the smelt; it may have been the peculiar cucumber-smell—certainly not the taste—which this delicious little fish possesses. I do not think A. Sancti Johannis a "fisher" by nature; at least, I never saw it in the act of fishing. Unfortunately I did not preserve the skin of this bird (the feathers got rather shabby during confinement); had I done so, I think it would have puzzled more than one good ornithologist to separate it from skins of the European A. lagopus, inasmuch as the under surface of the body was no darker than ordinary specimens of A. lagopus, although I never examined any afterwards but what were, as a rule, much darker. My bird was a female and measured twenty-three inches, wing sixteen and three-quarter inches, and, from the appearance of the ovary, would have laid the following year (1867). The black hawk—or, rather it should be buzzard—is a summer migrant to Newfoundland, but, as a rule, remains later in the fall than most of the Falconidæ.

American Hen Harrier (Circus Hudsonius, *Linn.*)—Although one of the most abundant hawks in the Atlantic States of America, and said by my old friend Downs to be equally common in Nova Scotia, I did not, strange to say, obtain a single example in Newfoundland, although I found some of the settlers knew the bird by its white rump, and distinguished it by the name of "hen hawk." I am almost certain of having seen it on the wing myself at Cow Head. Without specimens, it is impossible for me to say in what peculiarities of plumage (if any), &c., this bird differs from the European C. cyaneus.

Bald or Whiteheaded Eagle (Haliæëtus leucocephalus, *Linn.*)—This handsome bird is called the "grepe" in Newfoundland. It is tolerably common, but as the settlers increase, this noble bird gradually, but surely, decreases. Twenty years ago, or even less, several eyries existed in the immediate neighbourhood of Cow Head, but at present the sites only remain; it is said to breed on a peculiar island-rock, called "The Prior," in the mouth of the Bay of Islands. I have, on more than one occasion, seen the "grepe" fishing at Cow Head and Bonne Bay, and obtained one egg from the latter place. The nest was built in a large pine-tree, and contained two eggs—one addled: the egg is very similar to that of H. albicilla.* The bird is only a summer migrant to Newfoundland.

It is not improbable that Aquila canadensis may eventually be found to visit Newfoundland.

American Osprey, or Fish Hawk (Pandion carolinensis, *Gmel.*) —This fine species is common in Newfoundland: it is a summer migrant, coming in May and retiring in the early part of October. Often, on a calm summer's evening, as I lay on the grass smoking my pipe, have I watched two or three pairs of these birds fishing in the harbour. Suddenly the slow circling flight is stopped,—the quick eye discerns its scaly prey,—the body assumes an almost vertical position; the wings for a moment vibrate rapidly, as if to give their owner impetus, and then with almost unerring aim, like an arrow from a bow, the osprey drops into the water. In a few seconds he reappears, and rising a few feet from the water, the rapid vibration of wings is again observable, but this time only to drive the claws more firmly into the sides of his finny morsel, with which he slowly sails away to some high tree in the woods, where probably is a nest,—

"Itself a burden for the tallest tree."

This beautiful hawk does not escape the ruthless "gunners" in Newfoundland, although utterly useless after death to the settlers. The osprey builds in trees in the extensive woods, either near the sea-coast or some inland lake. The eggs which I obtained from Bonne Bay cannot be distinguished from European specimens received from the late Mr. Wheelwright. Having no English specimens of the osprey by me, I am unable to point out any differences whereby they may be selected from American examples. The authors of 'Birds of North America' give none;

* In the Proc. Zool. Soc. for 1863 (p. 252) Dr. Sclater recorded H. albicilla as a Newfoundland bird, an error which he corrected in the 'Proceedings' of the same Society for 1865 (p. 701).

both Wilson and Audubon considered the European and American osprey of the same species.

STRIGIDÆ.

American Barn Owl (Strix Pratincola, *Bonap.*)—Apparently rare in Newfoundland: I only examined one specimen during my residence there, which, having only the first joint of the wing broken, was kept alive several days by the children of the man who shot it: this occurred in August, 1866. It is probably a summer migrant.

Great Horned Owl, (Bubo Virginianus, *Gmel.*)—Visits Newfoundland for the purpose of nidification, and is not very uncommon during that season, and more especially later in the summer when the young leave the nests. It is called the "cat owl" by the settlers. The only nest which came under my observation was built *on the ground*, on a tussock of grass in the centre of a pond. The same nest had been previously occupied for several years by a pair of geese (*Bernicla canadensis*). I think it the more important to note this observation (which, however, may not be constant even in Newfoundland, as birds of prey are very varying in this respect) as Mr. E. A. Samuels, in the 'Birds of Massachusetts,' says it "nests in hollows of trees, and in high forks of pines."

Mottled Owl, or *American Screech Owl*, (Scops Asio *Linn.*)—A summer migrant to Newfoundland, and tolerably common. As this is one of the commonest owls in North America, it seems strange that Mr. Downs should not meet with it in Nova Scotia, especially as it frequents the States bordering on the Atlantic more than those inland.

American Long-eared Owl, (Otus Wilsonianus, *Lesson.*)—Not common: I only examined one specimen, which was killed near Cow Head. It appears to be a summer migrant.

American Short-eared Owl, (Brachyotus Cassini, *Brewer.*)—Not common, but I think rather more so than Otus Wilsonianus. It is a summer migrant.

Barred Owl, (Syrnium nebulosum *Forster*). Apparently a summer migrant, but not common; at least I only obtained one specimen, shot at Cow Head in September, 1866.

Saw-whet Owl, (Nyctale acadia *Gmelin*).—Not uncommon, and well known to the settlers as the "saw-whet." I only obtained one specimen, which was picked up dead at Cow Head, and appeared to be uninjured. It is a summer migrant.

Sparrow Owl, (Nyctale Richardsoni, *Bonap.*)—I include this species on the authority of Mr. Downs, who states, in his "Notes on the Land Birds of Nova Scotia," that it is "abundant in Newfoundland;" but, strange to say, I never met with a single specimen, neither were the settlers acquainted with the species: I have very little doubt, however, that it occurs on the island. It is this species which closely resembles the European Nyctea Tengmalmi, but not having specimens I am unable to point out the distinctive characters.

Snowy Owl, (Nyctea nivea *Daudin*).—Tolerably common, and probably remains in Newfoundland throughout the year, although very rarely seen during the summer months, but this may be owing to its following in the wake of its chief prey, the polar hare (*Lepus glacialis*), and ptarmigan (*Lagopus rupestris*), which retire to the high land as soon as the snow partially disappears. The "white owl," as the settlers term this species, is a bold, rapacious bird, and not easily driven from its slaughtered prey. One of the specimens, which I obtained at Cow Head, was feeding on an eider duck—probably a wounded bird which it had killed—and was twice knocked over with stones, the last time apparently killed, before it would relinquish the duck: it had, however, sufficient life and strength to force its claws into the arm of the man who picked it up, although protected with all the clothes he usually wore. A large Newfoundland dog, used for retrieving seals, &c., refused to go near this bird after it was knocked down with stones: the men who were present assured me that the bird kept making a "hissing" noise, apparently at the sight of the dog. During my residence in Newfoundland I heard several amusing anecdotes of the snow owl, but, although I can vouch for the truth of them, it is scarcely necessary to reproduce them all in the pages of the "Zoologist:" I will, however, relate one or two which I do not think have before appeared in print. William Youngs of Codroy (Newfoundland), having continually had the bait stolen from one of his fox traps, determined to watch the trap and shoot the robber: for this purpose he selected a fine moonlight night, with snow on the ground, and, with his gun in his hand, a white swan-skin frock on, and a white handkerchief tied round his cap, he secreted himself in a small bush about twenty yards from his trap, fully determined to shoot the first comer; but his determination proved fruitless, for a large white owl—probably the thief—seeing something white sticking up through the centre of the bush, and evidently mistaking it for a fine plump willow grouse, instantly made a "stoop," and, at the same time, sending its claws almost to the man's brains, suddenly disappeared with the cap and white handkerchief: the man was so startled for the moment that he was unable to shoot at the bird. The snowy owl is a frequent attendant—although generally unnoticed—of the sportsman, and often succeeds in carrying off a grouse or duck before the retriever gets to it. On one occasion some men were waiting in ice "gazes" for the purpose of shooting wild geese (*Bernicla canadensis and B. brenta*), when one of them, named James Carter, left his "gaze" to go and have a chat with his neighbour, incautiously leaving his new white swan-skin cuffs and gun behind him. He had scarcely left his "gaze" when an unseen enemy, in the shape of a fine snowy owl, pounced in and succeeded in getting clear off again with both of the white cuffs. A fine adult bird of this species entered my host's house, *via* the chimney, and fought so valiantly for its life that the man had to kill it with a "pew"—a piece of pointed iron fastened to a wooden handle about four feet long, and used for throwing codfish from the boats. A good many snowy owls are annually caught in the fox-traps of the settlers; and when very fat, which they frequently are, are considered good eating by many, and I see no reason why they should not be so, but I could never sufficiently overcome my repugnance to birds of prey as food to taste one. None of the settlers appeared to know anything of the breeding of this bird, although Mr. Downs states that it "breeds in Newfoundland." Mr. Cordeaux has kindly examined parasites of Nyctea nivea from Newfoundland, and informs me that they are identical with others from European specimens.

Hawk Owl, (Surnia ulula *Linn.*)—Perhaps the commonest owl in Newfoundland, or, from being a day-flying species, is more frequently seen than any other. It is a bold, familiar bird, generally found in the neighbourhood of houses, preying on chicken, tame pigeons, &c.,—remaining throughout the year, but not so abundant in the depth of winter as at other seasons. In the fall of the year, and probably at other times, the hawk owl has a habit of perching on the bare and dead top of high fir trees, from which it commands a good view of the immediate neighbourhood, and suddenly drops upon any unfortunate object in the shape of food that may happen to pass within a convenient distance.

(To be continued.)

ON THE ORIGIN AND CLASSIFICATION OF ORIGINAL OR CRYSTALLINE ROCKS.

BY THOMAS MACFARLANE.

I.—INTRODUCTION.

"All attempts to separate sharply from each other the various "rocks or mineral aggregates of which the earth's crust is com-"posed, and to arrange them systematically, have failed." "We "cannot consider the rocks as species, nor arrange them in a "system corresponding to their nature, nor even, in describing "them, treat them all in the same manner." *

So wrote Bernhard Von Cotta in 1862. On reading such sentences we are tempted to ask: Are species always sharply defined in other sciences? Are all systems perfect or natural? Why should lithology be an exception to other sciences, and its students be deprived of the advantages of a systematic arrangement of the objects to be studied? A "natural" system is not demanded, even were such a thing possible, in this or any other science. The more rigid any method of classification, and the more marked and unbending its divisional lines are made, the more unnatural it becomes.

It is exceedingly gratifying to find that, undeterred by the difficulties of rock classification, such lithologists as Von Hochstetter, Kjerulf and Zirkel, have been found willing to attempt it. Their labours, and those of other workers in the same field, have shed a flood of light upon a previously obscure and uninteresting subject. Although a perfect system will, perhaps, never be attained, still each attempt at properly arranging our knowledge of the subject has its value. Chemical analysis and microscopical

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* Cotta; Die Gesteinslehre, pp. 1, 4.

examination of rocks have very much contributed towards rendering such attempts successful. In the present paper it is proposed to give a systematic view of the various classes and species of crystalline rocks, in arranging which it is intended that their chemical composition shall have greater prominence and weight than has been usual heretofore.

However much it may seem desirable in this department of science, where all the systems of classification have been confessedly imperfect, to invent a system independent altogether of the ideas, more or less well founded, which prevail as to their origin and age, and in which their physical and chemical characters should only have consideration, it must not, on the other hand, be forgotten that what is still more desirable in such a system is that it should re-arrange our knowledge of the subject in a clearer form, render it more easy of comprehension to the student, and be so dovetailed into the past of the science as to be useful for its advancement in the future. On this account it becomes impossible to neglect even the theoretical views of our forerunners in this science of petrology, far less their arduous and often underrated geognostic labours. It also becomes requisite to give a proper value to all the considerations which may have influenced their views, and to build upon the foundation which they have left us, the results of the observations and research of the investigators of our own day.

Considerations as to the manner of formation, texture, chemical and mineralogical composition, age and localities of rocks, have all, more or less, influenced geologists in naming and classifying them. The well-known distinction between eruptive and sedimentary rocks will occur to every reader as an instance of classification according to origin. Hunt's division of crystalline rocks into indigenous and exotic, and Scheerer's distinction of plutonites and vulcanites are both founded upon their real or supposed manner of formation. Lava and Rhyolite are examples of special rocks similarly named. Then, with regard to texture, probably no other character possessed by rocks has given rise to a greater number of generic terms. Schist, slate, porphyry, trachyte, amygdaloid, conglomerate, and breccia, are examples of this, but of special names founded on texture only a few can be instanced, such as granite and aphanite. The influence of chemical composition on lithological nomenclature is not, as yet, very marked, for it is only recently that the analysis of rocks has had much attention. Quite lately, however, Cotta has proposed to distinguish as basites those eruptive rocks containing less, and as acidites those containing more than sixty per cent. of silica; and Scheerer, Kjerulf and Roth have each indicated methods of classification founded, to a very considerable extent, on general chemical composition. By far the greater number of special names in lithology are based upon mineralogical characters. This is the case with pyroxenite, hornblende schist, quartzite, and many simple rocks, while among those of a compound nature, where it was impossible to indicate their mineralogical composition in one word, recourse was had to special names, with definite ideas attached to them as to mineralogical constitution. Thus, diorite came to denote a rock composed of triclinic felspar and hornblende; granulite, a schistose compound of quartz, orthoclase and garnet; dolerite, a mixture of labradorite, augite and magnetite. As regards classification, the mineralogical nature of rocks has always been abundantly considered. In this way we have Hunt's orthosites and anorthosites; Senft's labradorites and alabradorites, while Zirkel has made the nature of the different felspar species the corner-stone of his system of classification,—crystalline or original rocks being divided into orthoclase rocks, oligoclase rocks, labradorite rocks, anorthite rocks, and rocks void of felspar. The manner in which considerations as to geological age influence the names of rocks may be illustrated by the following examples. Sometimes certain porphyries and trachytes are, in hand specimens, scarcely distinguishable from each other. When, however, such rocks occur among carboniferous or permian strata, geologists have been inclined to term them porphyries; and, on the other hand, when they are of tertiary or recent age, the name trachyte is generally given them. Exactly the same mode of determination, if such it can be called, has been adopted in the case of greenstone and basalt, or rocks of such indistinct mineralogical composition as trap and aphanite. With reference to locality it has principally occasioned special names, such as syenite, dunite and andesite, or caused varieties of certain other species to be indicated by such terms as banatite, sievite, cherzolite, &c. From these considerations it would appear that, generally speaking, origin has been allowed to determine the various divisions and sub-divisions among rocks; that the majority of the generic names have reference to texture, while mineralogical composition and locality have had the greatest share in originating the special names of rocks.

In striving to attend to what has been indicated as desirable and necessary in any attempt at classifying rocks, it has appeared to us most judicious to attach greatest weight to their various characters in the following order: 1, origin; 2, texture; 3, chemical composition; 4, mineralogical composition; and 5, locality. If a system be required at all resembling those of other branches of science, these characters might be allowed respectively to determine the classes, orders, families, species, and varieties of rocks.

II.—CLASSES OF ROCKS.

If we, at the present day, look around us, and ascertain, from actual experience, what the methods are which nature employs in producing rocks, we find that they result from the operation of two very distinct agencies. On the one hand we may see in different countries, widely separated from each other, streams of melted matter issuing from volcanoes and solidifying to rocks on their sides or at their feet, while on the other hand we may observe, on every sea beach or river delta, sand and clay, the debris of pre-existing crystalline masses or fragmentary strata being gradually consolidated to new rocks. Exactly parallel to these operations of nature are certain artificial processes at work around us, the products of which are entirely analogous to the two classes of rocks just indicated. We may stand before an iron furnace and watch the steady stream of slag flowing from the hearth into a large iron wagon, and there solidifying to a mass of solid, sometimes crystalline rock; and we may also visit a stamp mill where valuable metallic particles are being extracted from poor vein-stones, and find, in the slime-pits of the establishment, banded layers of half solidified strata, requiring but a little time to effect their perfect consolidation.

These two means employed by nature in producing rocks have been steadily recognized by the majority of geologists, and the two classes which result have been indicated by a superabundance of names. Unstratified and stratified: igneous and aqueous; eruptive and sedimentary; exotic and indigenous; primary and secondary; (protogene and deuterogene;) crystalline and clastic; massive and fragmentary; original and derivate, are all terms which have been used for distinguishing these two great classes, and the least objectionable among them would appear to be the two last mentioned. The first of these, original (Ursprüngliche,) was first adopted by Zirkel* for denoting igneous or eruptive rocks, while the term derivate was first suggested by David Forbes† as equivalent to secondary or sedimentary rocks. The latter term we have ventured to modify, and in the following pages we shall use the names original and derived for indicating the two great classes. These names would seem to deserve the preference, for the following reasons. It is admitted by geologists, on all hands, that the material which constitutes the various sedimentary formations, consisting of limestone, hardened clay, or consolidated sand, although it may have been immediately derived from pre-existing rocks of a detrital nature, originally came from the decomposition and disintegration of crystalline rocks, of such as are known to constitute the oldest formations of the earth's crust, or to have broken through and deposited themselves on the outside of it. It is further an accepted theorem, universally acknowledged by scientific men, that our globe was originally in a state of igneous fusion, and that all the material which constitutes the rocks of our day existed in the form of a melted zone encircling the central part of the globe. It is evident that, before the conditions for the formation of sedimentary rocks could exist, the liquid globe must have become, to some extent, solid; a crust, at least, must have been formed upon it, from the disintegration of which the material of such sedimentary rocks could have been derived, and upon which that material could have been deposited. This crust, and the rocks which from time to time after its solidification penetrated or were erupted through it, must, consequently, have been the first rocks, and they must have yielded the material for all those subsequently formed by aqueous agencies. It would, therefore, appear legitimate to name the former class original, and the latter, derived rocks.

Where, as in the case of the volcanic and sedimentary rocks which are being formed at the present day, we can observe the process of their formation, no doubt can arise as to their origin. These rocks, however, form but a very minute fraction of those which build up the earth's crust, and it becomes necessary, in order properly to discriminate among the latter, to point out the

* Petrographie I., p. 173.

† The Microscope in Geology, p. 6.

distinguishing characters of original and derived rocks. The further we go back in geological time, and the older the rocks are which we are called on to classify, the greater is the difficulty of doing so, and the more divergent the opinions of geologists become as to their origin. The stratigraphical relations of rocks are most effective in determining this, but it will be necessary at present to confine ourselves to considerations of a more purely petrological nature. This is the more easily done, since the lithological characters afford abundant means of recognizing original and derived rocks, and distinguishing them from each other.

Original rocks are made up of crystalline particles of one or more minerals, principally silicates. These are seldom perfect in crystalline form, are frequently more or less irregular or distorted, and are intimately bound together to a compact whole, without the intervention of any foreign substance as a cementing material. They are thus mutually interlocked to a crystalline mass, which, however, possesses at the same time an average mineralogical and chemical composition. This would seem to indicate that the mass must have been originally liquid, and, to some extent, in the same condition during crystallization, otherwise it would have been impossible for the various chemical constituents to move toward the points where the minerals were being formed into whose composition they enter. On the other hand, this liquidity must have been somewhat limited in degree, for the minerals seem to have pressed against each other, so as to have mutually interfered with their crystalline development, and so as also to have fitted perfectly into each other on complete solidification. The size of the crystalline particles varies from a foot or more in diameter down to that of microscopical minuteness. It is even the case that they become so minute as to occasion a perfectly vitreous structure which even the microscope is incapable of resolving into distinct minerals. In all such cases, although the rock can scarcely be termed crystalline, it remains, what its mode of occurrence plainly shows, an original rock.

Derived rocks are made up of the disintegrated fragments or particles, and the chemical constituents of previously existing rocks, abraded or dissolved away by water or other agents. These fragments or particles are sometimes angular, sometimes rounded off, and always bound together by means of an intervening cement, which is independent of, and may be altogether different in nature from, the enclosed fragments. They vary in their dimensions even more widely than the constituents of original rocks. There are sometimes found in them blocks of several cubic feet contents; and, on the other hand, they are frequently composed of the finest particles of dust. The cement which unites these particles is subject to great differences, both as regards its quantity and its nature. Sometimes it consists of the material of a newly erupted original rock which has happened to envelope and bind together fragments of a pre-existing crystalline or sedimentary rock. Sometimes it consists of the finely divided detritus of the rock of which the larger fragments are composed. Sometimes the finely comminuted cement is from a different rock than the fragments. Sometimes it is of an infiltrated crystalline nature. In some cases the fragments, and in others the cement predominates. Apart from the finely divided sandstone or clay which sometimes fills the interstices between the fragments, carbonate of lime, silica and iron oxide are the substances which, more frequently than any others, form the cementing material in these fragmentary rocks.

Recent investigations regarding the chemical composition of rocks have rendered the distinction between the original and derived classes still more marked, and made it possible to point out another essential point of difference between them. Original rocks possess a chemical composition in which a definite relation exists between the quantity of silica and that of the various bases which they contain. In derived rocks this definite relation is not to be observed. This peculiarity of chemical composition possessed by original rocks was first pointed out by Bunsen, and has been quite recently insisted upon as a feature distinguishing them from derived rocks by Von Richthofen in his "Communications from the West Coast of North America."*

These two great divisions do not, however, exhaust all the classes into which rocks have been divided. It has long been supposed, and more recently the belief has gained ground, that many of the rocks belonging to the divisions above indicated have experienced, since their solidification or deposition, certain changes in their chemical and mineralogical composition, and in their physical characters, whereby they have been rendered quite unlike their originals, and this without their having been disintegrated or displaced. The influences to which these changes

* Zeitschrift der Deutschen Geologischen Gesellschaft, vols. xix and xx.

have been ascribed are various. Heat, water holding different substances in solution, gases, atmospheric agencies acting separately or combined, have all played an important part in effecting these changes. The rocks thus modified have been called metamorphic, altered or hypogenous rocks, without very marked reference to the classes from which they have resulted. In the following pages the name altered will be applied only to those original rocks, and the term metamorphic only to those derived rocks which have experienced, *in situ*, such changes as those here indicated. It is not, however, proposed in the present paper to discuss the relations of derived and metamorphic rocks, but, in endeavouring to classify those of the original class, the altered rocks sometimes resulting from them will be noticed.

(To be Continued.)

THE PLANTS OF THE WEST COAST OF NEWFOUNDLAND.

By John Bell, M.A., M.D.

The account of the plants of the west coast of Newfoundland, in a recent number of this journal, ended with my visit to St. George's Bay.

As we sailed south, from that locality to the harbour behind Cod Roy Island, I observed that the forests had in some places been burned by the devastating fires, which are so often carelessly originated in these parts, and that grass had sprung up in the areas thus cleared, on which large herds of cattle were pasturing. These cattle belong to the people of the island-harbour village, which is composed of about thirty or forty families, whose schoolmaster visited us on our arrival. Large patches of snow still lay glistening in the sun on the tops of this somewhat elevated range of hills.

On the following morning, July 6th, we started on an expedition up the Great Cod Roy River, which, like many of the smaller rivers entering the Gulf of St. Lawrence, has its stream level for a few miles inland, until it reaches the mountain region, when it becomes more rapid and less navigable. It resembles them, too, in the manner of its *débouché*. On nearing the place where the river seemed to empty, we could at first see no entrance, but upon coming closer to the shore we found a deep narrow channel at the end of a long tongue of sand and gravel enclosing a lake or broad expanse of river, which at the time of our arrival was literally covered with gulls. Near this lake was a swamp overgrown with hoary alders, in and around which I found the Marsh Marigold (*Caltha palustris*), Spotted Touch-me-not (*Impatiens fulva*), Great Water and Curled Docks (*Rumex hydrolapathum et crispus*), Hemp-Nettle (*Galeopsis tetrahit*), Chickweed (*Stellaria media*), two Plantains (*Plantago major et Virginica*), Thyme-leaved Speedwell (*Veronica serpyllifolia*), with some Clovers and Bedstraws.

After ascending the river for a short distance, we stopped on the north shore, at the house of a settler named James Ryan, in whose garden I was surprised to find a great variety of cultivated vegetables and flowers. At this place I found vegetation to be about a fortnight in advance of what it was in St. George's Bay, doubtless the result of its more sheltered position and southern exposure. With his great variety of flowers and vegetables Ryan had also imported a great variety of European weeds, for at no place on the coast did I observe so many vegetable pests as at this settlement. Some of his cultivated and pasture fields presented as many imported weeds as those of some of the older farms of Canada. The Yellow-Rattle (*Rhinanthus crista-galli*), that pest of the maritime provinces, grew everywhere, and Ryan complained that it killed out all kinds of grass. It was accompanied by the Heal-all (*Brunella vulgaris*), the common Dandelion (*Taraxacum dens-leonis*), and Canada Thistle (*Cirsium arvense*), which did not confine itself to places under cultivation.

Along a boggy rill were growing, in flower, the American Brooklime (*Veronica Americana*), the bristly and creeping Crowfoots (*Ranunculus Pennsylvanicus et repens*), Canadian Burnet (*Sanguisorba Canadensis*), Round-leaved Dogwood (*Cornus circinata*), with other herbs and bushes already mentioned in my former paper. The view from this place was magnificent. The river, like a long narrow lake, lay below the house and stretched away inland, here and there dotted with boats and salmon nets, or intersected by points on which were settlers' houses and out-buildings, whose sides and shingled roofs seemed like marble in the glistening rays of the sun, while separated from the river by a strip of low wooded land, towered up the high, deep-gullied mountains, with patches of snow near their bare heathy summits. As we paddled upwards above this place the scenery was very beautiful,—each bend in the winding river presented some new and enchanting combination of water, meadow, wood, and mountain, in varying shades and colours. Along the river bank, which was bordered with green and hoary alders, beaked hazel, red dogwood (*Cornus stolonifera*), and other species of Cornus, I picked up the Water Horehound (*Lycopus Europæus*), Mouse-ear Chickweed (*Cerastium vulgatum*), and Small-flowered Crow-foot (*Ranunculus abortivus*).

About twelve miles from the mouth of the river the Balm-of-Gilead Poplar (*Populus balsamifera*), grew in clumps along the stream and in their shade the Cow parsnip attained an immense size. On the alluvial flats bordering the river the magnificent Ostrich and Cinnamon Ferns (*Struthiopteris Germanica et Osmunda cinnamomea*), spread out their luxuriant fronds in the form of great green vases among the high cranberry bushes (*Viburnun opulus*), and the water and straight yellow-leaved avens shot up their wiry stems amongst the grass and sedges. Quantities of several species of Pondweeds formed tangled masses in the quiet pools, on whose surface floated the round shining leaves and yellow flowers of the Spotted Dock. In some places along the river the ground in the wood was covered with a thick soft carpet of various mosses, (*Hypnum Boscii, crista-castrensis, splendens et delicatulum*), and the trunks of the trees were matted with tufts of *Neckera pennata*. In these rich damp woods the sweet, little one-flowered Pyrolas (*Moneses uniflora*), hid their single white blossoms in the mossy carpet, and the False Beech-drops (*Monotropa hypopitys*) pushed up their wax-like stems. Here, too, the smaller Lady's Slipper (*Cypripedium parviflorum*) nodded its mocassin-like flowers to its plainer cousins, the Dwarf and Northern green Orchids (*Platanthera obtusata et dilatata*), and the many flowered Coral-root (*Corallorrhiza multiflora*). Among the many ferns observed were the Lady Fern (*Asplenium filix-fœmina*) and the New York Shield-Fern (*Aspidium Novaboracense*), with numerous bushes of the swamp Gooseberry (*Ribes lacustre*), wild Red Currant (*Ribes rubrum*), Few-flowered Arrow wood (*Viburnum pauciflorum*), the Swamp Fly-honeysuckle (*Lonicera oblongifolium*), Low and Alpine Birch (*Betula pumila et nana*), while the tall wild nettle gave a sharp reminder of its presence with its pungent hairs.

At about fourteen miles from the mouth of the Great Cod Roy River some of the party went four or five miles south to the summit of the mountain range running east and west. At first our course lay through a hardwood bush and over several little streams, whose banks showed that they had been raging torrents earlier in the spring. In this bush I got the Spring Beauty (*Claytonia Caroliniana*), and a Galium with four broad leaves and little white flowers. As we ascended the damp, chilly mountain side, the trees became smaller, and the white birch and fir trees more numerous, until near the top nothing remained but stunted spruces, with trunks not thicker than a man's arm, but as hard as horn and probably as old as their taller brothers below. In some places these dwarfs were growing so closely together, and their tops had become so flattened and matted with the weight of snow in winter, that I actually walked for a considerable distance upon them like on an elevated pavement. The very top of the mountain presented a bare, desolate appearance. Large patches of snow twenty or thirty feet deep remained in the shaded depressions, while others were filled with boggy lakes, on the little islands in which the sea gulls seemed to have their nests, from the wild manner in which these birds screamed and flew around as we approached the ponds. In some places the gneiss rocks were broken and bare, in others covered with lichens, mosses and heaths. Among these I found the Bearberry Willow (*Salix uva-ursi*), the Alpine Bearberry (*Arctostaphylos alpina*), with the Phyllodoce (*P. taxifolia*), and other heaths already mentioned.

On returning to the schooner, a botanical survey of the little island of Cod Roy was rewarded by the discovery that the *Cornus Suecica* grew everywhere in profusion with its Canadian sister. This *Cornus* I afterwards found to be quite as common as the Canadian bunchberry all along the western Newfoundland coast, and on the north shore nearly as far west as Pointe des Monts. The other plants worthy of note on the island were the Fall Dandelion (*Leontodon autumnale*), the common American Cranberry (*Vaccinium macrocarpon*), the Wood-Rush (*Luzula campestris*), the Cloudberry (*Rubus chamæmorus*), the Mountain Cinquefoil, and a variety of the beach pea, so downy with short soft hairs as to look almost glaucous.

During the 11th and 12th July we ran up to Long Point, north of Cape St. George. In a boggy meadow near the end of the point I found the Alpine Bistort in flower (*Polygonum viviparum*), the Arrowgrass (*Triglochin maritimum*), and Mountain Fly-honeysuckle (*Lonicera cœrulea*). At West Bay, a little farther down the east side of this long point, the shallows are studded with the Fall Bulrush (*Scirpus lacustris*), and near the shore the common Soft Rush (*Juncus effusus*) grew in clumps in the mud. On the banks the Hedge Bindweed (*Calystegia sepium*) drew its trailing stems over the bushes, and from the rocks the common Bladder Fern (*Cystopteris fragilis*) spread its fragile and varying fronds.

We next sailed north to the Bay of Islands, which is a long narrow inlet divided into two arms, a short distance from the sea, and, as its name indicates, it contains a number of small rocky islands. At its mouth is a round granite island, whose steep sides dip perpendicularly into the deep channel on either side, through which the tide rushes with considerable rapidity as it rises and falls. On the south side of the entrance are several very high mountains, whose sides are nearly perpendicular, and form a bare wall, against which the waves perpetually lash, and against which we were almost wrecked on entering the bay, owing to the rapid flow of the tide and the strong shifting gusts of wind which blew around the crags, and to which I have no doubt these peaks owe the not very euphonious but expressive name of the Blow-me-down Mountains. As the early French navigators sailed along these newly discovered shores, they generally called the various points of interest after the name of the saint on whose day they arrived at the place, while the English names have too often been repetitions of those of some European place, or have been suggested by some passing fancy of the sailor. A few miles up the Bay of Islands I found the common bitter Cress (*Cardamine hirsuta*), and the Marginal fruiting Shield-Fern (*Aspidium marginale*), growing at the foot of a slaty cliff.

The Humber River enters at the head of the south arm of the Bay of Islands. This noble river is the outlet of Grand Pond, and with its tributaries winds through a large portion of Newfoundland. It is, or could easily be, made navigable up to the main fork, a distance of about forty miles, for flat-bottomed steamboats like those used on the Ohio. Along the river flats, in the valleys and on the "barren," when these are drained and the country is a little more cleared, there will be room for thousands of farms, and the hills will afford walks for immense flocks of sheep and pasture for countless herds of cattle, the surplus of all which will find a ready market at the ports and fishing stations, at the lumbering, manufacturing and mining establishments, which ere long will make this old and neglected colony one vast scene of active and profitable industry. The climate of the island is favourable to the developement of its agricultural resources of every kind. Instead of the cold foggy atmosphere, which is generally supposed to hang over this island, quite the reverse is the case—the air is clear and warm, and the temperature during the year remarkably equable, the mercury in winter seldom falling below zero of Fahrenheit's scale, or in summer rising above 90°, while the mean temperature of the year is about 44°. I never saw finer weather than during the two months I was on the island. It is only on the S.W. corner that fogs prevail to any extent, from the proximity of that part to the Gulf stream.

At half the distance between the sea and the main fork of the Humber, the river spreads out into a broad expanse of about fifteen miles in length, called Deer Lake, from which the mountains rise range after range, and stretch away into the dim distance. Along the banks of the river, before reaching Deer Lake, I observed the Black Ash (*Fraxinus sambucifolia*) to be quite abundant. The Aspen Poplar (*Populus tremuloides*) was not uncommon, and the Scarlet-fruited Thorn (*Cratægus coccinea*) here and there shewed its spring branches along the rocky banks. A pretty little white composite flower grew on the damp rocks with the pinguicula and violets; but I was unable to get a specimen of it. In other places the green and hoary alders, red osier dogwood, sweet-gale and dwarf willows bordered the stream to the water's edge. The woods were principally composed of the following trees:—Black and white Spruce and Balsam-fir (*Abies nigra, alba et balsamea*), Mountain Ash (*Pyrus Americana*), Black Ash, Choke and wild Red Cherries (*Prunus Virginiana et Pennsylvanica*), Cranberry trees and Sweet Viburnum (*Viburnum opulus et lantago*). On a little island on the north side of Deer Lake I found the Mountain Painted Cup (*Castilleia septentrionalis*) and one of the deciduous Equisetums. In the shallows of the lake the Water Milfoil (*Myriophyllum spicatum*) floated in abundance, with other weeds. On entering the Humber at the upper end of Deer Lake, our progress was often arrested by the oars becoming entanged in masses of Eel-grass and Pond-weeds, which filled the dark-brown waters at the sides of the slowly flowing stream. In the neighbourhood of the fork no plants were observed different from those already mentioned; but one expedition to Grand Pond, in the centre of the island, brought back specimens of the Bastard Toad-flax (*Comandra livida,*) *Epilobium latifolium* and *angustifolium* and *Viburnum opulus.* After spending a few days at the main fork of the Humber, we started down the river, and after a long pull of from ten in the morning till eleven at night, reached the schooner in safety. At the mouth of the river we passed several long salmon nets, some of which were stretched so far across the stream as to render it almost impossible for any salmon to reach their spawning ground. In buying some salmon from one of the fishermen, it was singular to find how very ignorant he was of the value of the various silver coins in common use, so general is the system of obtaining by barter all goods imported to these stations.

For two nights after our arrival we had the rare opportunity of seeing the woods on fire on a magnificent scale, on the north side of the south arm of the bay. This grand conflagration commenced from a "smudge," or smouldering, smoking fire of rotten wood, lighted by some woodmen at the head of the bay to keep away mosquitoes. The weather had been warm and dry for some time previously, and had prepared the firs, birches, fallen wood, and even the vegetable mould for this terrific bon-fire. As the fire spread along the ground, and from tree to tree, it sent immense clouds of smoke and wreaths of flame upwards to the sky, and created a draught for itself, which added yet greater fierceness to the devouring element, and carried up ashes and burning cinders, which again fell to the ground only to be new *foci* of destruction. The crackle, roar and crash of the burning and falling trees could be heard for miles; and as the fire, with almost the rapidity and violence of an explosion, ran up the immense fir and birch trees on the tops of the hills, it made a sight which, when once seen, can never be forgotten. As the fire travelled along the hills towards the fishing station, opposite which the schooner was anchored, the ashes and cinders covered the deck, and it required constant watching to prevent the sails from catching fire, while the ship's crew were away helping to tear down fences to prevent the spread of the fire, and to save the houses of the settlers. A fall of rain on the morning of the 22nd of July quenched the ardour of the conflagration, and a smart easterly breeze springing up the same afternoon, gaily carried us homeward-bound, through the imposing portals of the Bay of Islands.

WHY ARE INSECTS ATTRACTED BY ARTIFICIAL LIGHTS?

By A. S. Ritchie.

This question has given rise to many speculative answers,—none of which as yet are generally satisfactory.

Mr. Guyon writes thus in Science Gossip *:—"If a room were thoroughly darkened, with the exception of a small opening, such as a key-hole, through which the outer daylight was allowed to enter, such an aperture would appear from within, by contrast, almost as bright as the flame of a candle, and any winged insects enclosed in such a room would be pretty certain to direct their flight to the opening. Moths in a room are probably under a sense of being lost and confined, and as bees hurry up and down the window, so nocturnal lepidoptera knock against the ceiling, or dash into the candle flame, perhaps equally with the impulse to escape. Insects seem to be under a fixed impression that the direction of the light is the way out." The same author writes: "The idea has often occurred to me—though it may be rather a fanciful one,—that possibly the insects might regard the flame as light shining from an aperture through which they might make their escape,—somewhat as children imagine the stars to be pin-holes in the sky."

These remarks, so far as we understand them, do not tell us what brings insects from their various haunts into our rooms. They only prove that these creatures prefer light to darkness,—a very natural conclusion, we think, seeing that nature has supplied them with well-developed eyes.

The second answer given to the question runs as follows:—"Most of the night-loving insects are so affected by the sudden appearance of light, that when a candle is introduced, they rush madly into the flame as though they were deliberately inclined to commit suicide." . . . "The true cause of this proceeding has not yet been satisfactorily explained. It has been suggested

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* Vol. for 1869, page 57.

that their eyes do not absorb (as in most insects), but reflect the light,—an organization which enables them to distinguish objects in a state of partial darkness, but which leads to their destruction when the light is strong. Blinded, as it were, by excess of radiance they lose all discernment in the blaze, and perish in the flame."

Our opinion with regard to the structure and office of the eyes of insects is in accordance with the above remarks; all that is answered, however, is the cause of their perishing in the flame, which we attribute to paralysis of the optic nerve by the excess of light.

The third answer to the question runs thus:—"We know," ('I have often seen it,' says the writer), "that certain flowers emit of an evening a strong phosphorescent light, visible at some some distance. How many do so whose light is only visible to the keen eyes of insects we do not know; but I think it probable that many more do than we are aware of. Is it too wild a suggestion that nature has supplied those storehouses of insect food, —the flowers,—with this phosphoric glow as a beacon light to these hungry night rovers, and responding to the invitatation, they make for our lighted windows as to a banquet hall?"

We venture to make the following remarks on the quotations cited:—If it be true that plants give off a peculiar light, this, to a certain extent, answers the question, and goes far to prove that insects are attracted by the light to feed. Dr. W. B. Carpenter says on this subject: "It has been asserted that many plants,—especially those of an orange colour, such as *Tropæolum majus* (Nasturtium), *Calendula* officinalis (Marigold), *Helianthus annuus* (Sunflower),—disengage light in serene and warm evenings, sometimes in the form of sparks, sometimes in a more uniform manner, and many physiologists are disposed to question these assertions, from their not having been themselves able to witness the phenomenon." We have spoken on this subject to several botanists who have never witnessed this light-giving property in plants.

We shall now give our opinion on this subject, and will do so as fully and clearly as possible, by answering the following questions:—

First.—What species of insects are generally attracted to our open windows by artificial lights, such as lamps, &c.?

Secondly.—What are the habits of those species, and for what purposes are they attracted?

Thirdly, and lastly.—Is it on dark or moonlight nights that insects are attracted to artificial lights?

In answering these questions, our opinions are based upon actual observation and experience.

To the first question, viz.: What species of insects are generally attracted to our open windows by artificial lights? we suggest the following reply: We have taken representatives of nearly all the orders of insects in our rooms by lamplight during the past ten years,—but mainly Lepidoptera (or moths). The following is a statement taken from notes of captures on an evening in July, 1869. Working with the microscope at an open window, with the lamp burning on the table, the following insects were attracted by the light:—First, a beetle (*Harpalus Pennsylvanicus*), rather a strange fellow to be about at this hour; next visitor, a water beetle (*Acilius fraternus*), then followed several moths, principally small species; the mosquito also made its appearance, and some small Ephemeræ. They flew out and in at the window, and in the reflected light across the street, numbers of moths could be seen as they crossed the rays from the lamp. Comparatively few rushed into or against the lamp,—evidently finding the light too strong for them, they flew out of the window to join in the dance going on outside, where the greatest number appeared to be. This answers the question in regard to the species generally attracted.

We shall now consider the second question, viz.:—What are some of the habits of those species, and for what purposes are they attracted? Without going into particulars about the habits of the several species, we will confine ourselves to the several orders as regards their being attracted by lights. Nearly all the specimens we have seen are nocturnal,—these feed and seek their mates by night. There are exceptions to this, as to most other rules, for in the case of some of the insects named, *e.g.*, *Harpalus* and *Acilius*,—both are diurnal species. The first named was abundant last summer, flying into lighted rooms in numbers, perhaps awakened by the light shining from the window on the side-walk, under which it had retired for the night, and so got up a little ahead of time. The other, *Acilius*, has been found at fault before, as also some of the large species of the family *Dytiscidæ*. They have been seen to pitch themselves on the glass roofs of conservatories, probably taking the shining glass for the surface of a pool or pond.

The reason for the appearance of water beetles at such unseasonable hours may be accounted for thus:—In summer the little ponds and pools are dried up, when it becomes necessary for them to shift, and in their wanderings they are no doubt dazzled and attracted by the light.

The order Lepidoptera comprises the majority of our evening visitors, such as moths. There are three classes of these creatures, divided into diurnal, twilight and nocturnal flyers. The eyes of the nocturnal species are constructed something like the owls, that is they are incapable of bearing the bright light of the sun. Any one conversant with the habits of these creatures will have noticed on confining a moth in a small box or in a partially darkened room, how its eyes shine. This shews that a difference exists between moths' eyes and those of other insects,—for instance, in those of the dragon fly, which spends its day in the rays of the sun, placed in a like position, no such effect is observed. This bears out the suggestion that the visual organs of nocturnal Lepidoptera reflect, and do not absorb, light.

On the other hand, observe the appearance of some of the Sphingidæ and other nocturnal moths. In the day-time we have often observed them sticking to the trunk of a tree, or in the crevice or corner of a fence. Failing to secure them instantly, they would fly foolishly hither and thither, evidently annoyed by the sunlight, darting among the brushwood and bushes till at last they were captured,—none the better as cabinet specimens, on account of their wings being rubbed or antennae broken.

The purposes for which these creatures come out at night are two-fold,—I speak here of the typical night flyers of the order Lepidoptera.

The first of these purposes is for feeding. The following circumstance will corroborate this view:—Having sugared some trees on the mountain, I hung a lantern about two feet above where the sugar was spread. The night was very suitable for mothing,—dark and warm. We had not to wait long with our nets before several moths made their appearance, and with ready mouth, licked the sugar. Specimens of diptera also congregated, attracted by the smell as well as the light. Few flew to the light, but rested on or near the part rubbed with the sugar. The second purpose is with a view to finding their mates in order to perpetuate their species. It may be mentioned here that one of the chief aims of an insect's life seems to be to accomplish this end. This is more particularly the case with regard to moths, as may be seen from the following circumstance, which happened four years ago:—Sitting, with the window open, and a lamp burning on the table, a large moth flew into the room. I shut the window and captured it. It was a female of *Telea polyphemus.* The window was scarcely closed when something flew against it; knowing it to be another moth, the sash was again opened; in a very few seconds in the moth came, and flew up and down the ceiling, when the inevitable net soon enclosed it. This moth was the male of the above species, and its visit was, no doubt, a clear case of love-making. I mention another circumstance with regard to the females of the larger moths in particular, which I have observed frequently. A female never dies without depositing her eggs in some way or other. I have pinned moths time and again on the trunk of a tree, and in every instance (if not at the time of piercing the creature on the tree) always in the box before she died, when they are ejected on the introduction of the pin; they are unformed and soft. The creature, apparently aware of some change coming over her, does her best for the continuation of her kind up to the latest moment of her existence. Insects, especially Lepidoptera, copulate on the wing, and sometimes at great heights. We had an opportunity of witnessing this at Belœil mountain on the occasion of the field meeting of this Society last summer.

Examples of *Papillio turnus* were abundant,—flying higher than the trees,—and higher than the old ruin on the top of the mountain.

Vanessa antiopa was also observed, evidently enjoying themselves, as they flew towards the sun,—away above trees and other objects,—for diurnal Lepidoptera pair, and fulfil the end of their being in the bright beams of the sun. May we not draw the same conclusion with regard to the nocturnal species?

On moonlight nights where are the moths? No doubt flying at great heights, seeking each others company for the purpose of perpetuating their kind; and on moonless nights—as will be shewn further on,—those creatures are attracted by artificial lights for the same purpose. I would venture to offer the following suggestions: I have always found that moonlight nights were bad nights for mothing. On clear, moonlight nights these creatures find all they require in the broad expanse of field and forest. The journeys they take, and the enjoyment they have are uninterrupted on such occasions; but when a moonless, warm, moist, but not wet, evening comes, they are aroused by artificial lights, which to them, I believe, is their best substitute for moonlight. The conclusions I arrive at are, that nearly all insects which come out at night, come either for the purpose of feeding, or of continuing their species. They cannot, on account of the structure of their eyes, serve one of the purposes for which they were made, during the bright sunshine. The pale, mellow beams of the moon is their Pharos, and suits them best. You may sit at your open window, with your lamp or lamps, on a bright, moonlight night, and the number of typical night flyers, or insects of any kind, will be few indeed; experience is the best teacher, and so it has been in the present instance. But on a moonless night, with your lamp, you may make many captures. Insects on dark nights then seem to be attracted by lights, either in your rooms or by lanterns in the woods, because such light come nearest to the light they love and enjoy, namely, that of that

"Orbed maiden, with white fire laden,
Whom mortals call the moon."

NOTES ON VEGETABLE PRODUCTIONS.*

By Geo. E. Bulger, F.L.S., F.R.G.S., C.M.Z.S., &c.

Seeds of the Wild Liquorice (*Abrus precatorius* Linn.)—These seeds are the produce of a twining plant, which seems to have been brought originally from the West Indies, though it is now common enough in India and other eastern countries. It belongs to the papilionaceous division of the natural order *Leguminosæ*. The English call it wild-liquorice, and the French *liane à réglisse*. There are several varieties, and three differently-coloured kinds of seeds are well known—black, white and scarlet. The last mentioned have a jet-black spot at one end, and, as they are very hard, glossy and brilliant, they are a good deal in request as beads for necklaces and other ornaments amongst the Hindoos. They are called retti-weights in India, and are used by jewellers and druggists, each seed being popularly supposed to be equivalent to one grain; but Dr. Mason says he has weighed

* Part of a small collection recently presented to the Museum of the Natural History Society of Montreal.

many of them, and found them to vary from one to two grains. The native goldsmiths are said to make an adhesive compound from them, which is employed in the finer work of jewellery. Several parts of the plant are applied to various medicinal purposes. The root is used as a substitute for liquorice—hence the English name—and Lunan says that a decoction of the leaves is drunk in the West Indies instead of tea. According to Linnæus the seeds are very deleterious, but, as the Egyptians use them for food, they can hardly be so injurious as the great botanist has led us to suppose. As a plant, the *Abrus precatorius* does not possess much beauty, and the pale-purple flowers are neither gay nor striking. I have not seen it growing very abundantly in India, though I have found it pretty widely distributed in that country, as well as in Burmah. Mr. Gosse says it is a common hedge-climber in Jamaica, and it is doubtless equally plentiful in the other islands of the West Indies. The derivation of the generic name is from *abros* (pretty), in allusion, probably, to the beauty of the little seeds; and Loudon says the specific designation, *precatorius*, is due to the fact of their being used as beads for rosaries.

Seed-pod of the Moreton-Bay Chestnut Tree (*Castanospermum Australe* Cunn.)—The *Castanospermum Australe*, as its English name imports, is an inhabitant of the forests near Moreton Bay, in Australia. It is a handsome tree, belonging to the nat. ord. *Leguminosæ*, with an abundance of elegant foliage; and, in the season of bloom, the bright saffron-orange papilionaceous flowers are very gay. The seeds are large, and, in some slight degree, resemble chestnuts in taste and appearance. They are enclosed in an inflated legume or pod, which is hard and woody in its texture, and of a pale, reddish-brown colour. They are nearly globular in shape, and each pod contains from two to five seeds. Is is said that they furnish an article of food to the natives of the country where they grow, and that Europeans have been known to subsist upon them for some time without any injurious effects. The tree—the only one of its genus known to science—is very ornamental, and has been successfully cultivated in East Indian gardens, including the famous Lal Baug at Bangalore. The generic name is compounded from *castanea*, a chestnut, and *sperma*, a seed.

Nickar Berries (seeds of *Guilandina bonduc* H. K.)—*Guilandina bonduc* is a thorny, climbing shrub of the nat. ord.

Leguminosæ. It grows abundantly in India, and is also common in the West Indies and other tropical countries. Burton mentions it in his *Abeokuta*, and in Harvey and Sonder's *Flora Capensis* it is enumerated as an inhabitant of South Africa. Two species are described under the names, respectively, of *bonduc* and *bonducella*, but, if the latter is distinct, I have not seen it, and several botanical writers of repute ignore it entirely, excepting as a synonyme of *bonduc.** The flowers of *bonduc* are yellow, the leaves abruptly pinnated, and the whole plant is plentifully armed with ferocious spines. The prickly legumes usually contain two only of the grey and shining seeds, which, being very hard, are used as beads and marbles. They are extensively employed in medicine amongst the natives of the East, and are reputed, in Egypt, to be prized as charms against sorcery. They are frequently called bonduc-nuts, and are so strongly coated with silex, that, Sir Emerson Tennent tells us, they are said to strike fire like a flint. Royle asserts that *Guilandina bonduc* was the *akutmookt* of Avicenna, and that there are grounds for supposing

* Since the above was written, Mr. Whiteaves has drawn my attention to a paragraph in the *Treasury of Botany*, wherein, on the authority of Mr. A. Smith, *Guilandina bonduc* is described as having solitary prickles on the leaves, and producing yellow seeds, whereas *bonducella* is stated to have prickles in pairs, and lead-coloured seeds. Mr. Whiteaves has also shewn me specimens from the West Indies of both kinds of seeds, which are certainly very distinct in coloration. I am unable to solve the problem, or to decide whether the differently-coloured seeds belong to the same species or not; but I never saw the yellow ones in India, where I gathered, with my own hands, many hundred specimens of the grey kind; and I have the high authority of Wight and Arnott to support me in my opinion that the so-called species of *bonduc* and *bonducella* are identical. I quote from the *Prodromus Floræ Peninsulæ Indiæ Orientalis*, as follows: "It might be thought preferable to adopt the name *Bonducella*, as it was of that form only that Linnæus had seen specimens, *Bonduc* having been taken up from Plunkenet's figure; but the two being identical, not even varieties, we have preferred that which is simpler, and not a derivative of the other." I suspect that many of the less important characters of the species are very inconstant, and hence the confusion which has arisen. Indeed I find in Sir William Jones' *Botanical Observations on Select Indian Plants*, which appeared in the *Asiatic Researches*, vol. iv, the following statement regarding *Guilandina*: "The species of this genus vary in a singular manner; on several plants, with the oblong leaflets and *double prickles* of the *Bonducella*, I could only see *male* flowers as *Rheede* has described them; they were yellow, with an aromatic fragrance: others, with similar *leaves* and *prickles*, were clearly *polygamous*."

it to have been one of the kinds of eagle-stone of the ancients. Ainslie identifies it with the *caretti* of Rheede, and describes the seeds as yellow, finely variegated with annular saffron-coloured zones, but these characters are not applicable to the common form, in which the seeds are of a uniform grey, with the annular markings very faint indeed. In Scotland they are often thrown upon the sea-shore, and are there known as molucca-beans. The genus was, according to Paxton, named in honour of Melchior Guilandina, of Prussia, a great traveller, and a Professor of Botany at Padua.

EAGLE-WOOD (*Aquilaria agallocha* Rox.)—It is now pretty generally thought that the far-famed lign-aloes of sacred history was the produce of a tree belonging to the genus *Aquilaria* of the nat. ord. *Aquilariaceæ;* and there are even grounds for supposing it to have been furnished by the *Aquilaria agallocha* of Roxburgh, from which is obtained at least one kind of the precious and fragrant resin known as *calambac;* but, until more accurate and precise information is forthcoming, the uncertainty that has hitherto enshrouded the identity of this delightful and glorious substance can scarcely be removed, or the halo of romance and mystery which hangs around it entirely dispelled.

Aquilaria agallocha is stated by Roxburgh to be a native of the mountainous parts of India, east and south of Silhet, in about the latitude of 24° to 25° north; but, as there is abundant and reliable testimony to show that a fragrant heart-wood, similar in most respects to the produce of that tree, is brought from many other countries, including Malacca, Java, Siam, and Cochin-China, it is quite evident that either the species under consideration, or others possessing like qualities, are pretty widely distributed over the continent and islands of Asia. Indeed, in works on eastern botany two or three different kinds are recognized, but, so far as I can learn, they have never been compared with Roxburgh's *agallocha*, with a view towards ascertaining if they really are specifically distinct.

I have not seen the tree of *Aquilaria agallocha*, but it is stated to be of immense size, and to possess a white, soft, light and inodorous timber, the heart-wood alone being heavy, hard, dark coloured, and highly fragrant. From the latter are extracted the rich essential oil known in India as *ugger*, and the costly resin called *calambac*. Both of these are extensively used as perfumes, and in the manufacture of incense. There are said to be several qualities of eagle-wood, and different kinds of resin procurable from it, which vary in value as in name, but, although I carefully searched the bazaars of Madras, Calcutta, Benares, Delhi, Agra, and other large Indian cities, assisted by an interpreter, I failed in obtaining more than one variety of each, and I could not learn that any others were even known.

The multitude of synonymes, which seem to be the property of eagle-wood and its products, have added, in no small degree, to the confusion which exists regarding it, and the imperfect and often conflicting accounts of travellers have rather increased the mystery than otherwise, and thus have almost nullified the advantage of their researches. On the whole, this interesting subject requires clearing up, and it is to be hoped that, ere long, it will receive the attention it so well deserves.

I cannot credit the statement that the fragrant wood is only found in trees which are diseased and decaying, for all the specimens that I examined were apparently sound and in the most absolute health, with the cells full of the precious and sweet-scented resin. The origin of the scientific names is obvious, but their relevancy is not so clear.

CAPSULE OF THE FRANGIPANNI-FLOWER TREE (*Plumieria alba* Jacq.)—The history of this beautiful tree is very romantically associated with the visit of Columbus to the West India Islands, and with Mercutio Frangipanni, a botanist of the expedition. I find, in *Notes and Queries*, that Frangipanni lived in 1493, was a famous botanist and traveller, and belonged to a noble and celebrated Italian family. When the great explorer's vessel approached Antigua, the sailors observed that a delicious fragrance pervaded the air, and, upon landing, they found the island abounding in plants of *Plumieria alba*, laden with blossoms, and rich in "odours of Paradise." From the circumstance of Mercutio Frangipanni having expressed his great admiration of this lovely plant, it is called, by the inhabitants of Antigua, the Frangipanni-flower, and from it is distilled the famous essence of the same name.

This tree was long ago introduced into India, and it is now very plentiful in that country. At Bangalore, in the Mysore territories, no garden is without it, and, although leafless for a considerable portion of the year, it appeared to me to be never entirely out of bloom. When destitute of its rich and elegant foliage, it is not very attractive, owing to the somewhat peculiar and rather ungraceful growth of the branches; but, about the middle of March, there are few more beautiful objects, and so abundant is the perfume, that it is literally wafted hither and thither by

"— every breeze that roams about."

The flowers are white, fleshy and bell-shaped, with a yellow tube; and the leaves are large, lanceolate and of a dark and glossy green.

The loveliness of the plants themselves, and the rich fragrance of their delightful blossoms, have attracted the attention of all travellers, and Gosse, in his most charming works on Jamaica, has more than once touched upon the beauty of the Spanish jasmines, as the two species, *Plumieria alba et rubra,* which grow there, seem to be called. Bates, in *The Naturalist on the Amazons,* mentions *Plumieria phagedænica* as one of the most singular ornaments of the campos. *Plumieria acuminata* is called the pagoda-tree in India, and is included, as well as the other species, in the native pharmacopœia. The genus belongs to the nat. ord. *Apocynaceæ,* and was named in honour of Charles Plumier, author of *Plantæ Americanæ.*

GRU-GRU NUT (seed of *Acrocomia sclerocarpa,* Martius.)—These nuts, so-called, are the seeds of a noble South American palm, which, owing to its great height and stately growth, is one of the most majestic representatives of the kingly race to which it belongs. The *Journal of Horticulture* says the fruit are about the size of Orleans plums, perfectly globular and smooth, and, when fresh, of an olive-green colour. They have a thin, woody rind, beneath which is a layer of fibrous, gelatinous pulp surrounding the hard stone or gru-gru nut, and this again contains a single seed. The seeds of all the species of this genus contain hard stones, resembling in some degree those under notice; they are polished and carved by the natives of South America, and applied to many ornamental purposes. Both pulp and kernal are said to be eatable—the latter being white and pleasantly tasted. The tree belongs to the nat. ord. *Palmaceæ,* and the generic name is derived from *akros,* top, and *kome,* a tuft.

SEEDS OF THE PERIM-KARA TREE (*Elæocarpus oblongus,* Gærtn.)—The Perim-kara is a noble tree, and a great ornament to the forests of the Neilgherries and Southern India, where it grows; especially at the end of the cold season, when the elliptic-oblong leaves assume a most brilliant scarlet-crimson tint before they fall. The blossoms are brown and white, and possess a very unpleasant odour; the fruit is a drupe, not unlike the olive in appearance, only larger, and it contains a rugose nut, which, after being polished, is applied to many ornamental uses. According to Royle, the fruit of at least one species is eaten like olives, and those of other kinds are pickled and used by the natives of India, in their curries. The nuts are strung and employed as sacred beads by the Brahmins, and Royle says they are set in gold, and even sold as ornaments in the shops of Europe. I am unable to trace the origin of the native name, but the generic one is derived from *elaia*, the olive tree, and *karpos*, a fruit, in allusion to the resemblance between the fruits of the Perim-kara and the olive. Nat. ord. *Elæocarpaceæ*.

SEEDS OF THE RED-WOOD TREE (*Adenanthera pavonina*, Linn.)—This is a large tree, and, amongst the natives of India, its timber is known as one of the red sandal-woods. The flowers are small, fragrant, and of a yellowish white; the seeds are scarlet, glossy and hard. Like those of *Abrus precatorius*, the latter are used by the Hindoo jewellers as weights — each one being supposed to be equal to four grains; but, as they vary a good deal in size, they are, of course, not to be depended upon for this purpose. Bruised and beaten up with borax and water, we are informed that a cement is made from them, and their pulp, when mixed with honey, is used medicinally. The timber is very hard, of a deep red colour, and exceedingly durable; it affords a dye, which does not appear to be either very much used or very valuable. The tree was long since introduced from the East into the West Indies, and it has become very abundant there. In Jamaica, according to the *Journal of Horticulture*, the bi-convex seeds are known as Circassian beans, Lady Coote beans, and St. Vincent beans, and they are used for necklaces and other ornaments. Loudon, in his list of synonymes, quotes bastard flower-fence as the property of this tree. It belongs to the nat. ord. *Leguminosæ*, and the seeds are produced in a twisted, sickle-shaped pod, which usually contains about ten or a dozen. The generic name is derived from the fact of the anthers being gland-tipped—from *aden*, a gland, and *anthera*, an anther.

SANDAL-WOOD (*Santalum album*, Linn.)—Sandal-wood, sometimes called Saunders-wood, is the produce of *Santalum album* of the nat. ord. *Santalaceæ*. It is a native of India and other countries of the East, and is a small, handsome tree, with numerous little flowers, which are first straw-coloured, and afterwards of a deep purple. The fruit is a round, black berry. The outer timber is white and almost inodorous—the fragrant portion being only the yellow heart-wood, which is very hard and very handsome. The perfume extracted from sandal-wood is highly prized amongst the Easterns, and it is, perhaps, more extensively used than any other. Medicinal qualities are attributed to the essential oil, as also to the powdered heart-wood. The *Santalum album* is supposed, by some authors, to be identical with the almug or algum trees of Scripture. The name is derived from the Persian word *sandul*.

INDIAN SHOT (*Canna Indica*, Linn.)—This pretty little shrub, with its large leaves and bright scarlet flowers, is very ornamental, and, consequently, cultivated extensively in gardens. It is a native of the tropics in both hemispheres. The seeds are round, black and glossy, resembling shot—hence the English name. The root-stalk of some of the species is edible, and, from one kind at least, is obtained the substance called *tous les mois*. The leaves are used as thatch, and from the seeds is prepared a beautiful purple dye; the roots, seeds, etc., are employed in Hindoo medicine. Loudon says that, in America and the Brazils, the *Canna* is called wild plantain, and that the leaves are used as envelopes for many articles of commerce,—hence, probably, the French name *balisier*—*balija* being Spanish for envelope. Francis Buchanan tells us (*Asiatic Researches*, vol. vi.) that this plant is peculiarly sacred to Bouddha, as it is supposed to have sprung from his blood, when, once on a time, he had cut his foot, by striking it against a stone; and that, therefore, the Burmese value the seeds for rosaries. It belongs to the nat. ord. *Marantaceæ*, and its name is derived from a Celtic word signifying a cane or mat.

GREAT AMERICAN ALOE (*Agave Americana*, Linn.)—The romance which made the so-called American Aloe a centennial flower has passed away, and it is now well known that the intervals between its periods of bloom are very much shorter than was supposed, and that they depend, when the plant is under cultivation, pretty much on the mode of treating it. It is a noble and striking object, especially when its long, stately flower-scape towers up to the height of 18 or 20 feet from the centre of its clustre of sword-like, succulent leaves. The various species are applied to many useful purposes in the different parts of the world, where they are naturalized and abundant. They furnish an excellent fibre called *pita*, which is manufactured into a superior and durable rope of great strength and power. This rope is stated to have been subjected to a course of experiments in India, and found to have been stronger than the productions of coir, country-hemp and jute. A bundle of the agave-fibre bore 270 lbs. weight, and that of Russian hemp only 160 lbs. It is a famous hedge-plant, and is much used for that purpose at the Cape of Good Hope and in the East. Loudon informs us that it is either wild or acclimated in Sicily, the south of Spain and in Italy. It is abundant in the West Indies, and Humboldt says that it is common everywhere in equinoctial America, from the plains even to elevations of 10,000 feet.

In Mexico, where it is sometimes called *niaguey*, a liquor is obtained from its juice, which, when fermented, is known as *pulque;* and from this is distilled an ardent spirit named *aguardiente de maguey*. The leaves of one kind are, according to Mollhausen, baked and eaten under the appellation of *mezcal*, and they are elsewhere used to make paper of, as also an excellent and impenetrable thatch. It is said that the juice possesses strong healing properties, and, in Jamaica, Long tells us that a species of soap is prepared from it.

I have often employed strips of the dried flower-stem—which is a light, pith-like substance—instead of cork for the lining of insect cases; and Bennett records the same use of it in Australia. He also says that, owing to the minute particles of silica which it contains, razor-strops are made of it in that country; and I have possessed and used with great success several that were brought from the West Indies. Chapman, in his poem called *Barbadoes*, speaks of this plant as the May-pole.

> " Here, towering in its pride, the May-pole glows,
> Whose pointed top a bee swarmed circlet shews
> Of waving yellow; whose high-branched stem
> Takes back the rapt thought to Jerusalem,
> Shewing the candlestick that stood of old
> In the first temple, chased in purest gold."

The *Agave* belongs to the nat. ord. *Amaryllidaceæ*, and the name is derived from *agaus*, regal.

SEEDS OF THE GELA (*Entada pursætha*, DeC.)—This is an enormous climbing plant of the nat. ord. *Leguminosæ*. Its stem, which is thick, rope-like and very long, ascends to the highest trees, whence depend its beautiful foliage, small, yellow flowers and immense seed-pods, which Sir Emerson Tennent met with six inches wide and fully five feet in length. He says the Kandyans call it *maha-pus-wael*, meaning great hollow climber, and that probably the mountain region of Pusilawa, which he describes as very beautiful, and one of the finest coffee-districts in Ceylon, takes its name from this plant. The seeds, he adds, which are handsome brown beans of an immense size, furnish the natives of Ceylon with tinder-boxes, which they make by scooping out a portion of the interior. They are also used in medicine and as a detergent. The plant seems widely distributed, and is included in the Cape Flora. The seeds, according to Harvey and Sonder, are the common sword-beans of the East and West Indies, and of the tropical Pacific. The generic name is of Indian origin —*entada* being the Malayalam designation.

NATURAL HISTORY SOCIETY.

MONTHLY MEETINGS.

(Proceedings from January 1st to April 30th, 1870.)

Third monthly meeting, January 31st, 1870; Rev. Dr. De Sola presiding.

DONATIONS TO THE LIBRARY.

Réapparition du Genre Arethusina, Barrande; and Faune Silurienne des Environs de Hof, en Baviere—par Joachim Barrande. From the Author.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass. (Nos. 9 to 13). From the Trustees.

PROCEEDINGS.

Prof. J. W. Marsh, of Pacific College, Forest Grove, Oregon, was elected a corresponding member of the Society.

The following resolutions, having been moved by Principal Dawson and seconded by Rev. Dr. De Sola, were carried unanimously:—

"That this Society, in presenting its medal to Sir W. E.

Logan, LL.D., F.R.S., &c., although it cannot add appreciably to the many honours which he has received, desires to place on record, not merely on its own behalf, but on that of all the students of Natural Science in Canada, its high estimation of the value of his services in creating, as well as directing, the geological survey of this country, in promoting the development of its mineral resources, in stimulating and aiding the efforts of scientific institutions, and in extending throughout the world the name of Canadian science.

We desire also to express our high appreciation of Sir William's admirable personal qualities, and our hope that he may be spared for many years to Canada and to science, and that the relief from official cares may give him the opportunity to pursue to completion the researches in physical geology in which he is now engaged."

Mr. E. Billings read a paper "On the occurrence of Gasteropoda in the Primordial Zone." He commenced by giving a short account of palæontological discoveries recently made in other countries, and then exhibited a fossil that had been collected during the summer of 1869 by Mr. T. G. Weston, of the Geological survey, in the Primordial slates of St. John, N.B. The specimen was a small species of *Ophileta*, and its geological position was several thousand feet below the lowest beds in which any Gasteropoda had been heretofore found in America. The rocks were of the same age as the Lower Lingula Flags of Wales, the "Menevian group" of the late Mr. Salter. Another species, but of a different genus, has been found by Mr. Murray in Newfoundland, in rocks which appear to be Primordial, but whose age cannot yet be determined with certainty for want of sufficient fossil evidence.

Prof. R. Bell then read a paper "On the Intelligence of Animals." He spoke of the reasoning powers in many of the higher and larger animals as being too well established to require a plea, and devoted the greater part of his paper to the consideration of instances of what might be regarded as intelligence in such small creatures as insects. Many arguments were adduced, based on the organization and development of these creatures, and more especially on their habits, for regarding them as possessed of something more than mere instinct. Amongst other proofs of the possession of a reasoning power, the fact was mentioned, that insects, if baffled in one means of accomplishing their object, will generally try another; and that we find them as prompt and skilful in overcoming exceptional and artificial difficulties, as in performing the ordinary duties of their lives. The habits of insects, like those of the larger and higher animals, appear to be in a great measure the result of the accumulated experience of many generations. The term instinct, the writer said, has too general and vague a signification, and is often used as a convenient way of accounting for what it is found difficult to explain.

After the reading of this paper, a discussion ensued, in which Drs. De Sola and Evans, and Messrs. Billings, Ritchie, Whiteaves and other members took part.

Fourth monthly meeting, February 28th, 1870; Rev. Dr. De Sola in the chair.

DONATIONS TO THE LIBRARY.

Geology of Tennessee, Safford. Presented by Dr. A. Gottingen, State Librarian, Nashville, Tenn.

On the Chemical and Mineralogical composition of the Dhurmsalla Meteo[illegible] Stone, by Rev. S. Haughton, M.D., F.R.S., &c. From the Author.

The Principles of Æsthetic Medicine, by Dr. J. B. Catlow. From the Author.

Le Glacier de Boium, en Juillet, 1868, par S. A. Sexe; and two other 4to pamphlets. From the Royal Society of Christiania.

PROCEEDINGS.

Mr. A. S. Ritchie read a paper entitled "Why are insects attracted to artificial light," which will be found entire at page 61 of the present volume.

Prof. R. Bell gave a verbal account of the zoology and botany of the Nipigon country. Principal Dawson made some remarks on this communication, and said that it was much to be regretted that, when parties were sent by the Geological Survey to explore distant and comparatively unknown parts of the Dominion, no competent naturalist formed part of the expedition. Much practical knowledge as to the agricultural capabilities, &c,, of the region explored was thus lost to the community.

Fifth monthly meeting, March 28th, 1870; the President, Rev. Dr. De Sola, in the chair.

DONATIONS TO THE LIBRARY.

North American Oology, by Thomas Brewer, M. D. Part I. Quarto. Plates, uncoloured.

Zoology of H. M. S. *Samarang*. Fishes. By Sir John Richardson. Quarto. Plates. Both from G. Barnston.

PROCEEDINGS.

The two following resolutions, having been moved by Dr. Smallwood, seconded by Dr. Carpenter, (in the absence of Principal Dawson, were unanimously adopted:

1. "That as Mr. Whiteaves has liberally offered to place his private collections of recent shells and British Jurassic fossils in the Museum of the Society, and to make them accessible to members and others, for the purpose of study, so long as he shall remain in Montreal, and under the rules applicable to the collections of the Society, the Treasurer be authorized to expend a sum not exceeding one hundred dollars, in providing the necessary cabinets and materials for mounting and preserving the collections— it being understood that Mr. Whiteaves will himself mount and label the specimens; also, that the Treasurer be authorized and requested to insure this collection for a sum of not less than one thousand dollars, but not to exceed two thousand, so long at it remains within the building of the Society."

2. "That whereas, it is important to the cause of science, and conducive to the interests and reputation of this Dominion, that researches, by dredging, should be prosecuted in the Gulf and River St. Lawrence, in order to ascertain the character of marine life in the greater depths, and at the confluence of the fresh and salt waters of the river; and whereas this Society, and individual members thereof, have so far entered upon such researches as to prove their feasibility and importance, but have not the means of continuing them effectually, it is the opinion of the Society that aid should be afforded to such operations by the Government, in the manner in which this has been done in Great Britain, and other countries, especially by giving, for a short time in summer, facilities on board government vessels, to a party to be furnished and fitted out by this Society, which would undertake to provide observers, and scientific apparatus, and to make reports upon such

results as might be obtained; that Drs. Smallwood and P. P. Carpenter, also Messrs. E. Hartley and J. F. Whiteaves be a committee to correspond with the Dominion government, through the Hon. the Minister of Marine, with the view of effecting the desired results; that Principal Dawson be requested, when in London, to obtain information as to the best methods of making such subsidiary observations on the temperature, chemical constitution, etc., of the waters at great depths, as have been made in the recent dredging operations under the auspices of the British government, and, if possible, to procure specimens of the necessary apparatus."

The two following papers were read by Dr. P. P. Carpenter:

1. On some Peculiarities in Local Faunæ, exhibited in the Dredgings, by Mr. McAndrew, in the Red Sea; by Captain Pedersen, in the Gulf of California, and by Mr. Dall, in Alaska.

2. On the Vital Statistics of Montreal for 1869, with special reference to the great disproportion in death-rate between the French, the Irish, and the English portions of the population.

Sixth monthly meeting, April 25th, 1870; Rev. Dr. De Sola presiding.

DONATIONS TO THE LIBRARY.

Hooker's Icones Plantarum. Octavo. London. Half Morocco. Presented by E. Hartley, Esq.

Reliquiæ Aquitanicæ. Part 10. From the executors of the late Henry Christy, Esq.

Température de la mer entre l'Irlande, l'Ecosse, et la Norvége. Avec cinq cartes, par H. Mohn, Christiania; from the Royal Society of Christiania.

A flora and fauna within living animals, by Joseph Leidy, M.D., 4to, Washington; from G. Barnston, Esq.

PROCEEDINGS.

John Thomas Molson was elected a life member.

Gordon Broome, F.G.S., and James Dakers were elected ordinary members.

Alfred Bell (of London, England) was elected a corresponding member.

The following resolutions having been moved by A. S. Ritchie, and seconded by G. Barnston, were unanimously adopted:—

"That the members of this society regret deeply the resignation of their janitor and taxidermist, Mr. W. Hunter, who has so satisfactorily filled the joint situation for a number of years. They also sympathize with him in his bereavement, and in his continued ill health, the immediate cause of his resignation. It is hereby recommended to the society that steps be taken to present Mr. Hunter with a suitable testimonial in consideration of his long and valuable services."

Messrs. G. Barnston, John B. Goode, and the mover, were appointed a committee to carry out these resolutions.

Dr. Smallwood read a paper "On some phenomena of the Solar Eclipse of August, 1869."

Mr. A. S. Ritchie read an essay entitled: "Aquaria Studies, No. 1." This will be found at page 1 of the present volume.

SOMERVILLE LECTURES.

The six lectures of this course were delivered as follows:—

1. February 10th, 1870. "Explorations in the Nipigon country," by Professor R. Bell, C.E., F.G.S.
2. February 17th. "Recent discoveries in Solar Physics, and the total eclipse of August 7th, 1869," by James Douglas, jr., President of the Literary and Historical Society, Quebec.
3. February 24th. "The chemistry of Iron and Steel," by Dr. T. Sterry Hunt, F.R.S.
4. March 10th. "On Deep Sea Dredging," by Principal Dawson, LL.D., F.R.S.
5. March 17th. "On Gold," by Dr. G. P. Girdwood.
6. March 24th. "On Economic Mineral Deposits," by G. Broome, Esq., F.G.S.

ANNUAL CONVERSAZIONE.

The eighth annual conversazione was held at the rooms on the evening of Wednesday, March 9th, 1870.

The whole of the ground floor was tastefully decorated with evergreens, under the superintendence of Mr. D. McCord. Fine geological maps and sections were kindly lent for the occasion by the officers of the Geological Survey of Canada. Messrs. Theodore Hart and Hugh Allan also kindly contributed bouquets of choice cut flowers from their respective greenhouses. A number of microscopes, with objects, were placed in the library, this department being under the special superintendence of the Montreal Microscopic Club. Mr. J. M. Young sent one of

Powell & Lealand's large binocular instruments, with all the newest accessories. This is probably the finest microscope ever imported into Canada. Other instruments were contributed by Dr. J. B. Edwards, Messrs. James Ferrier, jr., A. S. Ritchie, D. B. Scott, R. McLachlan, and J. F. Whiteaves. Mr. Scott shewed the circulation of the blood in the web of the foot of the Shad Frog, also beautiful living examples of *Vorticella campanularia*, *V. nebulifera*, *Stentor cœruleus*, and other infusoria from his own aquarium. Mr. A. S. Ritchie illustrated details of insect structure, especially elytra of exotic beetles, and wings of tropical butterflies and moths. He also exhibited some good diatom slides, and a photograph, of microscopic animals and plants from a pond at Leytonstone (near London, England) by H. C. Richter. Mr. R. McLachlan shewed German examples of *trichina spiralis*, and Mr. Whiteaves some choice polariscope objects, while Messrs. Young and Ferrier contributed a number of fine slides by English preparers. The string band of the P. C. O. Rifle Brigade was in attendance and performed a choice selection of music during the evening. A little after 8 o'clock, H. R. H. Prince Arthur, attended by Lieut. Picard, entered the building, where he was received by a deputation of the senior officers of the society. The following address to H. R. H. was then read by the acting president, Rev. Dr. De Sola:—

To His Royal Highness Prince ARTHUR *Patrick William Albert, Knight of the most ancient and most noble order of the Thistle, Knight of the most illustrious order of Saint Patrick, &c., &c.*

MAY IT PLEASE YOUR ROYAL HIGHNESS.

We, the officers and members of the Natural History of Montreal, beg leave to approach your Royal Highness with our most respectful salutations, and to tender you a very cordial welcome on this occasion, when we are honoured with your presence amongst us.

We beg to assure your Royal Highness of the reverence and regard in which we hold the exalted virtues and beneficent rule of Her Most Gracious Majesty the Queen.

Our Society has existed as a corporate body for 38 years, during which time it has ever had as its chief object the advancement of the study of Natural History in this city and throughout Canada. It has erected this building, in which we have collected and arranged a museum which is attaining a magnitude that will bear favorable comparison with ordinary public museums in England, and is essentially valuable for its exhibition of local specimens. It has created the nucleus of a useful library of reference on scientific subjects. It has sought to promote original investigation and to foster a taste for the study of nature by its lectures, its papers regularly read, and by its organ the "Canadian Naturalist" which spreads the best attainable information on the natural productions of Canada, not merely among students in the Dominion, but throughout the scientific world where it is favorably known. We believe that the aims and labors of such an association as ours will enlist the fullest approval of your Royal Highness as they did that of your honoured and lamented father, whose name is revered wherever science is cultivated, as one of its most earnest friends and efficient promoters.

To which His Royal Highness read the following reply:

To the Officers and Members of the Natural History Society of Montreal.

GENTLEMEN,—It is to me a source of great satisfaction to receive this address of welcome at the hands of a Corporation so learned and distinguished, many of whose members have battled so bravely in the cause of science.

Their achievements in the field of Geology and Organic Chemistry are well-known, not only to Canadians, but to the scientific world at large, and the meritorious literary contributions in other branches of science afford clear indications of the ability and of the attainments of the various members. The establishment of this excellent museum, so full of objects of deep interest, reflects great credit upon this Society. Most praiseworthy are the efforts of the members to popularise the natural sciences, and most sincerely do I offer to them my congratulations on the success that has attended their undertaking.

ARTHUR.

Dr. De Sola said:

MAY IT PLEASE YOUR ROYAL HIGHNESS; LADIES AND GENTLEMEN:

The annual conversazione of the Natural History Society, always a gala season for its members, becomes especially so this evening, when we are privileged to welcome to it the honored son of our highly revered and dearly beloved Queen, on whom may God bestow many years of happiness and blessing. On so memorable an occasion in the history of this society, there devolves upon me a duty that could have been more worthily and ably discharged by another—the pleasant duty of extending to you, ladies and gentlemen, on behalf of the society, a very cordial welcome to the entertainment we are enabled to offer you. I beg to assure you that we experience a very high degree of gratification in believing that your presence on this and other occasions is intended to evince your sympathies with the objects of our society. May we be permitted to hope that these sympathies will lead you to become, instead of mere annual visitors, permanent, earnest co-labourers with us. I at least propose in a few remarks on some of the intellectual and utilitarian aspects of the study that engages us here, to show you that we have some warrant for the invitation we give you to labor with us in its great and glorious cause.

In its most extended sense Natural Science means an investigation into the laws governing, and the elements composing, the whole of God's material works; the heavens above, and the earth beneath. The boundlessness of such a field of inquiry, I could not on this occasion, more forcibly and, I trust, more appropriately, impress on you, than by quoting the words of that excellent and lamented Prince, whose like in respect to his extensive attainments in literature and science, and his judicious and successful efforts to promote them, Britain has never yet seen; who, in his life, afforded us a noble illustration of all that dignifies humanity, and in his death, left us a precious example how the time and talents God bestows on us may be most beneficially employed for the best interests of mankind. Need I say I refer to Albert the good? These are his words addressed to the British Association at Aberdeen, in 1859:—

"But in gaining new centres of light from which to direct our researches, and new and powerful means of adding to its ever increasing treasures, science approaches no nearer to the limits of its range, although travelling further and further from its original point of departure. For God's world is infinite, and the boundlessness of the universe, whose confines appear ever to retreat before our finite minds, strikes us no less with awe when, prying into the starry crowd of Heaven, we find new worlds revealed to us by every increase of the telescope, than when the microscope dicloses to us in a drop of water or an atom of dust, new worlds of life and animation, or the remains of such as have passed away."

A society such as ours has to regard Natural Science in its more limited sense. It is only from a few salient points that we can hope to penetrate a field which is not more distinguished by its boundlessness than by its variety. But in its immense variety we discover the more we advance in the study, a prevailing uniformity that speaks of plan and system. And as the astronomer has shown that the slight deviations and perturbations of the spheres in their course are, equally with the regularity of their movements, the result of fixed laws, so the scientific naturalist holds it as one of his highest duties to discover and exhibit the principle governing not merely the uniformity of structure and habits of living nature, but all those deviations from it, that at first sight seem so unaccountable and perplexing. If this be so, then, all persons of all degrees, stations and occupations, should aid in some way or other a Natural History Society. For the scientific naturalist wants facts and results of observations; and he frequently wants those facts which may appear trivial and unimportant, but which he is able by his powers of generalization to show, when connected with other facts already obtained, possess a very great value in connecting what is vague, contradictory or erroneous in his former deductions. And the contributor of these facts need not to be a scientific one. Every one with ordinary powers of observation may make important additions to the stores of scientific knowledge. Some of the most valuable contributions to Natural History have been made by unscientific travellers, who simply but faithfully described what they saw and collected. But we need not go to foreign countries to pursue our investigations; there is quite enough room for them in this Canada of ours. For not to speak of the specially interesting field we have for geological and mineralogical research, there is ample scope for observation and enquiry into the structure and vital actions of even our lowest plants and animals, not by any means thoroughly investigated; and it may be safely promised the diligent collectors among our insects and marine tribes, that their labors will not always remain unrewarded by the discovery of some species hitherto unknown, and thus valuable contributions made to an important department of natural history— the geographical distribution of animals.

The duty of acquiring and imparting knowledge from observation, though a very evident one, inasmuch as it advantages society as well as the individual, is yet one very generally neglected. We have heard of a pedagogue in a small village, who having joined a crowd anxiously engaged in watching an eclipse of the sun, and who having been asked in deference to his superior learning what was the cause of this extraordinary appearance, replied, "It is only a phenomenon." The truth seems too evident to repeat that if, when we behold anything extraordinary in nature, we check our instinctive curiosity by saying to ourselves: "It is only a phenomenon;" we shall not be one step nearer any rational knowledge of the appearance than if we had never observed it. "How many singular phenomena," exclaims the zealous naturalist, in accents of bitter regret, "how many rare and precious fossils have been lost to the world, seen by blind eyes. How many gas lamps might have trembled at sounds before a Lecomte observed under what conditions the ball-room lights responded to the tones of a violoncello."

But the study of Natural History is not merely valuable as a means of cultivating the powers of observation, but of educating all the faculties of the mind. Advancing as it does from the study of the simple to the analysis of the complex it must necessarily bring into play all those mental powers that men are called upon to exercise in all the engagements of life. "The process by which truth is attained" says Mill, "reasoning and observation, have been carried to their greatest known perfection in the physical sciences." Natural History being concerned rather with the knowledge of things than of words, can lay claim to an exactness which is not the least of its merits. Another of its advantages is, that it supplies us with great ideas of natural law and harmonious adjustment. Finally, it bestows on us a general quickness of perception, for the habits of observation it necessitates, gives to the intellect a superior aptitude of understanding and enjoying the thing observed.

Were this the occasion to dwell on the utilitarian aspects of the study, we might refer to the countless blessings it has bestowed on man in the shape of all those things essential to his wants and comforts. We might point to an improved agriculture and horticulture—to the protection of crops from the devastions of insects, to the multiplication of the ores, the coal, the useful and precious stones and metals; we might poinl to the wondrous triumphs of science applied to the arts; to the labour-saving processes which enable all to possess so cheaply the comforts and elegancies of life formerly attainable only by the very few. Especially might we point to these in the mother country, but they are not entirely absent in this Dominion, even with a sparse population of comparatively scant leisure and opportunities. For where first stood the primeval forest in which roamed only savage man and wild beasts, now rise large cities, important centres of commerce, pleasant villages and smiling hamlets; where formerly prevailed unbroken stillness and solitude is now heard the busy hum of industry, the cheerful sound of civilized man's labour in his work shops and in his factories, with his labour saving implements and machines and engines, and his countless devices for multiplying force and velocity, all originating in science and directed by science, the friend of art and the guide of industry. Where the Indian canoe slowly bore its untutored occupant in his short journeys on the bosom of our noble streams, now rides the majestic steamboat carrying its hundreds of passengers hundreds of miles, even through a night's sleep, on their errands of business, pleasure and duty; where on the banks of these streams could only be seen a few rude wigwams approached by the narrow bridle path or painful trail, now stand thousands of commodious houses and palatial mansions, everywhere connected with broad and easy roads or well furnished railways, along which rushes the mighty locomotive, so fearful in its energy and power, with its freight of human beings, and all that ministers to their wants in distant settlements, speeding on its way through tunnelled hills and mountains, over the marvellous tubular and suspension bridges that hang over gorges of dizzy depths; following the telegraph wire, along which the lightning with its proper rapidity conveys man's messages, wishes and behests; over the canals that science has substituted for rivers not navigable; along rich corn fields and beautiful gardens replete with lovely flowers, luscious fruits and perfumed exotics, all multiplied and improved by scientific culture; such are some of the results which science, applied to the arts, has obtained for us in Canada; and there is not one of her sons or daughters who may not yet aid in further developing these blessed results.

But, it is no mere material, grovelling earthly science that we laud and advocate in this Institution, but a science whose eye alternates between earth and heaven;—below, seeking the advancement and good of humanity; above, finding communion with the Great Creator and Architect of all, acquiring the fuller knowledge of wisdom and design, and adaptation and harmony everywhere displayed.

"To see in part
That all, as in some piece of art,
Is toil co-operant to an end,"

—and that end the elevation and felicity of man. Yes, the benevolence, the wisdom and the omnipotence of Him, who formed all and maintains all, are made more and more manifest to us as we advance step after step in the study of natural science. We hear the voice of God on the mighty waters, when He thundereth and when He flasheth the flames of fire that shiver the mighty cedars. We raise our eyes and we see his infinite and unapproachable wisdom displayed in the delicate adjustments and felicitous arrangements of the varied forces that astronomy reveals. We see it in the mechanical, chemical and physical properties of the atmosphere, in the effects of light and heat, in developing and fostering all the varied beautiful animal and vegetable life; in the production of cooling winds and fructifying showers. We read this testimony in the towering rocks and giant trees as in the grains of sand and petals of the flowers; in the nerves and veins and arteries which permeate this wondrous frame of ours, as in the vessels that convey the sap from the root to the leaf in the vegetable world, in short in all the countless adaptations and modifications everywhere visible, everywhere needed. And when we pass from the known to the unknown; from the revealed to the unrevealed; from the study of the stupendous and inimitable organisms, it is given us to understand, to the contemplation of the mysterious powers and qualities and forces in nature which seem almost for ever destined to baffle man's puny efforts to resolve them, we cannot fail to carry away a sentiment of the most profound humility, a deep seated conviction of the utter weakness and insignificance of our powers. Yes, from the study of nature, from this house in which it is specially cultivated, we should and we must carry into the active occupations of our lives, in our daily intercourse with our fellow beings, an earnest desire to emulate, as far as we may, the attributes of the Creator, as revealed to us by nature; to select the most comprehensive of these attributes,—benevolence, as the main spring of all our thoughts and actions; so that we may look upon all men, no matter what their origin, color or creed, as equally the objects of the one Creator's care and the one Creator's love and so that we may learn to practice that toleration for each other's cherished opinions, political or religious, that shall ever banish from amongst us the bitter wrangling of dogmatism and the rancour of sectarian strife, and shall secure among us the rule of that harmony everywhere prevalent in nature, and everywhere taught by her,—the harmony that shall prove

> "The chain of love,
> Combining all below and all above."

Principal Dawson, in a short address, rapidly epitomized the work done by the Society since its establishment, more than thirty years ago, in gathering and recording facts in Canadian natural history; also in promoting the origination of the Geological Survey, and, incidentally, in being instrumental in the founding of the Somerville course of lectures. He also pointed out in detail the peculiar functions of the Society as being, to compare small things with great, in one respect at least, somewhat analogous to those of the British association,—at least, in so far as either of them might urge on the attention of the public and the Government any opening of new paths of scientific local enquiry. It gathered facts and preserved a record of them in the "Canadian Naturalist,"—facts which would otherwise have been lost, or retained no scientific value. It had one of the most important museums in the city; and outside of its more proper sphere, it had lent its countenance and assistance to obtaining the passage of the Act for the protection of insectivorous birds, to the promotion of city sanitary effort, and to the formation of the Society for the Prevention of Cruelty to Animals. It was, however, to be regretted that Canada did not show herself more disposed to take part amongst the nations in some departments of scientific investigation; likewise, that competent zoologists and botanists were not invited to accompany the expeditions sent out by the Geological Survey, as they might do with great advantage and at a light expense.

The Chairman called on Dr. J. Baker Edwards, F.C.S., to make some remarks on

APPLIED SCIENCE, AS ILLUSTRATED IN THE USEFUL PRODUCTS OBTAINED FROM COAL.

Dr. Edwards stated that the direction of his remarks would not be towards a chemical demonstration of the miscellaneous products derived from coal, but, by the enumeration of their character and importance, to derive an encouragement for the spread of scientific knowledge throughout all classes of the community. Canada, being a country full of mineral wealth, might look to the education of the industrious classes as one of the great sources of her future wealth and importance; and although coal was not one of her mineral treasures, yet we should not fail to see that we are as much interested as consumers of its products, as if we were producers of it as a mineral. The different varieties of coal—anthracite, cannel, albertite, &c.,—were then described, and the production of coal-gas illustrated by a large diagram showing the interior of a gas works. The first product of coal, illuminating gas, being illustrated by a photometer, by which the Montreal gas was declared to be equal to 21 sperm candles, which, he believed, was superior to any in Canada, and equal to most of the large towns of the north of England, the "applied science" was to be found in the choice of suitable admixtures of coal to form the best coke as well as the best and purest gas. The use of gas as fuel, by Siemann's Regenerative Furnaces, was next described; and this mode was recommended as the most economical for any coal containing much gas; by its aid a new process for the production of soda ash was now being worked with much success in Liverpool. In the necessary purification of gas for illuminating purposes, quantities of tar and ammoniacal liquor are produced; and by the chemical treatment of the tar especially, new and valuable products are obtained. The benzole so largely employed for the solution and manufacture of rubber compounds is derived from this source, as also the asphalt of our pavements, roofing and tarpaulings. In cookery and perfumery we meet with nitro-benzole under the name of almond flavour, from which is derived aniline, the base of that beautiful series of colours well known as the aniline dyes. Important as these are in a commercial point of view, they are surpassed in social importance by the production of carbolic acid, which now stands at the head of our disinfecting agents. From this substance is also obtained a yellow dye, picric acid, which is said to possess explosive properties rivalling gun-cotton and nitro-glycerine. Finally, from the ammonia and sulphur recovered from the process, we have valuable fertilizing agents which, when returned to the soil, complete the great cycle of vegetable existence. From this brief review of the value of applied science to coal, Dr. Edwards urged the importance of the establishment of schools of technical science to supply an existing want in this community, and to enable the coming generation to develop the immense mineral resources of this rich country.

Illustrations of the luminous and chromatic properties of flame were shown after the lecture by the aid of the photometer, the electric light, the sodium light, &c.; also, the process of dyeing silk by Aniline colours.

His Royal Highness then proceeded to examine with some care the various objects in the museum, the curator pointing out any of special interest. He paid particular attention to the collection of mammals and birds, also to the series of Canadian insects, the study of entomology, particularly of the lepidoptera, seeming to have had special attractions to His Royal Highness. The company separated a little after eleven o'clock. J. F. W.

ABSTRACTS OF THE PROCEEDINGS OF THE GEOLOGICAL SOCIETY OF LONDON.

At a recent meeting of the Geological Society of London, the following communications were made, of which we present abstracts to our readers:

"Notes on some specimens of Lower-Silurian Trilobites." By E. Billings, Esq., F.G.S., Palæontologist of the Geological Survey of Canada.

The author first described a specimen of *Asaphus platycephalus*, in which the hypostome was not only preserved *in situ*, but also the remains (more or less well preserved) of eight pairs of legs, corresponding with the eight segments of the thorax, to the underside of which they had been attached. The appendages take their rise close to the central axis of each segment, and all curve forwards, and are thus most probably ambulatory rather than natatory feet. They appear to have had four or five articulations in each leg.

Three small ovate tubercles on the pygidium may, perhaps, indicate the processes by which the respiratory feet were attached.

Mr. Billings referred to the large number of Trilobites which have been examined, and expressed his belief that only the most perfectly preserved specimens are likely to have the organs on the underside preserved.

Mr. Billings next described the doublure or pleura in the Trilobites, comparing it to that of *Limulus*. He then proceeded to describe a row of small scars and tubercles on the underside of the pleuræ, to which both Dr. Volborth and Dr. Eichwald believed soft swimming feet or hard horny legs had been attached. As these were first seen by Dr. Pander in a Russian Trilobite, Mr. Billings has called them "Panderian organs." He thinks, soft natatory appendages may have been attached to these scars.

Mr. Billings directed attention to the *Protichnites* and *Climactichnites*, which he thinks may now be referred to *Crustacea*, belonging to the division *Trilobita*.

Finally, Mr. Billings described a section of a rolled-up *Cymene senaria*, the interior cavity of which appears to be full of minute ovate bodies, from 1-80th to 1-100th of an inch in diameter.—These small ovate bodies the author believes to be eggs.

"Note on the palpus and other appendages of *Asaphus*, from the Trenton Limestone, in the British Museum." By Henry Woodward, Esq., F.G.S., F.Z.S.

Mr. Woodward, when comparing the Trilobite sent over by Mr. Billings with specimens in the British Museum, presented by Dr. J. J. Bigsby, F.R.S., discovered upon the eroded upper surface of one of these, not only the hypostome exposed to view, but also three pairs of appendages, and what he believes to be the palpus of one of the maxillæ. This furnishes an additional fact to Mr. Billings's most interesting discovery, besides confirming its correctness.

Mr. Woodward considers the so-called "Panderian organs" to be only the fulcral points upon which the pleuræ move, and showed that such structures exist in most recent Crustacea.

He considered that the evidence tended to place the Trilobita near to, if not in, the Isopoda Normalia.

He remarked that the prominence of the hypostome reminded one strongly of that organ in *Apus*, and suggested that we might fairly expect to find that the Trilobita represented a more generalized type of structure than their representatives at the present day, the modern Isopoda.

Discussion.

Mr. Woodward had carefully examined Mr. Billings's specimen, and agreed with him in considering that there was undoubted evidence of the presence of walking-appendages under the thorax.

The presence of such limbs might *à priori* have been expected; and the nature of the test suggested that Trilobites were walking rather than swimming forms of Isopods. The branchiæ had probably been under the telson; and this would account for its large development. It was not more surprising to find highly organized Trilobites than it was to find such highly organized crustaceans as *Pterygotus*, *Eurypterus* and *Slimonia* in the same beds.

Prof. Rupert Jones, Principal Dawson, and Sir Wm. Logan made some remarks, more especially on Protichnites and Climactichnites, the latter having been explained as galleries of Crustacea by Prof. Jones, when first exhibited in England.

"Notes on the Geology of Arisaig, Nova Scotia." By the Rev. D. Honeyman, D.C.L., F.G.S.

The author referred to a previous paper on the Upper Silurian Rocks of Nova Scotia, which he stated appeared to him now to be generally repetitions of his Arisaig series. He noticed the occurrence of fossils in one of the beds previously supposed to be almost destitute of organic remains, and described the occurrence, in Arisaig township, of a band of crystalline rocks which appeared to contain *Eozoon* and were probably of Laurentian age. A note from Prof. Rupert Jones, giving an account of the fossils referred to by Dr. Honeyman, was also read.

Discussion.

Sir W. Logan said that Dr. Hunt had seen the specimens of serpentinous limestone, and considered that they might be Laurentian. Sections of them appeared to Dr. Dawson to show tubulation rather different from that found in Laurentian *Eozoon*. They might, therefore, belong to a different age.

The following among other specimens were exhibited to the Meeting:--

Specimens of *Sigillaria*, Calamites, etc.; exhibited by Principal Dawson.

Specimens of Trilobites; exhibited by E. Billings, Esq.

REVIEWS AND NOTICES OF BOOKS.

DISINFECTANTS AND DISINFECTION, BY R. A. SMITH, PH.D., F.R.S.—(*Continued from No. 2, page 228.*)—A large portion of the experimental and original investigations of our author were made by Royal Commission, in conjunction with Professor Crookes, F.R.S., in an enquiry into the nature of and remedy for the Cattle Plague of 1865-66.

A subject of so great national and world-wide importance demanded the closest scientific scrutiny;—and whilst, on the one hand, the microscope was made the instrument of valuable information as to the cause of the disease, (viz: the existence of organic spores in the atmosphere which attended the outbreak and marked the duration of the disease); the materials of disinfection which proved most valuable, after a long series of experiments, were, as already indicated, the Tar Acids—in the form of Carbolic Acid, and as Carbolate of Lime.*

In referring to tar and its accompanying products, our author treats us to a very learned and interesting historic review, (pp. 8-17) and enters into the chemical history of "tar acids," (page 59). By the distillation of wood tar, we obtain *creosote* and *acetic acid* (vinegar). By the distillation of coal tar, we produce *carbolic* and *cresylic acids*.

Of *creosote* we know—that it kills and preserves from decay, insects, fishes, and animals, that it stops the flow of blood in man, and preserves flesh from decay.

In the *coal tar acids*—we find some differences. Carbolic acid is poisonous, but less so than creosote. It coagulates, but does not stop bleeding. It exercises preserving and antiputrescent powers in wonderfully dilute solutions. The action of the tar acids our author thus explains (page 62) :—"There is neither "life nor decay without motion. Tar acids arrest that motion "which takes place in decay. They are, therefore, antiseptic— "they antisept. As soon as the decay ceases, the putrid gases "cease to arise. The acids are, therefore, disinfectant. They

* Misprinted "Carbonic Acid" and "Carbonate of Lime" in the former notice.

" prevent oxidation of organic, but not of inorganic substances; " they will not prevent iron from rusting."

Pettenkofer states that "they arrest, but do not destroy fermentation." This seems, however, to depend greatly on the strength of the acids used, and the conclusion drawn by the author is that all vital action may be destroyed by strong acids, and that in various degrees of dilution they are more or less potent on the lower organisms—both animal and vegetable. Experiments made by Mr. Crookes showed that a solution containing 1 per cent of carbolic acid:—1° preserved meat with fresh odour; 2° preserved gut skin, size, and glue; 3° stopped the fermentation of yeast in a saccharine solution; 4° killed cheese-mites, infusoria fish, caterpillars, beetles, and gnats.

Cresylic acid, which accompanies carbolic acid, is also a powerful antiseptic, and has much less coagulating power over albumen, than carbolic acid. It has a stronger smell, bears greater dilution, and is probably a more powerful disinfectant than carbolic acid, and better adapted for injection into the veins of diseased animals—a process which was found of great service during the Cattle Plague.

"Petroleum is a very poor disinfectant compared to tar acids. " Probably it contains a little either of carbolic acid or of some " allied compound, to which it owes all its disinfecting power. " Tar oils which most resemble petroleum have also a weak disin- " fecting power; but, when the acids are washed out by water, " there is no disinfecting power remaining."

Lime is a good disinfectant, but very weak. As it is, however, cheap and abundant, it is an excellent auxilliary, especially applied as lime-wash to the walls of buildings. It is, certainly, greatly raised in value by admixture with carbolic acid, which is thus retained in contact with large surfaces of air which it completely disinfects. The process, however, needs frequent repetition, if the generation of air poisons be continuous, as in stables, cattle sheds, or slaughter-houses.

After consideration of the several metallic salts, which have been recommended as disinfectants, (of which our author forms a less favourable opinion than of the tar acids,) attention is called to the necessary removal of manure and refuse by water-closets and sewers, earth closets and middens. Of the first he says:— " The water-closet system is a great luxury, unquestionably, but " like all other luxuries, it is taxed. * * * It is the very "symbol of abundance and extravagance. The mechanism must "be very excellent, and, with the best, a little chemical assistance "from disinfectants is often needful. Water-closets which are "not carefully attended to are unsafe. It is an immense advance "upon the old cess-pools, which were found after much loss of "life to be manufactures of disease of the most active nature. "But unless we get good sewers, we have similar evils from the "water system. 'There are sewers and sewers.' The liquid "matter, when neither removed rapidly, nor disinfected, is our "old enemy, the cess-pool, with a territory extending miles long "instead of feet. The midden is better than the bad sewer. I "believe we shall never see the extinction of either middens or "water-closets; we may remedy some of the evils. To allow "bad air to form in the sewers, and then draw it into the houses, "or permit it to rush into the streets, is bad engineering. The "sewers may be ventilated, and filtered through charcoal; or the "formation of bad air may be prevented by a proper use of disin- "fectants." On the earth closet question, our author remarks:— "One may very correctly look upon the soil as the greatest agent "for purifying and disinfecting. Disinfection by its means is per- "fect so long as the decomposing matter can be perfectly dried "up by it; but, should moisture be in excess, a dangerous "condition of malaria is apt to ensue." Admitting the conditions which Mr. Moule lays down, viz., two cwt. of dry earth per week for six persons, he says:—"Nobody can doubt the disinfecting "power of the soil, and certainly, Mr. Moule has found a mode "of applying it in many cases."

The author's treatise is rendered especially valuable by a series of original experiments on the comparative power of disinfectants, which are expressed in a tabular form, for which our space is too limited. The objects of the experiments, however, may be thus stated:—

1st. To show the amount of gas evolved when the disinfectants act on organic substances in water.

2nd. To show the amount of certain disinfectants required to prevent the evolution of sulphuretted hydrogen.

3rd. Amount of certain disinfectants required to remove putrid smells.

4th. Influence of volatile substances in preventing putrefaction.

5th. Comparative power of antiseptics in preserving meat.

6th. The antiseptic effects of certain gases on flesh.

The value of air and water are then considered, as the great natural disinfectants. Air, especially ozonized air, is a most powerful disinfectant; and the use of water in the bath is advocated and lauded in the following quotation from Martial, "The Joys of a Life in the Water":

"Baiæ, the prince of watering-places,
Somehow the weather's always fine;
The light is long, and the day's decline
Is very slow, and 'going away'
Are words one never thinks to say.
Rocks with all beauties there abound
Cut out of many a distant ground;
Warm breathing onyx fat and fine,
And various-coloured serpentine.
If hot Laconian vapours please,
Here lie, though melting, at your ease;
Two streams supply you all you crave,
The Virgo and the Marcian wave,
Water so bright and clear and fair,
You think no liquid can be there."

The comparative value of disinfectants to *prevent decomposition* of organic matter, *i.e.*, as antiseptics, is thus given:

		COST.
100″	Common Salt	1.0
7″	Cresylic Acid	4.9
23″.2	Chloride of Lime	7.0
9″.3	Carbolic Acid	14.0

Special directions are given for the best mode of preserving cattle skins, horn tips, salted and dry cattle-gut, melted tallow in casks, cows' hair, pigs' bristles, sheep's wool, fresh bones, skins and guts, raw flesh, wagons, platforms, cattle-pens, and ships.

On the general subject of disinfection our author wisely remarks:—"It is a very complicated problem. Disinfection is "not a magic act, performed by a small piece of a substance, "which removes all evils at once. There are many evils in various "conditions, and each must be attacked in its own peculiar mode. "People must use their reason. Everyone must pick out the "cheapest and most convenient disinfectant, according to the "circumstances of the case. Chloride of lime destroys smells "rapidly; Condy's fluid, ditto, and is itself without smell. Tar "acids (carbolic and cresylic) are good for continuous action, "especially for closets and the open air. Burnett's fluid, for "preserving moist bodies long."—(pp. 133-134).

The work is eminently practical and suggestive. Perhaps it would be more acceptable to the public if it had been more dogmatic and positive in its generalizations. It is a valuable accumulation of facts carefully chronicled, and we may hope that some Liebig will arise to give us the great deductions which are involved in this most important subject—which are still "desiderata." J. B. E.

PROTOPLASM; OR, LIFE, MATTER, AND MIND. By Lionel S. Beale, M.D., F.R.S. 2nd Edition. London: Churchill, 1870. —We have only to state in reference to this the second edition of Dr. Beale's interesting book, that it is much enlarged and contains a new section on the Mind. It is an able display of the author's well-known views in reference to the early development of the tissues, and embraces an attempt to apply these views to some of the problems, half physical, half metaphysical, which of late years have attracted the attention of thinking biologist. Whatever opinions may be held as to the dispute between Dr. Beale and Mr. Huxley, it is certain that the volume itself is full of interest both to the microscopist and the ordinary educated man.—*Monthly Microscopical Journal.*

THE CELL-DOCTRINE: ITS HISTORY AND PRESENT STATE, &c. Jy James Tyson, M.D., Lecturer on Microscopy in the University of Pennsylvania. Philadelphia: Lyndsay & Blakiston, 1870.—It is surprising how very little is known by medical men generally of the arguments for and against the cell-doctrine of Schwann and Schleiden. Notwithstanding the admirable essay published by Professor Huxley many years since in the 'Medico-Chirurgical Review,' and the numerous fine memoirs which Dr. Beale has given from time to time, it is still a fact that very few know how the question as to the mode of origin of the tissues now stands. It was to meet this want, and, at the same time, to help to promulgate Dr. Beale's views, that the author of the present volume prepared this treatise.—*Monthly Micro. Journal.*

GEOLOGY AND MINERALOGY.

At a meeting of the Geological Society of London, held December 22nd, 1869, the following papers were read:

NOTES ON THE STRUCTURE OF SIGILLARIA, by Principal Dawson, F.R.S., F.G.S., Montreal.—In this paper the author criticised the statements of Mr. Carruthers on the structure of Sigillaria (see Q. J. G. S. xxv. p. 248). He remarked that Sigillaria, as evidenced by his specimens, is not coniferous; that the coniferous trunks found in the coal-formation of *Nova Scotia do not* present discigerous tissue of the same type as that of Sigillaria; that no Conifer has a slender woody axis surrounded by an enormously thick bark; that Calamodendron was probably a Gymnosperm, and allied to Sigillaria; that although Stigmaria may not always show medullary rays, the distinct separation of the wood into wedges is an evidence of their having existed; that the difference in minute structure between Sigillaria and Stigmaria involves no serious difficulty if the former be regarded as allied to Cycadaceæ; and further, that we do not know how many of the Stigmariæ belong to Sigillaria proper, or Favularia, or to such forms as Clathraria and Leioderma, which *may have been more* nearly allied to Lepidophloios; that the fruit figured by Goldenberg as that of Sigillaria is more probably that of Lepidophloios, or may be a male catkin with pollen; and that he has found Trigonocarpa scattered around the trunks of Sigillariæ, and on the surface of the soil on which they grew. He agreed with Mr. Carruthers in regarding Mr. Binney's *Sigillaria vascularis* as allied to Lepidodendron.

Discussion.—Professor Morris thought that Clathraria and Lepidophloios ought to be discriminated from the Sigillariæ, as being rather more nearly allied with cycadaceous plants, especially the former. He pointed out the maner in which certain vascular bundles communicating between the centre of the stem of Sigillaria and allied genera and their bark might be mistaken for medullary rays.

NOTE ON SOME NEW ANIMAL REMAINS FROM THE CARBONIFEROUS AND DEVONIAN OF CANADA, by Principal Dawson, F.R.S., F.G.S., Montreal.—The author described the characters presented by the lower jaw of an Amphibian, of which a cast had occurred in the coarse sandstone of the coal-formation between Ragged Reef and the Joggins Coal-mine. It measured 6 inches in length; its surface was marked on the lower and posterior part with a network of ridges inclosing rounded depressions. The anterior part of the jaw had contained about 16 teeth, some of which remained in the matrix. These were stout, conical, and blunt, with large pulp-cavities, and about 32 longitudinal striæ, corresponding to the same number of folds of dentine. The author stated that this jaw resembled most closely those of Baphetes and Dendrerpeton, but more especially the former. He regarded it as distinct from *Baphetes planiceps*, and proposed for it the name of *B. minor*. If distinct, this raises the number of species of Amphibia from the Coal-measure of Nova Scotia to nine. The author also noticed some insect remains found by him in slabs containing Sphenophyllum. They were referred by Mr. Scudder to the Blattariæ. From the Devonian beds of Gaspé the author stated that he had obtained a small species of Cephalaspis, the first yet detected in America. With it were spines of Machairacanthus and remains of some other fishes. At Gaspé he had also obtained a new species or variety of Psilophyton, several trunks of Prototaxites, and a species of Cyclostigma.

Discussion.—The president objected to the term Reptiles being applied to Amphibia, from which they were totally distinct. He questioned the safety of attributing the jaw to Baphetes, of which no lower jaw had been previously found. Mr. Etheridge remarked that the Cephalaspis differed materially in its proportions from any in either the Russian or British rocks.

BOTANY AND ZOOLOGY.

North American Laminariaceæ.—At a late meeting of the Nova Scotian Institute, Prof. Lawson read a short paper on this group of sea weeds, of which we give an abstract. He commenced by stating that although many subjects interesting to science had been the objects of study to members of the Institute, yet that the Laminariaceæ of our coast and harbors had been entirely neglected; and he expressed a hope that some of them would qualify to supply the omission. The study had long engaged the earnest attention of celebrated naturalists. He enumerated the following species, which are fully described in Dr. Harvey's *Nereis Boreali-Americana.*

Alaria esculenta—On rocks about low water mark, extending south to Cape Cod.

A. Pylaii.—On rocks near low water mark, Newfoundland.

Laminaria Fascia.—A very small and delicate plant, only a few inches in length, found in Halifax harbor, on rocks and stones near low water mark by Prof. Harvey—widely distributed—occurring not only at Halifax and on the New York coast, but also on the Atlantic and Mediterranean shores of Europe, and at the Falkland Islands. Specimens of the allied *L. debilis* were shown from Kutzing.

L. lorea.—Shores of Newfoundland.

L. dermatodea.—On rocks at and below low water mark, Newfoundland.

L. saccharina.—At and below low water mark. Harvey gives it as common on rocky shores from Greenland to New York, and cast up from deeper water on the New Jersey coast. Prof. Lawson has a specimen collected by Dr. Rae at Montreal Island.

L. longicruris.—Abundant below low water mark along the shores of Halifax harbor, at Point Pleasant and around the wharves at the city. The species abounds along the shores from Greenland to Cape Cod, and occurs in Newfoundland. It occurs likewise in Europe, but there the range is quite northern as it scarcely extends beyond the limits of the Arctic Sea, whence ragged fragments are sometimes drifted upon the Northern coasts of Scotland and Ireland. Its reported occurrence in the Bahama Islands is probably a mistake.

L. trilaminata.—Found floating near Narragansett, Rhode Island; it is probably an abnormal form of *L. saccharina.*

L. digitata.—On rocks at and below low water mark, common as far as Cape Cod. Dr. Harvey's impression that possibly more than one species is confounded under this name should induce observers to examine the numerous forms with much care.

Agarum Turneri.—The species of Agarum differ notably from Laminaria in the flat frond being pierced throughout with holes, hence the common name, Sea Colander, by which they are known. This species grows below low water mark, and is thrown up in quantities by southern gales at Point Pleasant. It extends from Greenland to Cape Cod, and has likewise been collected on the coast of Russian America, but it is unknown on the European shores.

A. pertusum.—Newfoundland. This plant is distinguished by its less regularly shaped and smaller and fewer perforations..

Chorda filum.—The frond is of great length attached by a small disc and very slender at the base, thickening towards the middle, and again attenuating. It is often so long that when taken out of the water it ressembles a fishing line. It occurs between tide marks and extends into deep water, and is often abundant.

C. lomentaria.—Extends from our coast south to Charleston, S. C.

Dr. Lawson, in conclusion, read a letter from Dr. A. F. Le-Jolis, of Cherbourg, France, in which he states—that he is engaged in a monograph of the whole group of the Laminariaceæ, that for such a study materials are never too numerous, and that he would be happy to receive a fresh supply of specimens from North America. He asks Dr. Lawson's help, and that he would interest his friends in his favour. It is not necessary that the specimens be prepared for the herbarium. On the contrary, he had rather they were coarsely dried. without being washed in fresh water or compressed. The parcels may be addressed to him, and sent by any vessel sailing for France, or, if convenient, through the steam packets from New York to Hamburg, which stop at Cherbourg on their return from America.—*Newspaper Report.*

THE DIFFUSION OF PLANTS.—Prof. Delpino, of Florence, has published some interesting researches on the relation between the diffusion of plants and animals. The life of every plant has three principal objects: its nourishment, its reproduction and the distribution of its seeds; for each of these three objects special bio logical conditions being requisite. The fertilisation of many plants can be effected only by some particular animal: as *Arum italicum*, *Aristolochia*, and *Asarum*, by gnats; the fig tribe by different species of *Cynips* (or gall-fly); *Arum dracunculus*, *Stapelia*, and *Rafflesia*, by blue-bottle flies; many others by different kinds of flies or bee-like insects (*Hymenoptera*), and some even by small birds belonging to the family of *Trochilida*, or humming-birds; *Rosa*, *Paonia*, and *Magnolia*, *grandiflora*, by beetles of the chafer tribe; others again by small slugs. If in any particular locality the animal necessary for the fertilisation of a particular plant is absent, it is certain that the plant cannot spread; and thus the conditions for the diffusion of plants are dependent on the geographical distribution of animals. A remarkable illustration is furnished by two plants belonging to the same genus, grown in the botanic gardens in Italy, *Lobelia syphilitica* and *L. fulgens*; the flowers of the former are abundantly visited by *Bombris terrestris* and *italicus*, and freely produce seeds; the latter, notwithstanding its beauty and its great store of honey, is never visited by insects in the neighbourhood of Florence, and never bears seeds spontaneously, but can be readily fertilized by artificial impregnation. Prof. Delpino conjectures that it is naturally fertilised by humming-birds. He believes that the scarlet colour of the corolla, so common in the tropics, but comparatively rare with us, is especially attractive to small birds, but offensive rather than otherwise to *Hymenoptera*. As a rule, scarlet flowers are large, bag-like in form, horizontal in position, and with the nectar completely separated, which would of itself perfectly prevent their fertilisation by insects. The largest European flowers, such as the pæony and large bird-weed (*Convolvulus sepium*) are fertilised by sphinxes and rose-chafers.—*Botanishe Zeitung*.

NATIONAL MUSEUM OF BOHEMIA, Nov. 24, 1869.—M. T. Palacky explained his views of the botanical geography of Asia. M. Grisebach has recently divided Asia into four botanical provinces: (1) Western, or that of the Steppes; (2) Eastern, or Chinese; (3) Boreal, or Siberian; and (4) Southern, or that of India. M. Palachy admits only two provinces—the one Southern, the other Boreal—including in the latter the whole of Asia beyond the Himalayas, because the first three provinces of M. Grisebach do not appear to him to differ more from one another in regard to their flora than the sub-provinces of each do. The author lays special stress upon the tropical species inhabiting China—where they are not arrested by the steppes—as far north as Pekin, and even as the Amoor. According to M. Palachy, the existing flora of Central Asia is an invasion of the Mediterranean flora which took place after the elevation of the Turcoman plateau in place of the ancient post-tertiary sea between Europe and Asia. The principal obstacle in the way of researches connected with botanical geography, is the diversity of the views adopted by various botanists; one species of Hooker, Wallich and others being equivalent to at least twenty-five species of Maximowicz, Ruprecht and most of the German botanists.—*Nature*, No. 9.

NOTES ON CANADIAN BIRDS.—The occurrence of the following rare birds in Lower Canada deserves placing on record.

Falco Candicans, Gmelin. The American Jer Falcon.—The Rev. D. Anderson, M.A., of Point Levis, an acute ornithologist, informs the writer that he has in his collection an adult specimen of this rare species, which was shot on the north shore of the St. Lawrence, near the Bay of Seven Islands.

Mr. Hancock has shewn that there are two species of Gyr-falcon, both of which are now included in the list of American birds. It is just possible that the specimens described by the late Dr. Hall as *Falco Dawsonis* (this Journal, Vol. 7, page 62), are the young of the American Jer falcon.

Nyctale albifrons, Shaw. The White fronted or Kirtland's Owl.—A specimen of this scarce species was procured by the Rev. D. Anderson, which was shot at a place called Breakey's Mills, about six miles from the mouth of the Chaudiere river, near Quebec.

Cardinalis Virginianus, Bonaparte. The Summer Red Bird.—In the early part of June, 1862, Mr. W. Hunter saw two individuals of this species on Montreal mountain, one of which is now in his possession. It seems to be of rare occurrence, at least in Lower Canada.

J. F. W.

LOWER CANADIAN LAND AND FRESH WATER MOLLUSCA.—Since the publication of my paper on the above subject, a few additional species have been found in Lower Canada, as follows:

Bithinia tentaculata, Linn. This common European species has been found *living* in the Lachine canal, by Mr. G. T. Kennedy. According to Mr. G. W. Binney, this shell has been taken in Greenland.

Helix Morsei (?), Tryon. Montreal mountain. Mr. R. J. Fowler.

Helix (Pseudohyalina) exigua, Stimpson. West Farnham, P. Q. Mr. R. J. Fowler.

Helix (*Punctum*) *minutissimum*, Lea. Same locality and collector as for the preceding species.

NOTES ON OTHER SPECIES.—*Valvata humeralis* (?), Say. (*Can. Nat.*, Vol. 8, page 102.) Though this may not be the true *Humeralis* of Say, in my judgment the shells in question are perfectly distinct from any varieties of *V. tricarinata*, or of *V. sincera*. Mr. Binney refers them to the former, and the late Dr. Gould, to whom I sent specimens, to the latter species. Dr. Lea referred them doubtfully to *V. humeralis*. Our shells are covered with a thickish olivaceous epidermis, and are strongly transversely ribbed.

Planorbis macrostomus. Probably it would be better to unite this form, together with the Pl. trivolvis, lentus and corpulentus of Say, under the general name of Pl. trivolvis, Say.

Helix exoleta, Say, so far as I am aware, does not occur in Lower Canada. Prof. Bell's specimens, said by him to have been determined by Mr. Binney, are all *H. dentifera*, Binney.

Pupa simplex, Gould. The shells catalogued under this name, are all *Pupa badia*, C. B. Adams. J. F. W.

LOWER CANADIAN MARINE MOLLUSCA.—Since the appearance of my paper on dredging in Gaspé, in vol. iv., p. 270 of the new series of this journal, a few species of shells, which I had no means of identifying in Montreal, have been sent to Mr. J. G. Jeffreys, F.R.S., etc., for identification. Having been compared with specimens named by Moller, Mr. Jeffreys recognizes the following species, which must now be added to our list of Lower Canadian marine molluscs:—

Utriculus turritus, Moller.	*Bela Pingelii*, Moller.
Rissoa scrobiculata, Moller.	*Bela impressa*, Beck.

The shell supposed by me to be *Philine lineolata*, Gouth., Mr. Jeffreys informs me, is *Philine lima*, Brown. In like manner, the Margarita I referred to Gould's *M. argentata*, is *M. Glauca*, Moller, sp.; and the species queried as *Diaphana debilis*, Gould, is probably *Utriculus hyalinus*. J. F. W.

SWISS MAMMALIA.—M. Fatio gives the number of mammals inhabiting Switzerland in the wild state—that is, excluding the cat, dog, horse, ass, ox, sheep, and goat—as fifty-eight, or as sixty-one, if the rabbit (which is not indigenous, but has been imported of late years) be reckoned, and the two minute forms, *Sorex pygmæus* and *Mus minutus*, which have been said to occur, but which M. Fatio has not himself succeeded in finding. This list does not include the ibex, the stag, or the *Mus agrarius*, which have become extinct. Some mammals which occur in adjoining countries are remarkable for their absence in Switzerland: thus, the two bats, *Rhinolophus clivosus* and *R. Euryale*, which occur in Lombardy, *Mus agrarius*, occurring near the Rhine on the north, and by Como to the south, *Arvicola subterraneus*, also found near the Rhine, and *A. Savii*, found in Lombardy, are not met with in Switzerland.

M. Fatio has increased the catalogue of Swiss mammals, as given by some of his predecessors, by the addition of nine species of bats, two insectivora, and four rodents, one of which is considered a new species altogether.

This new species of M. Fatio, is a little black mouse, very much like the common house mouse (*Mus musculus*). but having a very dark black-coloured fur; the two presenting much the same contrast as do the *Mus rattus* and *Mus Alexandrinus*, which M. Fatio agrees with M. Arthur de l'Isle in considering one and the same species. The new mouse, however, which is called *Mus Poschiavinus*, from the locality where it was observed, presents more important differences when compared with *Mus musculus* than those of colour and proportion only. The palatine ridges in *M. Poschiavinus* are *four* in number, in place of *five* in the common species, and the anterior simple ridges are of a different form.

The strange thing about this little black mouse, which is found at Poschiavo in the Grisons, is that it lives on tobacco. It was first noticed in a tobacco-factory, and was found to make great ravages among the stores of the nicotian weed. When first caught, M. Fatio thought he had possibly got hold of young specimens of the black rat, but subsequently he obtained specimens bearing evident signs of maturity. It does not appear to have suggested itself to M. Fatio's mind, that his *Mus Poschiavinus* may be only a sample of the deleterious effect of indulgence in the noxious herb to which these rodents are addicted. What if this new black mouse is but a stunted race of the black rat? It would furnish an invaluable argument to the anti-tobacconists.

A very pretty coloured plate, representing two Poschiavinian mice helping themselves to cigars, illustrates the description of this species. It is not a little remarkable that an animal should normally feed on tobacco. Monkeys, as is well known to the frequenters of menageries, are exceedingly fond of the end of a cigar, and an elephant has been seen gravely to accept such an offering; but one would have supposed that the amount of nicotine in a pinch of snuff was enough to make a mouse unwell. The indifference of these mice to the toxic action of tobacco, calls to mind the similar indifference on the part of pigeons (rodents are like birds in many things) to the toxic action of opium in the largest doses, as lately noticed by Dr. Weir Michell.

Among the rarer and more interesting forms noticed by M. Fatio as still existing, or as having existed—for he notices the contents of the quaternary deposits in Switzerland—are the Bear (*Ursus arctos*), the Wolf (*Canis lupus*), the Wild Cat (*Felis catus*), the Lynx (*Felis lynx*), the Bouquetin or Ibex (*Capra ibex*), the Chamois (*Capella rufricapra*), and the Stag (*Cervus elaphus*). With regard to this last, it appears that, eighty years since, very fine specimens inhabited the Swiss valleys; now it only appears when driven from the German forests lying to the north; its remains are found in quaternary deposits. The fallow-deer is represented neither in the present nor in the quaternary fauna; the Roebuck, or Chevreuil, is the only cervine species still inhabiting the country. Wolves, lynxes, and wild cats are not uncommon in the forests of the Jura; but the lynx has not been found in the quaternary deposits, which is noteworthy, since Dr. Ransom, of Nottingham, has found it in England in such beds.

The bear is commonest in the Grisons; every year there is some bear-hunting to be done in these wild and elevated valleys. The ibex, though no longer found in the Swiss Alps, occurs in the immediately adjacent territory of Lombardy; where, however, it is now strictly preserved. The ibex of the Alps, of the Pyrenees, of Siberia, and of Crete, each have very distinctive characters, in the direction and length of their horns, but are hardly to be considered as distinct species. Some naturalists, however, distinguish a second species in Spain, as *Ægyceros Hispanicus*, occurring farther south than the so-called *Ægyceros Pyrenaicus*. The domesticated *Capra hircus*, has no doubt largely taken the place of the indigenous ibex; natural hybrids between the two are not uncommon. The industrious Swiss have sometimes exhibited to curious tourists an eccentric specimen of the common goat as a living idex. M. Fatio mentions such an instance, which may put naturalist travellers on their guard. A specimen presented by the King of Italy may be seen in the Zoological Gardens, Regent's Park. The chamois are still very numerous in Switzerland, though the large herds of eighty and a hundred, which used to be seen in past times, are not now met with. A certain amount of care is exercised now in regard to the time of hunting, and the animals are allowed to breed in security, so that they are on the increase in localities where they had become scarce. M. Fatio mentions an old hunter who boasted of having killed as many as 3,000 chamois.

The Alpine marmot, which is so common and so well known to Alpine tourists, is not the mammal which attains the highest elevation of habitat in Switzerland; another little rodent, the *Arvicola nivalis*, has that distinguished honour, living at a greater altitude than any other European mammal.

Both this species and the marmot live among tho oases of rock and herbage which stand out amidst the vast masses of mountain ice. The Bobac marmot does not occur in Switzerland, being confined to the north-eastern districts of Europe. The Alpine marmot inhabits the Carpathians and the Pyrenees, as well as the Alps.—*From a Review of Dr. V. Fatio's Faune des Vertebres de la Suisse. Part I. Mammals. By Dr. E. Ray Lankester, in "Nature."*

The Use of Birds and Worms.—Worms and birds are great friends to grass-turf. Where there are plenty of blackbirds and thrushes you will generally find the grass to thrive. No doubt the reason is that these cheerful creatures, like other cheerful creatures, have a desire to be useful. They know they cannot live upon song, and they cannot live by singing, for no one ever thinks of paying them for their merry minstrelsy; so they work for their crust, and on the grass find wireworms, slugs, snails and leather-jackets; the last named being the destructive grub, or the "Daddy Long-legs," the most outrageous destroyer of grass in the world. As to earth-worms, if you drive them out of your lawn, you must expect the grass to die. They are the cultivators of it. For any other crop we dig and manure constantly. For grass, we, as a rule, do neither. But we cut down a crop of it now and then, and carry it away. Now the worms dig and manure; that is to say, they bore holes and throw up common soil in little heaps, and in time will reverse the order of all the articles of the top crust.—*Gardener's Magazine.*

Uses of the Cockchafer.—" Through the columns of the *Moniteur Scientifique* we learn that nothing can be better to grease machinery with, and prepare salad, than cockchafer oil. In Prussia the people have reached the advanced stage of making cockchafer flour, which, at present, is only used for the purpose of making cakes for young pheasants, partridges, and quails. In this country (France) an attempt has been made to introduce the white worm or larva of the cockchafer into the kitchen, as a substitute for the snail; but gentlemen who are voracious when *Helix pomatia* is concerned, turn up their noses at the grub of *Melolontha vulgaris.* A servant of the name of Jonglet, proposes to extract from the cockchafer colouring matter, which, it is said, will make rapid strides in industry, and create a small revolution in the commercial world. He states that he can get yellow out of the obnoxious insect of a colour between chromium and gold,—and that each insect yields a few centigrammes. Several specimens of silk, dyed with this new colour, have been exhibited and much admired. Taken all in all, the cockchafer, what with the amount of manure he furnishes when slain in proper quantities, and the uses above mentioned, stands a fair chance of being classed as a valuable insect, and some day we may hear philanthropic persons calling out against its wanton destruction."—*Land and Water.*

The *Melolontha vulgaris* of Europe is represented in Canada by *Lachnosterna fusca,* commonly called the May bug. In reference to the appearance of this creature, we may state, that it occurs in immense numbers every three years; at least, such is our experience since 1855. The years 1858, 1861, 1864, and 1867, are those when this insect appeared in greatest numbers, and in 1870 we shall probably have another visitation of cockchafers. It must not be inferred from the above statement that no examples of these insects occurred in the intervening years, for it is always a common species in Canada. But there are years when certain species prevail in such numbers as to be noticed by everybody. One reason why the cockchafer should be tri-yearly may be owing to the circumstance that it remains in the larva state for three years. Here, then, an opportunity occurs for testing some of the alleged practical uses to which these insects may be put. A. S. R.

TOMATO-WORMS NOT POISONOUS.—The Tomato-worm belongs to an extensive group (the *Sphinx* family), almost all of which have a stiff pointed horn growing out of their tails—a merely ornamental appendage, such as those which are distributed in considerable numbers over the body of another magnificent larva which we illustrated some time since. Why or wherefore it is impossible to say, but this poor unfortunate Tomato-worm has been selected by the popular voice, out of about fifty others belonging to the same family, and found within the limits of the United States—all of which have a similar horn growing out of their tails,—to be falsely accused of using this horn as a sting. The Tomato-worm and the Tobacco-worm are as like as two peas, and produce moths which resemble each other so closely, that entomologists for a long time confounded them together. Each has exactly the same kind of horn growing on the hinder extremity of its body; yet while the Tomato-worm is generally accused of stinging folks with his horn, nobody, so far as we are aware, ever yet said that the Tobacco-worm would or could do so. The real truth of the matter is that neither of them can sting, either with his tail or with his head, or with any part of its body. Yet not a season elapses but the newspapers publish horrible accounts of people being stung to death by Tomato-worms, and earnestly recommended those who gather tomatoes to wear heavy buckskin gloves. These stories, however, have been contradicted so flatly and so often, that latterly the penny-a-liners have struck off upon another tack. Tomato-worms, it appears, do not sting with the horn that grows on their tails, but they "eject with great violence a green caustic fluid from their mouths to a distance of from 3 to 15 in."! Now, what is the real truth about this matter? Tomato-worms do really discharge from their mouths, when roughly handled, a greenish fluid, and so do the larva of almost all moths, and so does every species of grasshopper with which we are acquainted, and so do many different kinds of beetles. But it is not true that they can spit out this fluid even to the distance of a quarter of an inch, much less to the distance of 15 or even of 3 in.; and especially it is not true that the fluid is poisonous. If it were so, we should have been in our graves long ago; for we have had it repeatedly daubed over our fingers, but without the least ill effects therefrom, and so have scores of other entomologists in this country. The strangest thing of all is, that of two worms almost exactly alike, one of which eats tomato-leaves, and the other eats tobacco-leaves, the tomato-chewer should be accused of spitting, and the tobacco-chewer should be held to be guiltless of this offensive practice. Now, then, gentlemen of the public press, if tomato-worms neither sting nor spit, what is the next charge that you are going to bring against them? Why not assert that they can leap a distance of from 10 to 20 ft., having taken deadly aim at the human eyes, which they forthwith proceed to gouge out with their rough rasp-like pro-legs? Of course you would follow this up by recommending everybody never to go near a tomato patch, without a large pair of green goggles to protect the eyes from being destroyed.—*American Entomologist.*

CHEMISTRY AND PHYSICS.

HYDROGENIUM.—The last researches of the late lamented Prof. Graham, the Master of the Mint, were devoted to the study of a new condition of hydrogen antitheccal to that of oxygen in the form of ozone; and to this condition of the element he gave the name of Hydrogenium. By all analogy the new substance should be considered metallic, but like ozone, it has not been isolated. The details of Prof. Graham's researches, communicated to the Royal Society, were devoted to the relations of hydrogen to palladium. He had also observed hydrogenium in meteoric iron. Concluding an account of his researches to the Royal Society, Prof. Graham thus remarks on the chemical properties of hydrogenium which distinguish it from ordinary hydrogen:—

"The palladium alloy precipitates mercury and calomel from a solution of the chloride of mercury without anydisengagement of hydrogen; that is, hydrogenium decomposes chloride of mercury, while hydrogen does not. This explains why Mr. Stanislas Meunier failed in discovering the occluded hydrogen of meteoric iron, by dissolving the latter in a solution of chloride of mercury; for the hydrogen would be consumed, like the iron itself, in precipitating mercury. Hydrogen (associated with palladium) unites with chlorine and iodine in the dark, reduces a persalt of iron to the state of protosalt, converts red prussiate of potash into yellow prussiate, and has considerable deoxidizing powers. It appears to be the active form of hydrogen, as ozone is of oxygen.

"The general conclusions which appear to flow from this inquiry are, that in palladium fully charged with hydrogen, as in the portion of palladium wire now submitted to the Royal Society, there exists a compound of palladium and hydrogen in a proportion which may approach to equal equivalents.* That both substances are solid, metallic, and of a white aspect. That the alloy contains about 20 volumes of palladium united with a volume of hydrogenium; and that the density of the latter is about 2, a little higher than magnesium, to which hydrogenium may be supposed to bear some analogy. That hydrogenium has a certain amount of tenacity, and possesses the electrical conductivity of a metal. And finally, that hydrogenium takes its place among magnetic metals. The latter fact may have its bearing upon the appearance of hydrogenium in meteoric iron, in association with certain other magnetic elements."

METALLIC HYDROGEN.—At a recent meeting of the Lyceum of Natural History in New York, a paper was read by Dr. Loew, Assistant in the College of New York, "On the Preparation of Hydrogen Amalgam." The researches of Graham went to show that hydrogen could be alloyed with palladium, and that it was also contained in meteoric iron. He condensed the hydrogen in the palladium, and came nearer proving its metallic character than any other person had done. Schoenbein, in his search for ozone, found a method for making the peroxide of hydrogen which brought him to the very threshold of discovering hydrogenium. Schoenbein's experiment was this:—An amalgam of zinc and mercury is violently agitated in water; the water is then filtered, and, on being examined with iodide of starch and protosulphate of iron, will be found to contain peroxide of hydrogen or oxygenated water. Dr. Leow has carried the investigation further, and has, instead of oxidizing the hydrogen, succeeded in combining it with the mercury.

He takes an amalgam composed of no more than three or four per cent. of zinc, and shakes it with a solution of bichloride of platinum; the liquid becomes black, and a dark powder settles to the bottom. The contents of the flask are then thrown into

* Proceedings of the Royal Society, 1868, p. 425.

water, and hydrochloric acid added to dissolve the excess of zinc. The amalgam of hydrogen and mercury at once forms in a brilliant voluminous mass, resembling in every way the well-known ammonium amalgam. It is soft and spongy, and rapidly decomposes, but without any smell of ammonia. The hydrogen escapes, and soon nothing but pure mercury is left in the dish. The experiment appears to show conclusively that an amalgam of hydrogen and mercury can be formed, and that hydrogen is really a metal. It would also throw some doubt upon the existence of the amalgam of ammonium and mercury, and offer an explanation of that compound on the basis of its being the same amalgam of hydrogen and mercury that is prepared in the way now pointed out by Dr. Loew. The smell of escaping ammonia must be traced to some other source than the existence of that radical in combination with mercury.—'*Scientific American.*'

ARTIFICIAL PRODUCTION OF ICE. By P. H. Vander Weyde, M.D. *Calculation of the amount which can be produced from a given amount of coal in the modern ice machine.*—The amount of ice produced by an ice machine, worked by means of an exhaust or condensing air-pump, driven by steam power, is easily determined, theoretically, from the amount of coal burned in the furnace of the steam boiler. It has been proved that the combustion of one pound of anthracite coal produces, in round numbers, 14,000 units of heat, and that in order to freeze water of 72° Fahr., it is necessary to abstract, besides 40° of sensible heat, 140° of latent heat—together 180—which for one pound of water is, of course, equivalent to 180 units of heat. As this number of the units is the eightieth part of the 14,000 units produced by the combustion of one pound of coal, it is clear that the heat produced by the combustion of one ton of coal is equivalent to the heat to be abstracted from 80 tons of water of 72°, in order to change it into ice.

But in practice we find here exactly the same state of affairs as is the case with the steam engine. Theoretically, a steam engine ought to produce at least 700 units of force (foot-pounds) for every unit of heat consumed; in practice, good machinery only produces from about 70 to 100 foot-pounds, from about one-tenth to one-seventh part of the theoretical amount. In the best ice machines thus far constructed, instead of freezing 80 tons of water for every ton of coal consumed, only from about 8 to 11 tons of ice are produced also, from one-tenth to one-seventh part of the theoretical amount, proving, thus, the remarkable fact, that in both the steam engine and the ice machine, exactly the same relation exists between the theoretically calculated effects and the practical results.

As, however, all the best ice machines accomplish the conversion of the heat of the fuel into the freezing operation by the intervention of a steam engine, the fact that they practically produce only from one-tenth to one-seventh of the amount of the cold they theoretically should produce, is solely due to the other fact, that the steam engine itself practically produces only from one-tenth to one-seventh of the amount of power which would be strictly equivalent to the number of heat units consumed. It must not be lost sight of that it is only the power of the steam engine which generates the cold in the freezing machines, and that, therefore, improvements in the steam engine, which bring its practical results nearer to the theoretical standard, will at once exert their influence on the amount of ice the ice machines can produce, and, consequently, also on the cost of the ice manufactured in these machines.

Moreover, it appears that the kind of freezing machines in question, which convert power into cold, notwithstanding they are yet in their infancy, have already attained such a degree of excellence, that they are ahead of that class of machines which convert heat into power, either by steam, hot air, or any other possible means, as it is proved that they produce the full theoretical equivalent of cold (negative heat) for the number of foot-pounds employed; namely, cooling one pound of water one degree for a power equivalent to 700 pounds, descending one foot, which, expressed in the adopted scientific manner, is one unit of negative heat for every 700 foot-pounds consumed.—*Scientific American.*

PINS POINTED BY ELECTRICITY.—A recent discovery has been made by M. Cadery, telegraph inspector on the Western Swiss railroad, and is now applied with success at Aix la Chapelle (Belgium), whence needles and pins are shipped to all parts of the world. On passing a metallic wire (brass, copper, iron or steel), connected with the negative pole of a Bunsen's battery, through the bottom of a glass tube, closed in such a way as to hold an acidulated liquid, and leading the other wire of the positive pole through the superior opening of the glass tube, closed in such a way as to allow the positive wire to plunge into this acidulated liquid, taking care to leave a small interval between the extremities of the wires; the electric current thus established through the acidulated fluid as a conductor, produces the following phenomena. Very soon the extremity of the positive wire takes a conical point of more or less sharpness, depending on the free distance existing between the two wires plunging into the acidulated liquid. During this phenomenon, which takes from 5 to 15 minutes, according to the acid used, its strength, the composition of the wire, its degree of thickness, and also the intensity of the electric current, very fine sections of the wire are seen to separate from the wire. Water, acidulated with sulphuric acid, appears to be more efficacious, especially for iron and steel wires. Nitric acid is used in preference for brass and copper wires. The same effect will take place if to the positive pole (superior) an indefinite number of wires are tied together and dipped in the acidulated water, instead of the single wire, care being always to keep this positive wire at a little distance from the negative wire. I have seen a hundred brass wires after having been submitted to this operation, present points as sharp as the best English pins, although the electric current was produced by a very small Bunsen's battery. It appears to me very desirable that this new method should receive proper encouragement, and everything should be tried to bring it into general use. The operation of making the points of needles and pins in their manufacture is a dangerous and costly one. Medical men in large manufacturing cities have long recognized the dangerous effects produced by the fine metallic dust resulting from it, on the health of the workmen. The remedies for this evil are very imperfect, little used, and very impracticable; inhaling apparatus communicating with the outside air has been tried, but every danger would be suppressed by the method above described.—*Scientific American.*

ANOTHER NEW DYE.—The aniline dyes, it seems, have now a rival which not only vies with them in brilliancy and variety, but is of a less fleeting or more fixing character. The new colouring matter, according to the *Mechanics' Magazine*, is a purely vegetable extract, the plant from which it is obtained being imported from the western part of Africa, and also from the West Indies. The colouring matter is variously treated, according to the colours required and the dyes to be prepared from it. The process of production is carried on with machinery of a special character, which has been designed by the patentees, Messrs. Walker & Co., for this manufacture.—*Builder.*

CHEMICAL ANALYSIS OF A SAMPLE OF EXTRACT OF MEAT.—An analysis of extract of meat by Herr Reichardt is given in *Dingler's Polyteckniscles Journal.* The sample was prepared by a private firm, and yielded, on analysis, the following results:—Portion soluble in alcohol (of 83 per cent. strength), 80·76 per cent.; water, 16 per cent.; fatty matter, 0·2 per cent.; nitrogen, 9·99 per cent.; ash, 21·36 per cent. (containing potassa, 9·0 per cent.;) soda, 2·3 per cent.; phosphoric acid, 6·1 per cent. These results, as compared with Liebig's and the Fra Bentos extracts, are stated by the author to be in favour of the extract tested by him for MM. Buschenthal & Co.

MICROSCOPY.

BUTTERFLY PARASITE.—In the March number of this Journal, attention was drawn to the existence of a vegetable *parasite* on the legs of the dark Swallow-tail Butterfly (*Papilio asterias*). The facts are as follows:—

At a meeting of the Montreal Microscopic Club some time ago, the subject for illustration and examination was "Parasite—Animal and Vegetable."

Looking over my collection previous to the meeting, for example of the subject, I had occasion to open a small box containing four specimens of *Papilio asterias*, and observing something attached to the legs of one of the butterflies, it was subjected to microscopic examination, and I concluded it would suit the subject for investigation at the meeting of the club.

One leg with the *parasite* was mounted in balsam—the cover being secured with sealing wax varish, a very useful cement when an object is wanted for immediate use, as it dries quickly.

Members differed in opinion as to the objects—the general impression that it was a *vegetable parasite*, fungoid in its nature, remained. Not being thoroughly persuaded in my own mind as to its nature, from the peculiar situation of the organism—it being attached not to the leg, but impaled on the spines of the *tibiæ* and *tarsæ*, also on the tips of the *ungues*,—it appeared to me as if the creature, in feeding or flying over some plant, had brushed off something like seeds or flowers, or some fungoid growth. With a view to find out its real character, I sent a mounted slide to Mr. M. C. Cooke, the Editor of *Science Gossip*, and author of "An account of the British Fungi," also of "Microscopic Fungi," for his opinion. He very kindly returned me the following answer in the pages of the *Science Gossip*: "The supposed fungus on the legs of *Papilio asterias* is not a fungus at all, but pollen masses from some species of Orchis."

Before receiving this answer, however, I had determined for myself what the supposed fungus was. A friend having remarked that he had captured some large flies with their legs covered with a peculiar looking substance, I desired him to let me have a few specimens, together with a specimen of the plant on which he had taken them. The latter proved to be the milk weed, or wild cotton *Asclepias cornuti*. On examination, I found the pollen masses to be identical with those on the legs of the butterfly, and that they (the pollen masses) belong to a species of the genus *Asclepias*, and not to a member of the family *Orchidaceæ*.

This is another instance of the uses of insects as fertilizers of plants.

A. S. R.

MICROSCOPIC EXAMINATION OF DUST.—An ingenious apparatus is figured in the monthly *Microscopic Journal* for collecting atmospheric particles, contrived by Dr. Maddox; the results are also figured from micro-photographs. Dr. Maddox says:—

"Dr. Tyndall has shown us that organic matter may escape destruction to a great extent when air is drawn somewhat slowly 'over fragments of glass, wetted with concentrated sulphuric acid,' also 'over fragments of marble, wetted with a strong solution of caustic potash,' or when 'permitted to bubble through the liquid acid and through the solution of potash,' and likewise when rapidly passed through a red-hot platinum tube, containing a roll of platinum gauze. Valuable as these observations are in themselves, we are but little nearer the chief question, which is left open as to the vitality of such organic particles, or their relation to disease.

"It is not pretended that this form is the only useful one or the most convenient that can be adopted, but as it has now been in use some days, I find it answers its chief purpose very well, and is exceedingly easy to manipulate. The advantages claimed are, ready application at any spot, the collection of the atmospheric particles *into a small space* in such a manner as to be at once microscopically examined with a $\frac{1}{16}$th or $\frac{1}{20}$th objective, placed on a growing slide, or some form of cultivating apparatus for further observation, or mounted permanently. The difficulty is to select the best cultivating medium. Hitherto I have found besides (*débris*) organic and mineral matters, pollen grains, minute germs of various fungi or protophytes, and excessively minute bodies, 'molecules,' 'globules,' &c.; none were seen in motion. All seem to vary in abundance with the force of the wind and dryness of the ground.

"This apparatus is deficient as regards crucial tests, but for general use it is efficient, and may, by continued employment, be of service. If any doubt exist as to the medium furnishing the spores, it can be treated as though it had been exposed; hence thus far we have fairness in the results.

"I believe it will be only by constant, varied, and multiplied research, we shall ever obtain any answer to the important question of 'dust and disease;' hence my excuse for trespassing on the pages of this Journal, in the hope others may be induced to give the apparatus a fair trial or suggest something more useful.

"The examination of the collections made over forty days has shown that in this immediate locality, at this period, the air cannot be considered as *loaded* with microscopic germs; the largest number visible and counted as such on one cover being twenty-one (not including bacteroid bodies). A few only have germinated; they are under observation."

THE AMERICAN MICROSCOPICAL SOCIETY.—At the last annual meeting of the American Microspical Society the following officers were elected:—President, Dr. J. H. Hinton; 1st vice-president, Mr. Robert Dinwiddie; 2nd vice president, Mr. T. F. Harrison; corresponding secretary, Dr. S. G. Perry; recording secretary, Dr. J. S. Latimer; treasurer, Mr. E. C. Bogert; librarian, Dr. John Frey; curator, Mr. S. Jackson. Committee on nominations:—Dr. D. H. Goodwillie; Mr. R. A. Witthaus, Mr. J. W. S. Arnold.

A New American Natural History and Microscopical Society.—There has just been started in the city of Baltimore a society of fifty members, called the "Maryland Academy of Sciences." It is intended to pay special attention to microscopy. The following list of the officers may be useful to those societies which desire to correspond with the new Academy:—Philip T. Tyson, President; John G. Morris, D.D., Vive-President; Edwin A. Dalrymple, D.D., Corresponding Secretary.

MISCELLANEOUS.

Prof. Bell on the Nipigon Territory.—The Canadian shore of Lake Superior simply varied according to its geological structure, and the prevalence of Laurentian rocks and gneiss of of Huronian rocks. Not only the shore of Lake Superior varied in respect to its physical character, but the country behind it varied also in the same respect. The whole of the Canadian side of Lake Superior could not be called the North Shore, for we had an east side as well; but at the present time the North Shore was the most important. The basin of Lake Superior was eituated a thousand miles from the sea, its surface being six hundred feet above the sea level, or a hundred feet lower than the Montreal mountain. The bottom of the lake was four hundred feet below the sea level, its depth being four times the height of an ordinary church spire. The waters of this basin were kept from flowing over by a rocky rim which enclosed them; but in speaking of this basin, that of Lake Nipigon should be included at the same time. The Nipigon river was a feeder of Lake Superior, but could not be classified with the smaller feeders of the lake, for it was vastly larger than the other tributaries, and was the only clear water river entering it, and proceeding from a lake which deserved to be considered one of the great lakes, being supplied by sixteen tributaries. The party had left Fort William on the 4th of July last year, and in two or three days arrived at Red Rock at the mouth of the Nipigon River; and in four days and a half reached the lake, the distance being about 30 miles, in which there were seven portages, some of them about a mile long. The scenery along the Nipigon River was very fine; Red Rock, at its mouth, being thought by some to be one of the prettiest places in Canada, the river itself being unrivalled for trout fishing. Steamboats might pass up the river as far as about ten miles from its mouth, but above that point its navigation was interrupted by rapids. On arriving at the lake, the view was found to be very grand. Owing to the existence of magnetic rocks the surveying party could make but litlle use of their compasses; the angles, however, were taken and its distances measured by a micrometer; the latitudes were also taken by various observations of the sun and polestar, and meridian lines were also laid down. Lake Nipigon lies directly north of the northern extremity of Lake Superior, and is more than half the size of Lake Ontario; its general outline is elliptical. Its area was 3,700 square miles, or about four-sevenths of the size of Lake Ontario; its length 70, and its breadth 50 miles. As an illustration of the size of Lake Nipigon, there are nine lakes in Canada—amongst them, Lake St. John, Lake Metapedia, Lake Temiscouta, Lake Megantic, Lake St. Francis and Lake Memphremagog—but Lake Nipigon is four times as large as the whole nine put together. Lake Nipigon is by far the most beautiful of all the great lakes, and is studded throughout its whole extent by islands, large and small, and high and low, some rocky and some thickly wooded. They could not, of course, survey the whole of these during one season; but, in connection with their triangulations of the coast, they managed to located 460 of these with tolerable accuracy, and more roughly over 100 others. Some of these islands were large enough to form whole townships. One of them was eight miles in diameter, several were from five to six miles across, while those from two to three miles in breath were quite common. They were all covered with good soil and well timbered, and some day will, no doubt, be converted into well-cultivated farms. The coast line of the lake measures 580 miles, or, perhaps, considerably more than the coast line of Lake Ontario, and, therefore, a great deal of the country round the lake is accessible from the water. Sixteen rivers, with unpronounceable Indian names, flow into the lake, and the average size of these streams is as large as the Grand River of Ontario. The Gull River is much larger. As far as these rivers were examined, the country through which they flow was found to be level, with clayey soil, and a light surface of sand. Like all rivers flowing through level countries, the feeders are very crooked, and when the water is low they resemble great winding ditches with muddy banks. On one river which they ascended they met no rapids for ten miles up, and that was but a small one. Some distance up this same river they found an open margin, very fertile and covered with an abundance of good grass. He did not mean by this "beaver hay," but a very superior kind of grass, which was found by experience to be very valuable as fodder for cattle and horses. The country is very free from rocks, and at one place they could not find stones large enough to sink the lower edge of their net. There is evidence in the Nipigon country, as well as in the Thunder Bay region, that the forests have been frequently swept by fires in past times, and the Indians told him that these fires often originated from lightning. It was likely that prairies were formed in this way. He believed there was a tradition among the Indians that the prairies once extended eastward as far as Lake Nipigon, but all the country east of the Lake of the Woods has since been overgrown with forest. They sometimes left the stores and struck away into the woods and generally found the country level. Although the soil was good the trees were small, and stood so far apart that the party could carry their canoe without underbrushing a road anywhere. After having prosecuted their survey for seven weeks, they arrived at the Nipigon House, a Hudson Bay post, on the north-west shore of the Lake. This was one of the three posts maintained by the Company on the lake shore. The Nipigon House is surrounded with a farm and garden, which have been cultivated for about 100 years. During the early part of the present century the station was called Fort Duncan, and then, as now, it supplied the neighbouring country. The appearence of the field and garden crops indicated that the soil was well suited for agricultural purposes. The latitude of that part of the country was about the same as at the mouth of the St. Lawrence—between 49° and 50° north latitude, but it was well known that in that part of the country the isothermal lines bend to the North-West. The survey revealed the encouraging fact that we have an easy route for the construction of a railway to the North West.—*Gazette.*

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The next meeting will be held at Troy, (N. Y.), on the 17th August next. Members desiring the usual facilities for travel, &c., will obtain the required information on application to H. B. Nason, Esq., Correspondent Secretary, Troy, N. Y.