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THE

CANADIAN NATURALIST

AND

Quarterly Journal of Science.

REVISION OF THE LAND SNAILS OF THE PALEOZOIC ERA, WITH DESCRIPTIONS OF NEW SPECIES.

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

(*From the American Journal of Science.*)

The Gasteropods as a class occur as early as the Upper Cambrian, but all the earlier known types are marine. That portion of the group distinguished by the possession of air sacs instead of gills (Pulmonifera) has not hitherto been found in any formation older than the Carboniferous, and only four Carboniferous species have been described. In the present paper I propose to state some additional facts respecting the species already known, to discuss their affinities, and to describe two additional species, making six in all from the Paleozoic rocks, including one from the Erian or Devonian. For reasons to be mentioned in the sequel, I do not admit the genus *Palæorbis* founded, by some German naturalists, on fossils which I believe to be tubes of Annelids.

It may be useful to premise that of the two leading subdivisions of the group of Pulmonifera, the Operculate and Inoperculate, the first has been traced no farther back than the Eocene. The second, or Inoperculate division, includes some genera that are aquatic and some that are terrestrial. Of the aquatic genera no representatives are known in formations older than the Wealden and Purbeck, and these only in Europe. The terrestrial group or the family of the *Helicidæ*, which, singularly enough, is that which diverges farthest from the

ordinary gill-bearing Gasteropods, is the one which has been traced farthest back, and includes the Paleozoic species. It is further remarkable that a very great gap exists in the geological history of this family. No species are known between the Carboniferous and the early Tertiary, though in the intervening formations there are many fresh-water and estuarine deposits in which such remains might be expected to occur. There is perhaps no reason to doubt the continuance of the Helicidæ through this long portion of geological time, though it is probable that during the interval the family did not increase much in the number of its species, more especially as it seems certain that it has its culmination in the modern period, when it is represented by very many and large species, which are dispersed over nearly all parts of our continents.

The mode of occurrence of the Paleozoic Pulmonifera in the few localities where they have been found is characteristic. The earliest known species, *Pupa vestuta*, was found by Sir Charles Lyell and the writer, in the material filling the once hollow stem of a Sigillaria at the South Joggins in Nova Scotia, and many additional specimens have subsequently been obtained from similar repositories in the same locality, where they are associated with bones of Batrachians and remains of Millipedes. Other specimens, and also the species *Zonites priscus*, have been found in a thin, shaly layer, containing debris of plants and crusts of Cyprids, and which was probably deposited at the outlet of a small stream flowing through the coal-formation forest. The two species found in Illinois occur, according to Bradley, in an underclay or fossil soil which may have been the bed of a pond or estuary, and subsequently became a forest sub-soil. The Erian species occurs in shales charged with remains of land plants and which must consequently have received abundant drainage from neighboring land. It is only in such deposits that remains of true land-snails can be expected to occur; though, had fresh-water or brackish water Pulmonates abounded in Carboniferous age, their remains should have occurred in those bituminous and calcareo-bituminous shales which contain such vast quantities of debris of cyprids, lamellibranchs and fishes of the period, mixed with fossil plants.

With reference to their affinities, the Paleozoic land snails present no very remarkable peculiarity except their close resemblance to some modern forms. Of the known species, four be-

long to the genus *Pupa* in its wider sense, and are very near to sub-generic types still represented on the American continent and its islands. One is a small helicoid shell not separable from the modern genus *Zonites*, and the remaining one, though it has been placed in a new genus, is very near some small American snails of the present day (*Stenotrema*, etc.) All the species are of small size, though not smaller than some modern shells of the same types.

I shall now proceed to give the characters and descriptions of the several species, adding to the account of those previously known, such new facts as have occurred in my more recent explorations and examinations. I should state here that many of the new facts detailed have been obtained in the course of excavations for extraction of erect trees holding land animals, undertaken with the aid of a grant from the Government fund for aiding original researches, at the disposal of the Royal Society of London, and carried on within the past three years.

1. *Pupa vetusta* Dawson. (Figs 1 to 4, and 14, *a*, *b*.)

[Sir C. Lyell and Dr. Dawson on Remains of Reptiles and a Land Shell from the South Joggins in Nova Scotia, Journal of Geological Society of London, vol. ix, 1832 (figured but not named). Dawson's Acadian Geology, 1855, p. 160. Dawson's Air-breathers of the Coal Period, 1863. Acadian Geology, 2nd and 3rd editions, p. 384, 1868 and 1879.]

Description.—Shell cylindrical, somewhat abruptly conical at the apex, in some specimens tending to diminish in diameter in the latter turns or whorls of the shell. Whorls nine in adult shells, slightly convex, in width equal to half the diameter of the shell. Suture impressed. Aperture evenly rounded, not continuous above, rather longer than broad, destitute of teeth; peristome slightly reflected and smooth. Surface shining, marked with longitudinal smooth ridges, separated by spaces a little wider than the ridges; spaces about $\frac{1}{300}$th inch in width. Shell calcareous, thin, prismatic in structure. Young specimens abruptly conical and helicoid in form. Nucleus round, smooth, the first turn below the nucleus marked with rows of little pits which gradually pass into the continuous striæ. The last whorl of the adult presents irregular lines of growth instead of the regular microscopic ribs of the middle turns. Mature ovum membranous, or so slightly calcareous that it can be compressed without breaking: the embryo shell sometimes visible

within. Length of adult shell rather less than 1 centimeter, breadth in middle 4 millimeters.

Variety tenuistriata.—Along with the ordinary form there are others of similar size and general structure, but with the apex less obtuse and a somewhat greater tendency to diminish in diameter in the later whorls. They have also the microscopic ridges in the shell about half as far apart as those of the ordinary form. This form I was at first disposed to regard as specifically distinct, but there seems to be a gradual transition from one to the other, and the two forms seem to accompany each other throughout the entire range of the species.

State of preservation.—The shells are usually entire, but often somewhat flattened, and cracked or distorted in the process. Many fragments of shells, however, occur with the entire specimens, and some of these have a whitened or bleached appearance like that of modern land shells after having been exposed to the weather. In one layer I found impressions of several flattened shells, the substance of the shell having been altogether removed. Ordinarily the shell remains in such a state as to show its structure, and the more perfect specimens found in the erect trees have a grayish brown color, like that of some modern Pupæ.

The habitat of this species was in forests of the Coal-formation period, composed of *Sigillaria*, *Calamites*, *Lepidophloios* and *Ferns*. The only known locality is the South Joggins, Nova Scotia. At this place the shells have been obtained in considerable numbers, though perfect specimens which can be disengaged from the matrix, are comparatively few. They have been found in erect *Sigillariæ* and also in a bed of shale. The lowest and highest beds in which they occur are separated by 2,000 feet of vertical thickness of strata, including no less than thirty-five beds of coal and many underclays supporting erect trees, so that the species must have inhabited the locality for a very long time and must have survived many physical vicissitudes.

The first specimen, which was also the first known Paleozoic land shell, was found by Sir Charles Lyell and the writer in 1851, in breaking up the contents of an erect tree holding reptilian bones. The specimens obtained from this tree having been taken by Sir Charles to Cambridge and submitted to the late Prof. Jeffries Wyman, the shell in question was recognized by him and the late Dr. Gould, of Boston, as a land shell. It was subsequently examined by M. Deshayes and Mr. Gwyn

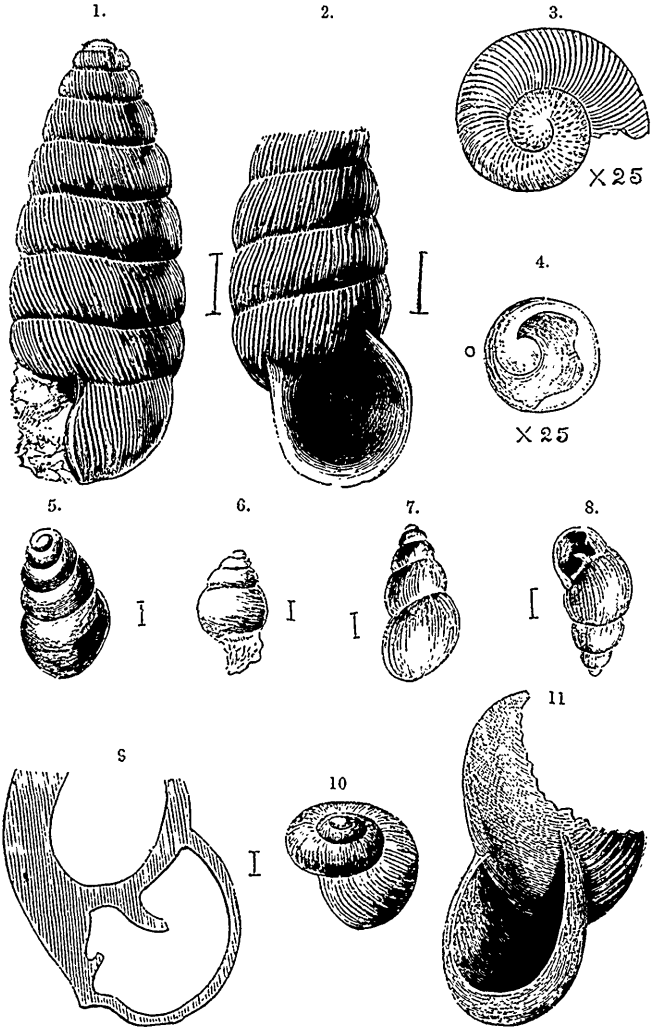

Fig. 1, *Pupa vetusta*, magnified 8 times lineally; 2, same, showing the aperture, × 8; 3, same, nuclear whorl, × 25; 4, same, mature egg and embryo shell, × 25; 5, 6, *Pupa Bigsbii*, × 8; 7, *Pupa Vermilionensis* × 8; 8, same, showing aperture, × 8, the small tooth on the columella somewhat exaggerated; 9, same, section of aperture, showing tooth × 16; 10, *Zonites priscus*, × 8; 11, same, crushed specimen, showing aperture × 20.

Jeffries, who concurred in this determination; and its microscopic structure was described by the late Prof. Quekett, of London, as similar to that of modern land shells. The single specimen obtained on this occasion was somewhat crushed and did not show the aperture. Hence the hesitation as to its nature, and the delay in naming it, though it was figured and described in the paper above cited in 1852. Better specimens showing the aperture were afterward obtained by the writer, and it was named and described by him in his "Air-breathers of the Coal Period," in 1863. Prof. Owen, in his "Palæontology," subsequently proposed the generic name *Dendropupa*. This I have hesitated to accept, as expressing a generic distinction not warranted by the facts; but, should the shell be considered to require a generic or sub-generic distinction, Owen's name should be adopted for it. There seems, however, nothing to prevent it from being placed in one of the modern sub-genera of simple-lipped Pupæ. With regard to the form of its aperture, I may explain that some currency has been given to an incorrect representation of it, through an unfortunate accident. In the case of delicate shells like this, imbedded in a hard matrix, it is of course difficult to work out the aperture perfectly; and in my published figure in the "Air-breathers," I had to restore somewhat the broken specimens in my possession. This restoration, specimens subsequently found have shown to be very exact. Nevertheless it was criticised by some English conchologists, and when Sir Charles Lyell was about to publish his Student's Manual, he asked me to give him one of my best specimens to be figured. This I sent with micro-photographs of others. It seems, however, that the artist or engraver mistook the form of the aperture and gave it an entirely unnatural appearance in the Student's Manual. That now given is taken from a photograph of the most perfect and least compressed specimens in my possession.

As already stated, this shell seems closely allied to some modern Pupæ. Perhaps the modern species which approaches most nearly to it in form, markings and size, is *Macrocheilus Gossei* from the West Indies, specimens of which were sent to me some years ago by Mr. Bland, of New York, with the remark that they must be very near to my Carboniferous species. Such edentulous species, as *Pupa (Leucochila) fallax* of Eastern America very closely resemble it; and it was regarded by the

late Dr. Carpenter as probably a near ally of those species which are placed by some European conchologists in the genus *Pupilla*.

The lowest bed in which *Pupa vetusta* occurs belongs to group VIII of Division 4 of my section of South Joggins, and is between Coal 37 and Coal 38 of Logan's Section, being about 42 feet below Coal 37. The next horizon, and that in which the shell was first discovered, is 1217 feet of vertical thickness higher, in group XV of Division 4 of my section. The shells occur here in erect *Sigillariæ*, standing on Coal 15 of Logan's section. The third horizon is in group XXVI of Division 4, about 800 feet higher than the last. Here also the shells occurred in an erect *Sigillaria*.

In the lowest of these three horizons, the shells are found, as already stated, in a thin bed of concretionary clay of dark gray color, though associated with reddish beds. It contains *Zonites priscus* as well, though this is very rare, and there are a few valves of *Cythere* and shells of *Naiadites*, as well as carbonaceous fragments, fronds of ferns, *Trigonocarpa*, etc. The *Pupæ* are mostly adult, but many very young shells also occur, as well as fragments of broken shells. The bed is evidently a layer of mud deposited in a pond or creek, or at the mouth of a small stream. In modern swamps, multitudes of fresh water shells occur in such places, and it is remarkable that in this case the only gasteropods are land shells, and these very plentiful, though only in one bed about an inch in thickness. This would seem to imply an absence of fresh-water Pulmonifera. In the erect *Sigillariæ* of Group XV, the shells occur either in a sandy matrix, more or less darkened with vegetable matter, or in a carbonaceous mass composed mainly of vegetable débris. Except when crushed or flattened, the shells in these repositories are usually filled with brownish calcite. From this I infer that most of them were alive when imbedded, or at least that they contained the bodies of the animals; and it is not improbable that they sheltered themselves in the hollow trees, as is the habit of many similar animals in modern forests. Their residence in these trees as well as the characters of their embryology are illustrated by the occurrence of their mature ova. They may also have formed part of the food of the reptilian animals whose remains occur with them. In illustration of this, I have elsewhere stated that I have found as many as eleven unbroken shells of *Physa heterostropha* in the stomach of a modern *Menobranchus*. I think it certain, however,

that both the shells and the reptiles occurring in these trees must have been strictly terrestrial in their habits, as they could not have found admission to the erect trees unless the ground had been sufficiently dry to allow several feet of the imbedded hollow trunks to be free from water. In the highest of the three horizons the shells occurred in an erect tree, but without any other fossils, and they had apparently been washed in along with a grayish mud.*

2. *Pupa Bigsbii* s. n. (Figs. 5 6.)

Description.—Shell half the size of *Pupa vetusta*, or between three and four millimeters in length, and one and five-tenths millimeters in breadth. Form long, conical. Body whorl about one-third of the entire length, giving the shell a somewhat bulimoid form. Whorls five in the largest specimens found, tumid, suture much impressed. Surface smooth. Aperture apparently oval in form, but not perfectly known, as the body whorl is crushed in all the specimens.

A few specimens, none of them quite perfect, were found in the erect trees of group XV at the Joggins, along with *Pupa vetusta*. They differ from that species in smaller size, different form and absence of sculpture. The specimens do not show whether the aperture was toothed or simple, but it was probably the latter, as the lip is evidently very thin and delicate. From its form it is probable that it belongs to a different sub-genus from *P. vetusta*. It is very much more rare than that species in the erect trees, and has not been found elsewhere.

I dedicate it to my venerable and dear friend Dr. Bigsby, F.R.S., of London, a pioneer of American geology, and still an indefatigable worker in the science.

3. *Pupa Vermilionensis* Bradley. (Figs. 8 and 9, and 14c.)

[Bradley in Report of Geological Survey of Illinois, vol. iv, p. 254 Id. in Am. Jour. Sci., vol. iv, p. 87.]

Description.†—Shell spindle-shaped, tapering to an obtuse apex, covered with microscopic ridges (25 to 30 in a millimeter) parallel to the lines of growth. Aperture oblique, oval. Outer lip thin, slightly reflexed. Columella lip reflexed, thickened;

* The discovery of the shells in this tree was made by Albert I. Hill, C. E.

† Slightly modified from Bradley.

furnished with a single central curved tooth, projecting nearly half way across the aperture. Junction of columella and outer lip somewhat angular and dentiform. In old individuals the columella tooth is often continuous through an entire turn or farther. It is not seen on shells having less than three turns. The last turn forms nearly half the length of the shell. Whorls rounded. Suture impressed. Surface glossy. Color black or gray. Length three and six-tenths millimeters. Width two millimeters. Some individuals are smooth or destitute of the fine microscopic ridges, but whether this is a natural peculiarity or a result of injury to the outer surface, is not certain.

As compared with *Pupa vetusta* this shell is less than half the size, of a less cylindrical form, its whorls more rounded, and its body whorl much larger in proportion. Its sculpture is much finer. The conspicuous tooth in the aperture is of course a strong mark of distinction. The shell is thin, and from its black color and failure to show structure under the microscope, I infer that it must have been of a horny or corneous texture, with little calcareous matter. The matrix is light-colored and concretionary, and somewhat hard and calcareous.

As compared with modern American species, *P. Vermilionensis* is very near to several of the smaller forms with teeth in the aperture. In its form and aperture it approaches closely to *P. (Leucochila) corticaria* of Say, or to the immature shell of *P. rupicola*. It has also some resemblance to the western species *P. hordeacea* Gabb, from Arizona.

This shell was discovered by the late Mr. F. H. Bradley in 1869, in concretionary limestone accompanying the underclay of Coal No. 6, Wabash Valley Section, at Pelly's Fort, Vermilion River, Illinois. In the first notice, which appeared in the Report of the Geological Survey of Illinois, it was referred to *Pupa vetusta*, but was subsequently described by Mr. Bradley in the American Journal of Science, under the name above cited.

I am indebted for specimens of this shell to Mr. John Collett, of the Geological Survey of Indiana, and also to Mr. W. Gurley, of Danville, Illinois.

4. *Zonites (Conulus) priscus* Carpenter. (Figs. 10 and 11, and 14*d*.)

[Quarterly Journal of Geological Society of London, Nov. 1867. Acadian Geology, 2nd edition, 1868, p. 385.]

*Description.**—Shell small, helicoid. Length two and five-tenths millimeters, width two and eight-tenths millimeters. Spire little elevated. Nucleus small. Whorls four, somewhat flattened, with the suture little impressed. Base somewhat excavated, with large umbilicus. Aperture oblique, suboval, somewhat regularly rounded. Lip simple. Surface marked with uneven striæ and somewhat more conspicuous ridges of growth. Angle of divergence about 130°. Shell thin and probably horny.

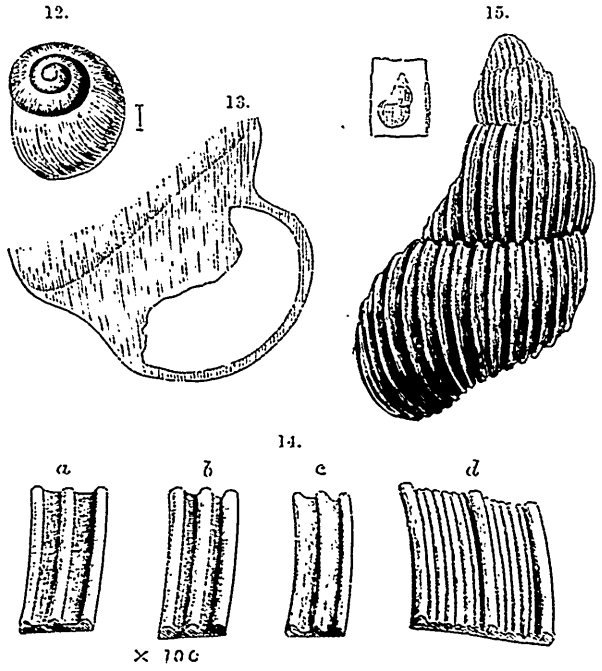

Fig. 12. *Dawsonella Meeki*, × 8; 13, same, section of aperture, × 16; the outer edge of the lamella is imperfect. 14, Markings of surface × 100: (*a*) *Pupa vetusta*; (*b*) *Pupa vetusta* var. *tenuistriata*; (*c*) *Pupa Vermilionensis*; (*d*) *Zonites priscus*. 15, *Strophites grandæva*, natural size, and magnified 8 diameters.

This little shell was discovered in 1866, in the bed already referred to as the lowest of those at the South Joggins in which *Pupa vetusta* has been found. Shortly after I had discovered this bed, being impressed with the probability that it might

* Slightly modified from Carpenter.

hold other remains of land animals beside the *Pupa*, I had some excavations made in it, and a considerable quantity of material taken out. I found, however, that the thin layer containing the land shells was not continuous, but in limited patches, and was rewarded only by the discovery of a few specimens of *Zonites priscus* and a small and not determinable fragment of bone, in addition to specimens of *Pupa vetusta*.

The specimens found at this time were submitted to the late Dr. P. P. Carpenter, by whom the species was named and described. One or two crushed specimens have been subsequently found in the erect trees holding *Pupa vetusta* in group XV, but the species is extremely rare in comparison. This may however, have depended on some difference in habitat or mode of life, rendering it less likely to be imbedded in the deposits in process of formation. It is also to be observed that the shell is much more delicate than that of *Pupa vetusta*, and therefore less likely to be preserved.

With regard to its affinities, it was compared by Dr. Carpenter with the African species *Paryphanta Caffra* Fer., "on an extremely small scale." Dr. Carpenter also compared it with *Hygromia*, and stated that it might well be ranked under *Pseudohyalina* of Morse, with the living species *minuscula* and *exigua*. He thought it best, however, to place it in the subgenus *Conulus* of the genus *Zonites*, as defined by Messrs. Adams. With regard to the subgeneric name, Dr. Carpenter explained that the subgenus *Conulus* of Fits, 1833, appears to be synonymous with *Trochiscus* Held, 1837, (non Sby.); also with *Petasia* Beck, 1837; and with *Perforatella* Schlütt.; and according to Adams is a subgenus of *Zonites* Montf. (non Leach, Gray). Those who do not care to enter into these subgeneric distinctions, may designate the species as a *Zonites*, or even, speaking loosely, as a *Helix*. There seems nothing in its characters to separate it, more than specifically, from many of our smaller helicoid snails with thin shells and simple aperture.

5. *Dawsonella Meeki* Bradley. (Figs. 12 and 13.)

[Report of Geological Survey of Illinois, vol. iv, p. 254. Am. Jour. of Sci., III, vol. iv, p. 88. Ibid. vol. vii, p. 157.]

*Description.**—Shell broad, depressed, helicoid. Spire obtuse, consisting of three to three and one-half turns. Length three

* Modified from Bradley.

and two-tenths millimeters, width four millimeters. Surface smooth, but with microscopic lines of growth, about fifteen in a millimeter. Aperture oblique, oval, greatly contracted by a broad lamellar expansion of the columella, extending more than half way across, even in small individuals. Outer lip thickened, slightly reflexed. Suture little impressed, imperforate, but last turn slightly excavated in the umbilical region. The shell is usually black in color, and under the microscope shows no distinct structure, from which it may be inferred that it was corneous in texture. It is thicker than the shell of *Zonites priscus*.

This species is found along with *Pupa Vermilionensis*, and was discovered by Bradley, who was, however, at first disposed to refer it to the genus *Anomphalus* of Meek; but subsequently, and with good reason, regarded it as distinct and as a land shell. In size and general form it resembles *Zonites priscus*, though expanding less rapidly and with rounder whorls; but it is at once distinguished by its want of the somewhat coarse sculpture of that species, and by the plate which partially covers its aperture. Its nearest modern allies in eastern America would seem to be such shells as *Helix* (*Triodopsis*) *palliata*, and *H.* (*Stenotrema*) *monodon*.

For specimens of this shell I am indebted to the persons above named as having furnished specimens of *Pupa Vermilionensis*.

6. *Strophites grandæva*, s. n. (Fig. 15.)

Description.—Shell cylindrical, with obtuse apex. Whorls four or more. Surface covered with sharp vertical ridges, separated by spaces three times as wide. The body whorl about four millimeters in diameter, with about thirteen vertical ridges visible on one side. Length of specimen probably not quite perfect, about eight millimeters. The shell, which has disappeared, must have been very thin, and the surface remaining is smooth and shining. In general form, so far as can be ascertained from a very imperfect specimen, this shell must have closely resembled the modern Pupæ of the genus *Strophia* of Albers.

The only specimen known is from the Erian (Devonian) plant-beds of St. John, New Brunswick, which, besides affording great numbers of remains of land plants, have produced the only Erian insects as yet known. It was sent to me by Mr. G. F. Matthew, of St. John, along with specimens of fossil plants;

several years ago, but I hesitated to describe it, waiting in hope of additional specimens. As these have not occurred, and I have now carefully examined the whole of the material from these beds, to which I have been able to obtain access, I venture to name it as probably the oldest known land shell, the beds in which it is found being either middle or upper Erian.

If a land snail, it is larger in size, and probably of a higher type than any of those known from the Coal-formation. This would not be wonderful, when we consider the greater variety of surface and the high character of the vegetation, which, as I have elsewhere endeavored to show, distinguished the later Erian age in north-eastern America.

Concluding Remarks.

It may be proper to mention here the alleged Pulmonifera of the genus *Palæorbis* described by some German naturalists. These I believe to be worm-tubes of the genus *Spirorbis*, and in fact, to be nothing else than the common *S. carbonarius* or *S. pusillus* of the Coal-formation. The history of this error may be stated thus. The eminent paleobotanists Germar, Gœppert and Geinitz have referred the *Spirorbis*, so common in the Coal-measures, to the fungi, under the name *Gyromyces*, and in this they have been followed by other naturalists; though as long ago as 1868 I had shown that this little organism is not only a calcareous shell, attached by one side to vegetable matters and shells of mollusks, but that it has the microscopic structure characteristic of modern shells of this type.* More recently, Van Beneden, Cœnius and Goldenberg, perceiving that the fossil is really a calcareous shell, but apparently unaware of the observations made in this country by myself and Mr. Lesquereux, have held the *Spirorbis* to be a pulmonate mollusk allied to *Planorbis*, and have supposed that its presence on fossil plants is confirmatory of this view, though the shells are attached by a flattened side to these plants, and are also found attached to shells of bivalves of the genus *Naiadites*. Mr. R. Etheridge, Jr., of the Geological Survey of Great Britain, has recently summed up the evidence as to the true nature of these shells, and has revised and added to the species, in a series of articles in the Geological Magazine of London, vol. viii.

* Acadian Geology, 2nd edition, p. 205.

If we exclude the alleged *Palæorbis* above referred to, all the Palæozoic Pulmonifera hitherto found are American. Since, however, in the Carboniferous age, Batrachians, Arachnidans, Insects and Millipedes occur on both continents, it is not unlikely that ere long European species of land snails will be announced. The species hitherto found in eastern America, are in every way strangely isolated. In the plant-beds of St. John, about 9,000 feet in thickness, and in the Coal-formation of the South Joggins, more than 7,000 feet in thickness, no other Gasteropods occur, nor, I believe, do any occur in the beds holding land snails in Illinois. Nor, as already stated, are any of the aquatic Pulmonifera known in the Palæozoic. Thus, in so far as at present known, these Palæozoic snails are separated not only from any predecessors, if there were any, or successors, but from any contemporary animals allied to them.

It is probable that the land snails of the Erian or Carboniferous were neither numerous nor important members of the faunæ of those periods. Had other species existed in any considerable number, there is no reason why they should not have been found in the erect trees, or in those shales which contain land plants. More especially would the discovery of any larger species, had they existed, been likely to have occurred. Further, what we know of the vegetation of the Palæozoic Period would lead us to infer that it did not abound in those succulent and nutritious leaves and fruits which are most congenial to land snails. It is to be observed, however, that we know little as yet of the upland life of the Erian or Carboniferous. The animal life of the drier parts of the low country is indeed as yet very little known; and but for the revelations, in this respect, of the erect trees in one bed in the Coal-formation of Nova Scotia, our knowledge of the land snails and millipedes, and also of an eminently terrestrial group of reptiles, the *Microsauria*, would have been much more imperfect than it is. We may hope for still further revelations of this kind, and, in the mean time, it would be premature to speculate as to the affinities of our little group of land snails with animals either their contemporaries or belonging to earlier or later formations, except to note the fact of the little change of form or structure in this type of life in that vast interval of time which separates the Erian Period from the present day.

NOTE.—(Feb. 21, 1881.)—Since the above paper was written, Prof. Whitfield of New York has announced* the discovery of another species of land snail in the coal formation of Ohio. It is a small species, three and one-third millimeters in length, of that type of pupidae having the aperture nearly vertical and armed with several projecting teeth. It has besides the peculiar feature of a small nearly circular notch near the upper end of the lower lip. On account of this peculiarity it is placed in a new genus *Anthracopupa*, and the species is named *A. ohioensis*.

Prof. Whitfield also mentions that he has examined the aperture of *Dawsonella Meeki*, and finds reason to believe, from the form of the callus in the aperture, and the peculiar thickening of the outer lip, that it may have been an operculated shell, though he admits that no trace of the operculum has yet been found.

NOTE ON FOSSILS FROM THE RED SANDSTONE SYSTEM OF PRINCE EDWARD ISLAND. BY MR. F. BAIN.

(Read at the Meeting of the Natural History Society, January 31, 1881.)

In the course of some short geological excursions during the past summer, I obtained from the system of strata classified as Triassic in Dr. J. W. Dawson's Report on the Geology of Prince Edward Island, the following fossil plants:

Walchia gracilis, Dawson.
Calamites gigas, Brongt.
Calamites Suckovii, Brongt.
Pecopteris rigida, Dawson.
Pecopteris arborescens (?), Schlotheim.

These were taken from various localities on the north side of the Hillsborough Bay and the south side of Lot 65, and occur through a depth of strata amounting to more than one thousand feet.

On the Island, two distinct systems of rocks are recognized: the Permo-carboniferous and the Triassic. In the first of these are a number of beds rich in remains of plants. But the Triassic is characterised by an exceeding barrenness of well-preserved organic remains.

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* American Journal of Science, Vol. XXI, No. 122.

Hitherto the most characteristic species obtained from it have been the reptile *Bathygnathus borealis* and fossil wood of a type elsewhere found in the Mesozoic. These are, however, sufficient to distinguish it from the underlying Permian. The fossils now referred to are species belonging to the latter, but found in beds heretofore referred to the Trias. The inference would be that the Permo-carboniferous formation is more extensively distributed on the south side of Prince Edward Island than has been supposed.

The following section observed at Rice Point and vicinity, shows the nature and arrangement of the beds affording the fossils referred to:

SECTION IN DESCENDING ORDER.

Rocks.	*Feet.*	*Fossils.*
1. Dark Red or Brown Sandstones,	15	
2. Dark red Sandstone, irreg. bed.,	50	*Calamites Suckovii, Knorria, Pecopteris arborescens.*
3. Shale, red.....	50	
4. Dark red Sandstones, irregularly bedded, often calcareous; many obscure remains of plants and *bituminous markings*; some thin beds of shale.....	325	*Knorrta.*
5. Red Sandstones, not often calcareous; few markings of plants; a few feet of Cal. Conglomerate and ochre-colored beds.....	175	*Calamites gigas.*
6. Alternate Beds of Red Sandstone and Shale with grey indurated bands at their junction; more regularly bedded than 4 and 5..	586	
7. Red Sandstone with indurated Calcareous bands.....	40	*Walchia gracilis, Pecopteris rigida.*
	1241	

THE SEQUOIAS OR GIANT TREES OF CALIFORNIA.

By Prof. O. Heer.

(Read before the Botanical Section of the Swiss Natural History Society.)
[Translated by W. B. Dawson.]

The Sequoia belongs to that most beautiful and widespread tribe, the Conifers; and I therefore take the liberty of bringing before your notice a description of these giant trees.

The name itself deserves consideration. It is that of an Indian of the Cherokee tribe, Sequo Yah, who invented an alphabet without any aid from the outside world of culture, and taught it to his tribe by writing it upon leaves. This came into general use among the Cherokees, before the white man had any knowledge of it; and afterwards, in 1828, a periodical was published in this character by the missionaries. Sequo Yah was banished from his home in Alabama, with the rest of his tribe, and settled in New Mexico, where he died in 1843.

When Endlicher was preparing his synopsis of the Conifers, in 1846, and had established a number of new genera, Dr. Jacbon Tschudi, the present Swiss ambassador at Vienna, who was then living with Endlicher, brought before his notice this remarkable man, and asked him to dedicate this red-wooded tree to the memory of a literary genius so conspicuous among the red men of America. Endlicher consented to do so, and only endeavored to make the name pronounceable by changing two of its letters. The tribe of the Cherokees is dying out, and with it, its language; but Sequo Yah's name will live as the designation of the giant trees of his country.

Endlicher has founded the Genus on the Redwood of the Americans, *Taxodium sempervirens* of Lamb; and has called the species *Sequoia sempervirens*. These trees form large forests in California, which extend along the coast as far as Oregon. Trees are there met with of 300 feet in height and 20 feet in diameter. The seeds have been brought to Europe a number of years ago, and we already see in upper Italy and around the Lake of Geneva high trees; but, on the other hand, they have not proved successful around Zurich.

In 1852, a second species of Sequoia was discovered in California, which, under the name of Big Tree, soon attained a

considerable celebrity. Lindley described it, in 1853, as *Wellingtonia gigantea;* and, in the following year, Decaisne and Dr. Torrey proved that it belonged to Sequoia, and that it accordingly should be called *Sequoia gigantea.* But Endlicher had already employed that name for another species, in 1847, and the prodigious size which he ascribes to that tree makes it probable that he had in some way received information respecting this Californian giant before it was made known by Lindley. It therefore remains doubtful whether his *Sequoia gigantea* is identical with *Wellingtonia gigantea* or not.

While the *Sequoia sempervirens,* in spite of the destructiveness of the American lumbermen, still forms large forests along the coast, the Sequoia gigantea is confined to the isolated clumps which are met with inland at a height of 5,000 to 7,000 feet above sea level, and are much sought after by tourists as one of the wonders of the country. Reports came to Europe concerning the largest of them which were quite fabulous, but we have received accurate accounts of them from Prof. Whitney. The tallest tree measured by him has a height of 325 feet, and in the case of one of the trees the number of the rings of growth indicated an age of about 1300 years. It had a girth of 50 to 60 feet.

We know only two living species of Sequoia, both of which are confined to California. The one (*S. sempervirens*) is clothed with erect leaves, arranged in two rows, very much like our yew-tree, and bears small round cones; the other (*S. gigantea*) has smaller leaves, set closely against the branches, giving the tree more the appearance of the cypress. The cones are egg-shaped, and much larger. These two types are therefore sharply defined.

Both of these trees have an interesting history. If we go back into the Tertiary, this same genus meets us with a long array of species. Two of these species correspond to those living at present: the *S. Langsdorfii* to the *S. sempervirens,* and the *S. Sternbergii,* to the *S. gigantea.* But whilst the living species are confined to California, in the Tertiary they are spread over several quarters of the globe.

Let us first consider the *Sequoia Langsdorfii.* This was first discovered in the Lignite of Wetterau, and was described as *Taxites Langsdorfii.* I found it in the upper Rhone and in Monod, and there lay beside the twigs the remains of a cone, which showed me that the *Taxites Langsdorfii* of Brogn... be-

longed to the Californian genus Sequoia established by Endlicher. I afterwards found much better preserved cones, together with seeds, under the plants of Samland and Greenland which fully confirmed the determination. At Atanckerdzuk in Greenland (about 70° N. Lat.) this tree is very common. I have received from this place hundreds of twigs with the leaves, and also the flowers and numerous cones, which leave no doubt that this tree stands very near to the Redwood. It differs from it, however, in having a much larger number of scales in the cone. The tree is also found in Spitzbergen at nearly 78° north latitude, where Nordenskiöld has collected, at Cape Lyell, wonderfully preserved branches. From this high latitude the species can be followed down through the whole of Europe as far as the middle of Italy (at Senegaglia, Gulf of Spezia). In Asia also we can follow it to the steppes of Kirghisen, to Possiet, and to the coast of the Sea of Japan, and across to Alaska and Sitka. It is thus known in Europe, Asia and America, from 43° to 78° north latitude, whilst its most nearly related living species, perhaps even descended from it, is now confined to California.

With this *S. Langsdorfii*, three other Miocene species are nearly related: (*S. brevifolia*, Hr., *S. disticha*, Hr., and *Nordenskiöldi*, Hr.) These have been met with in Greenland and Spitzbergen, and one of them has lately been found in the United States. Three other species, in addition to these, have been described by Lesquereux, which appear to belong to the group of the *S. Langsdorfii*, viz., *S. longifolia*, Lesq., *S. angustifolia* and *S. acuminata*, Lesq.

These species thus answer to the living *Sequoia sempervirens;* but we can also point to a Tertiary representative (in the Miocene) of the *S. gigantea*. It is the *Sequoia Sternbergii*, (*Araucarites Sternbergii*, Goepp.). The leaves are stiff and sharp-pointed, are thinly set round the branches, and lie forward in the same way: the egg-shaped cones have the same size. The species was first found in Austria, and was classed with the Araucaria; but the cones found by Massalongo show it to belong to Sequoia. I have specimens of the species from Oeningen, and also from Iceland and Greenland. The twigs are abundant in Surturbrand;* and the opinion may be expressed that the stumps and roots which Prof. Steenstrup has met with in the basaltic beds of Iceland belong to this tree.

* Brown Coal.

Although this species is not as widely distributed as the *Sequoia Langsdorfii*,, we can yet trace it from the middle of Italy to north Greenland, in latitude 70° north, and it is met with from the beginning of the Miocene to its close.

The *S. Langsdorfii* and *Sernbergii* represent the two extreme forms of the genus Sequoia. It is therefore very noticeable that we have in the Miocene six species, which fill up the gap. They are the *S. Couttsiæ*, *S. affinis*, Lesq., *S. imbricata*, Hr., *S. sibirica* Hr., *S. Heerii* Lesq., and *S. biformis* Lesq. Of these, *S. Couttsiæ*, Hr., is the most common and most important species. It has short leaves, lying along the branch, like *S. Sternbergii* and *gigantea*, and small round cones, like *S. Langsdorfii* and *sempervirens* I have received from Bovey Tracey in Devonshire splendid specimens of cones, seeds and twigs, which I have described in the Philosophical Transactions. More lately, Count Saporta has described specimens of cones and twigs from Armissan. Specimens of this species have also come to me from Samland and Greenland, and must therefore have had a wide range. It is very like to the American *S. affinis*, Lesq.

In the Tertiary there have been already found fourteen well marked species, which include representatives of the two living types, *S. sempervirens* and *S. gigantea*.

CRETACEOUS.

We can follow this genus still further back. If we go back to the Cretaceous age, we find ten species, of which five occur in the Urgon of the Lower Cretaceous, two in the Middle, and three in the Upper Cretaceous. Among these, the Lower Cretaceous exhibits the two types of the Sequoia sempervirens and *S. gigantea*. To the former the *S. Smithiana* answers, and to the latter, the *Reichenbachii*, Gein. The *S. Smithiana* stands indeed uncommonly near the *S. Langsdorfii* both in the appearance of the leaves on the twigs and in the shape of the cones. These are, however, smaller, and the leaves do not become narrower toward the base. The *S. pectina*, Hr., of the Upper Cretaceous has its leaves arranged in two rows and presents a similar appearance. The *S. Reichenbachii* is a type more distinct from those now living and those in the Tertiary. It has indeed also stiff, pointed leaves, lying forward, but they are arcuate, and the cones are smaller. This tree is already known for a long time, and it serves, in the Cretaceous, as a guiding star, which

we can follow from the Urgon of the Lower Cretaceous up to the Cenomanian. It is known in France, Belgium, Bohemia, Saxony, Greenland and Spitzbergen. It has been placed in another genus—Geinitzia—but I can recognize, by the help of the cones, that it belongs to Sequoia.

Below this, there is found in Greenland a nearly related species, the *S. ambigua*, Hr., of which the leaves are shorter and broader, and the cones round and somewhat smaller.

The connecting link between *S. Smithiana* and *Reichenbachii* is formed by *S. subulata* Hr., and *S. rigida*, Hr., and three species (*S. gracilis*, Hr., *S. fastigiata* and *S. Gardneriana*,, Carr.) with leaves lying closely along the branch, and which come very near to the Tertiary species *S. Couttsiæ*. We have therefore in the Cretaceous quite an array of species, which fill up the gap between the *S. sempervirens* and *gigantea* and show us that the genus Sequoia had already attained a great development in the Cretaceous. This was still greater in the Tertiary, in which it also reached its maximum of geographical distribution. Into the present world the two extremes of the genus have alone continued; the numerous species forming its main body have fallen out in the Tertiary.

JURASSIC.

If we look still further back, we find in the Jura a great number of conifers, and, among them, we meet in the genus Pinus with a type which is highly developed and which still survives; but for Sequoia we have till now looked in vain, so that for the present we cannot place the rise of the genus lower than the Urgon of the Cretaceous, however remarkable we may think it that in that period it should have developed into so many species; and it is still more surprising that two species already make their appearance which approach so near to the living *Sequoia sempervirens* and *S. gigantea*.

Altogether, we have become acquainted, up to the present time, with 26 species of Sequoia. The 14 species of the Arctic zone I have described and figured in my "Fossil Flora of the Arctic Regions."

THE HORNED CORYDALIS.

By the Rev. T. W. Fyles.

Corydalis cornutus is the monarch of the water-flies. I can well recall the admiration with which I first looked upon the weird beauty of this remarkable insect. The undulating body, dark and glabrous; the plated thorax; the square head, and powerful mandibulæ; the projecting eyes, black and bead-like; the long setaceous antennæ; the wonderful wings, clouded, yet transparent, flecked with white, nerved and barred, and measuring five inches from tip to tip,—presented, *tout ensemble*, an appearance both grim and fascinating. Beholding it, one could not but desire to know more of the creature's history.

In June and July of last year, this desire, as regards myself, was in a measure gratified. I had the pleasure of watching the insect through its changes, from its larval to its perfect condition. The circumstances were these:

On the 12th of June, a friend brought me a strange creature, which he had captured as it was crawling up the bank of the Yamaska River. It was four inches long, and about half an inch broad. Its color was dark-sepia. It had twelve segments besides the head. The first three of these were evidently thoracic, for the legs were attached to them, a pair to a segment. Each of the nine abdominal segments carried two remarkable appendages—one on each side—inclosing, I suppose, the branchiæ or gills. They were about a quarter of an inch in length, and gave the insect a fringed appearance. On the last segment they approached and overlapped the anal setæ. The square head of the insect was suggestive; and I said to myself: "This is the larva of the Horned Corydalis," and accordingly took measures for its safety.

I procured a large flower-pot, and half filled it with earth. In this earth I sank, to the rim, a glass saucer, full of water. I then put in the lava, and covered the pot with a pane of glass. The creature buried itself on the second day. I left it undisturbed for a week, and then thought I would remove the earth carefully until I came to it; but, on lifting the glass saucer, I found that I had no need to do more, for the larva lay exposed before me—

it had formed a cist immediately under the saucer. In this cist it remained, inactive, until the 28th of the month, when it underwent a change. The skin of the three segments next the head divided down the back, and the pupa made its *début* through the opening. The metamorphosis was very striking. Instead of the dark muddy larva, with all its grotesque appendages, there lay the bright, clean, yellow pupa, with rudimentary wings and antennæ, and eyes showing blue through the waxen skin. Spiracles, of the usual form, appeared along the sides, where the branchiæ had been cast off; and the six legs were drawn up under the body. The creature was very sensitive, either to the light, or to the slight jar occasioned by the removal of the glass, for it became uneasy; and, although it could use neither wings nor legs, it worked itself out of its cist, and made a complete tour of its prison yard, drawing itself along by its formidable jaws, which, at this stage, closely resembled those of the female imago. In a few days a change of color began to show itself. The abdomen became mottled with olive-green; and gradually the whole body of the insect darkened with the same hue.

The change to the imago took place in the afternoon of the 12th of July. The skin was rent in the same way as that of the larva had been; and the perfect insect crept from its ruptured envelope. It crawled up a slight frame-work which I had placed for its convenience, shook out its wings, and, in a few minutes, assumed its full proportions. One thing surprised me greatly. I had expected to see a *female* insect appear from the case; for the mandibles of the pupa had been, as I have said, of the exact size and shape of those of the female imago; but the creature, on making its appearance, presented the preposterously long and scythe-shaped mandibulæ of the *male*. These frightful appendages are doubtless weapons of offense; for the creature showed its *vim* by striking with them, viciously, at my finger. So eager was it for a fray, that, in following my hand with repeated snaps, it drove the weapons through its own extended wings. I noticed that the sharp tips of the "horns" were red, as if they contained a colored fluid. And I dare say it would be interesting to allow the creature to inflict a wound, for the sake of noting the effects. I was very unwilling, however, to deprive some one else of the satisfaction of being the first to try the experiment.

Although the mandibles of the male *C. cornutus* are of use to

the insect for attacking a foe, I doubt whether this is the only, or the chief purpose for which they are intended. I imagine that, in the nuptial flight, they are used for grasping the well-defended neck of the female.

C. cornutus lays its eggs on the stones and piles projecting from the river, where they are soon submerged. The aquarium would afford opportunities for studying the habits of the larva in its native element.

PROCEEDINGS OF THE NATURAL HISTORY SOCIETY OF MONTREAL.

The third meeting of the Society for the Session 1880–1881 was held on Monday evening Jan. 21st. The President occupied the chair. The Secretary read the minutes of last meeting, and announced the subjects of the Somerville lectures, together with the names of the lecturers.

Dr. Dawson then delivered an address on "New Devonian plants and other Canadian fossils."

He first described a new species of *Piloceras*, a remarkable chambered shell found by Mr. Macpherson in one of Dr. Dawson's excursions with his class in Geology, in the neighborhood of Lachute, and which, as he explained, throws much light on the structure of this ancient and curious group of shells.

He next noticed a globular organism found in great numbers in the Corniferous limestone of Kelly's Island, near Sandusky, and which he had described, some years ago, as a foraminiferal shell, under the name of *Saccammina Eriana*. He mentioned some new facts respecting it, and gave reasons for adhering to his former determination. The specimens described had been sent to him by Prof. Perry, of New York, and by Mr. Walker, of Hamilton.

He then proceeded to describe several ferns and other plants collected by Mr. Foord and Mr. Weston, of the Geological Survey, in the Devonian rocks of the Bay de Chaleur. Two of them, *Cyclopteris obtusa* and *Cyclopteris* (*Platyphyllum*) *Brownii*, are known elsewhere as upper Devonian forms. Another, *Archæopteris Gaspianis* is new. These are from the locality of the remarkable fossil fishes recently described by Mr. Whiteaves.

From another locality, and probably somewhat lower horizon, are abundant specimens of *Psilophyton* and *Cordaites angustifolia*, as well as a lycopodiaceous cone, probably new.

Lastly, he noticed the discovery, by Mr. F. Bain, of North River, Prince Edward Island, of several species of certain fossil plants in portions of the Red Sandstone formation of that Island considerably higher in stratigraphical position than that in which they were previously known to occur. The effect of this would be to require us to recognise portions of the sandstone hitherto regarded as Triassic, as being really Permian. We thus have apparently both in Prince Edward Island; and in Virginia true Permian beds holding the fossil plants characteristic of that formation.

Dr. Osler presented some notes supplementing his paper on the Canadian Fresh-water Polyzoa read before the Society in January 1877. He directed attention to the following points:

1st. The occurrence of a species of *Cristatella* which was found in great abundance in the small lakes drained by the Rivière du Loup (*en haut*), Quebec. This is the most highly organized of all the Polyzoa and is capable of a slow, snail-like movement.

2nd. The occurrence of an additional species of *Plumatellidæ*, *P. diffusa* of Leidy.

3rd. A winter ovum or statoblast presenting certain peculiarities in structure and in the form and arrangement of the annular spines, which serve to separate it from the ova of the *Pectinatella* or *Cristatella*. It probably belongs to a new species.

4th. The Rev. Thomas Hincks, F. R. S., described, in the "Annals and Magazine of Natural History," a supposed Pterobranchiate Polyzoon from Canada, sent to him by the late Prof. Hincks, of Univ. College, Toronto. The general description of this corresponds to the *Pectinatella magnifica*, except in the arrangement of the tentacles, which were borne on two distinct erect lobes, and not disposed in a horse-shoe figure. Dr. Osler was of opinion that there had been a slight error in observation, and that the species was the *Pectinatella*. He was confirmed in this by the fact that he had himself taken the specimen to Prof. Hincks, when a member of his Botany class, and so far as he remembers, it presented the characteristics which he afterwards learned were peculiar to the *Pectinatella*.

The fourth meeting was held on Monday Evening February 28th. Principal Dawson occupied the Chair.

Mr. Kenneth R. Macpherson was proposed for election as an ordinary member. The cabinet-keeper, Mr. Wm. Muir exhibited a number of birds that had been recently added to the Museum.

Dr. G. M. Dawson then addressed the meeting on "The Geology of the Peace River region."

He remarked that absolutely nothing was known of the geology of the great region through which the Peace River flows till 1875. In that year Mr. Selwyn, the director of the Geological Survey, visited the district, exploring the Peace River as far down as the confluence of the Smoky River. The results of this survey were published in the Geological Survey report, and constitute the basis of subsequent work. In 1879 it was considered desirable to obtain definite information of the Peace River district in connection with the projected line of the Canadian Pacific Railway. The geological and geographical results of this expedition in conjunction with those before obtained now enable a clear general view to be taken of the region. The Rocky Mountains formed a shore line during the deposition of the cretaceous rocks, which, stretching eastward over a distance of at least 350 miles, imply the existence of a sea of that width. Near the mountains these rocks are almost altogether represented by sandstones and conglomerates, while to the eastward, shales are more abundant, till on the Smoky River the formation resolves itself into the following subdivisions, named from the highest downward: Upper Sandstone, Upper Shales, Lower Sandstone, Lower Shales. These represent in a general way the Fox Hill, Pierre, Niobrara and Benton subdivisions of the United States geologists. A large number of fossils have been obtained from the "Upper Shales," which are definitely correlated with the Pierre group, while an interesting estuarine and fresh-water fauna, with plant remains, characterises the Lower Sandstones. The economic importance of these rocks is found in the fact that coal seams occur on two separate horizons, viz., the Upper and Lower Sandstones. The coals of the former, near the mountains, are of very good quality and resemble true bituminous coals. Those of the latter must be classed as lignites, but still have a high calorific value. It cannot be doubted that these fuels will before long be extensively mined, for the portion of the Peace River Valley embraced in the exploration of 1879 is estimated to contain about 23,000

square miles of good soil, which should the climate be as favorable for the growth of wheat as we have reason to believe, would produce over 300,000,000 bushels annually.

Mr. Whiteaves made some remarks concerning the fossils which Dr. G. M. Dawson had exhibited to illustrate his address.

It was moved by Mr. G. L. Marler, seconded by Mr. T. C. Brainerd, and unanimously resolved. "That this Society, in view of the contemplated removal of the Geological Survey from the city, would earnestly deprecate any departure from the pledge given on behalf of the Government by the Hon. Mr. Masson in his letter to the Board of Trade, of December 20th, 1879, that the museum accumulated under the late Sir W. E. Logan should be maintained in Montreal, and would express the hope that regard to the promise made, as well as the respect due to the expressed wish of Sir W. E. Logan, to the important educational and individual interests represented in this city, and to what we believe would be the unanimous wish of scientific men throughout the world were they consulted in the matter, may lead to the adoption of such measures as will leave undisturbed the collection made by our late lamented colleagues Logan and Billings"

Principal Dawson said a definite pledge had been given in an autograph letter from Hon. Mr. Masson to the Board of Trade that the Museum would be maintained. So the matter remained till a few weeks ago, when the rumor spread that the Museum building had been rented and that the Survey had been requested to pack up and leave by the first of May. To his mind the destruction of the Museum was an act of the grossest vandalism. The Museum, the work of men like Sir William Logan and the late Mr. Billings, was a kind of sacred inheritance to Canada, and he fully believed that if it were known to scientific men throughout the world that it was being so removed, there would be an unanimous cry of indignation against it from every scientific man worthy the name.

MISCELLANEOUS.

ON NEW ERIAN (DEVONIAN) PLANTS. By J. W. DAWSON, LL.D., F.R.S., F.G.S. [Abstract of a paper read before the Geological Society of London, June 23d. 1880.]

The paper first referred to recent publications bearing on the Erian (Devonian) flora of N.E. America, and then proceeded to describe new species from New York and New Brunswick, and to notice others from Queensland, Australia, and Scotland.

The first and most interesting is a small Tree-fern, *Asteropteris noveboracensis*, characterised by an axial cylinder composed of radiating vertical plates of scalariform tissue, imbedded in parenchyma, and surrounded by an outer cylinder penetrated with leaf-bundles with dumb-bell-shaped vascular bundles. The specimen was collected by Mr. B. Wright, in the Upper Devonian of New York.

Another new fern from New York is a species of *Equisetites* (*E. Wrightianus*), showing a hairy or bristly surface, and sheaths of about twelve, short, acuminate leaves.

A new and particular form of wood, obtained by Prof. Clarke, of Amherst College, Massachusetts, from the Devonian of New York, was described under the name *Celluloxylon primævum*. It presents some analogies with *Prototaxites* and with *Aphyllum paradoxum* of Unger.

Several new ferns were described from the well-known Middle Devonian plant-beds of St. John, New Brunswick; and new facts were mentioned as confirmatory of the age assigned to these beds, as showing the harmony of their flora with that of the Erian of New York, and as illustrating the fact that the flora of the Middle and Upper Devonian was eminently distinguished by the number and variety of its species of ferns, both herbaceous and arborescent. It will probably be found eventually that in ferns, equisetaceous plants and conifers, the Devonian was relatively richer than the Carboniferous.

Reference was also made to a seed of the genus *Æthcotesta* of Charles Brongniart, found by the Rev. T. Brown in the Old Red Sandstone of Perthshire, Scotland, and to a species of the genus *Dictyophyllum* of Grand'-Eury, discovered by Mr. J. L. Jack, F.G.S., in the Devonian of Queensland.

In all, this paper added six or seven new types to the flora of the Erian period. Several of them belong to generic forms not previously traced further back than the Carboniferous.

The author uses the term "Erian" for that great system of formations intervening in America between the Upper Silurian and the Lower Carboniferous, and which, in the present uncertainty as to formations of this age in Great Britain, should be regarded as the type of the formations of the period. It is the "Erie Division" of the original Survey of New York, and is spread around the shores of Lake Erie, and to a great distance to the southward.

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