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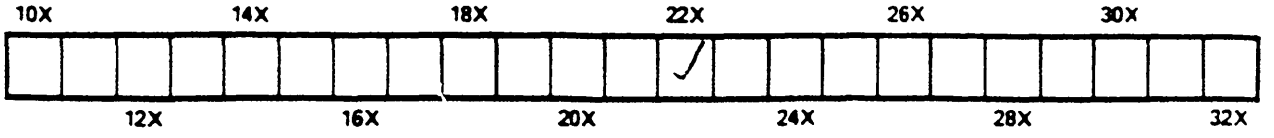

THE

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AND PROCEEDINGS OF THE

NATURAL HISTORY SOCIETY

OF MONTREAL.

CONDUCTED BY A COMMITTEE OF THE NATURAL HISTORY SOCIETY.

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

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THE

CANADIAN

NATURALIST AND GEOLOGIST.

VOL. V. FEBRUARY, 1860. No. 1.

ARTICLE I.—*On* FOSSIL PLANTS *from the* DEVONIAN ROCKS *of* CANADA.

By J. W. DAWSON, LL.D., F.G.S., Principal of McGill College, Montreal. (From the Proceedings of the Geological Society of London.)

IN 1843–44, Sir W. E. Logan ascertained, and published in his Report* for the latter year, the occurrence of a series of beds of Devonian age in the Peninsula of Gaspé, Lower Canada, containing fossil plants, apparently of the land, and some of them evidently *in situ*. Nothing was done toward the precise determination and description of these remains until 1856, when Sir William kindly permitted the writer of this paper to examine his collection, and to describe before the American Association for the Advancement of Science the most interesting specimen contained in it—a fossil trunk exhibiting a very remarkable and previously undescribed coniferous structure†. The other specimens in the collection were so fragmentary or obscure, that it was not deemed expedient to attempt their description before studying them (as all fossil plants should, when practicable, be studied) in the rocks in which they occur. With this view I visited Gaspé in the past

* Report of Progress of Canadian Geological Survey, 1844, p. 36, and Appendix.

† Proceedings of American Association, 1856, p. 174.

summer, and examined the localities indicated on the plans and sections of the Geological Survey. The facts and specimens thus obtained will probably be fully described and illustrated in one of the forthcoming Decades of Canadian Fossils; and in the meantime I propose to notice some of the species observed, which appear to be of especial interest in the present state of our general knowledge of the Devonian flora.

Before proceeding to these descriptions, it may be necessary to state that the deposit in which the fossils occur consists of sandstone and shale, of various colours and textures, with some conglomerate and thin-bedded coarse limestone, and a seam of bituminous coal, one inch in thickness. The whole series is estimated by Sir W. E. Logan at 7000 feet of vertical thickness. It rests on Upper Silurian rocks, and underlies unconformably the conglomerates which here form the base of the Carboniferous system. Some of the beds, especially in the lower part of the series, contain marine fossils of Lower Devonian forms, which are now in process of examination by Mr. Billings of the Geological Survey. The greater part of the beds are, however, destitute of marine fossils, and present appearances indicative of shallow water and even of land-surfaces. Some of the species of plants occur throughout the whole thickness; but the bed of coal and most of the plants *in situ* are found in the lower and middle portions of the series. Detailed sections and descriptions of the beds will be found in the Report above referred to.

1. Psilophyton, gen. nov. (Figs. 1 & 2.)

Lycopodiaceous plants, branching dichotomously, and covered with interrupted ridges or closely appressed minute leaves; the stems springing from a rhizoma having circular areoles, sending forth cylindrical rootlets. Internal structure: an axis of scalariform vessels, surrounded by a cylinder of parenchymatous cells and by an outer cortical cylinder of elongated woody cells (prosenchyma). Fructification probably in lateral masses, protected by leafy bracts.

The most remarkable and interesting plant of the formation is one which, I believe, has frequently been observed and described elsewhere from fragmentary specimens, but which occurs in the

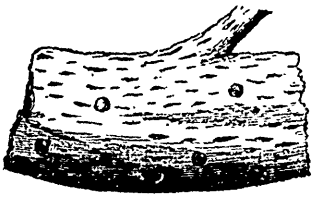


Fig. 1 *a*

Fig. 1 *d*

Fig. 1 *c*

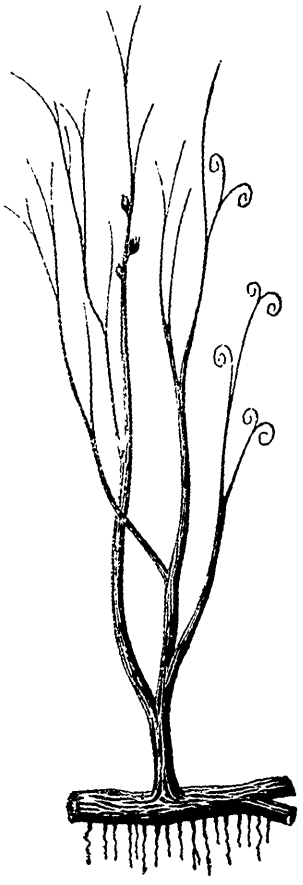


Fig. 1 *f*

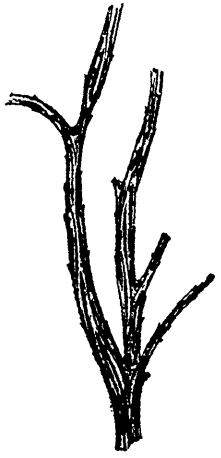
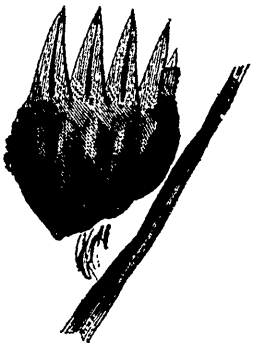


Fig. 1 *b*



Fig; 1 *e*

Fig. 1.—*Psilophyton princeps.* *a*, rhizome; *b*, stem; *c*, termination of branches; *d*, vernation *e*, fructification; *f*, restoration.

Gaspé sections in a state of perfection unusual with palæozoic plants. It is characterized by slender, bifurcating, ridged stems, proceeding from a horizontal rhizoma, which sends forth numerous rootlets. The rhizomata, evidently *in situ*, clothe some beds of indurated clay with a mat of creeping and occasionally bifurcating cylindrical stems, filling the beds below with their vertical rootlets. They attain a diameter of an inch or more, though usually smaller, and a length of at least three feet. They are irregularly dotted with minute linear punctures, the marks probably of ramenta; and at intervals there are circular areoles with central pits, like those of *Stigmaria*, but irregularly disposed, and giving origin to the roots, which, however, unlike those of *Stigmaria*, subdivide in descending into the soil. Apart from the stems, these rhizomata might be included in the genus *Karstenia* or *Halonia*, or even as abnormal species in *Stigmaria* (fig. 1 *a*,). The aërial stems vary from a fourth to a tenth of an inch in diameter at their origin, rise obliquely from the rhizoma, and bifurcate very regularly. The extreme points divide nearly at right angles, and in some, probably young, branches the ultimate branchlets bend into a spiral curve with a somewhat unilateral arrangement of the leaflets. In the shale overlying the small coal-seam above-mentioned, there are immense numbers of these little branchlets, rolled so closely as to resemble spiral shells They probably indicate a circinate vernation like that of ferns. (See figs. 1 *b*, *c*, *d*.) The surface of the stems is very smooth and glossy, quite destitute of scars, but marked with numerous interrupted ridges spirally arranged, and sometimes seen to project a little at the upper ends, as if rudimentary leaves. This leaf-like character is more distinct toward the extremities of the branches; but the leaves are not sufficiently well preserved to show anything more than that they are slender and acicular.

The greater part of the specimens are flattened, with the epidermis alone preserved in a coaly state; but a few fragments were found with the internal structure remaining. It consists of a slender axis of scalariform vessels, surrounded by a space now occupied by calcspar, but showing in parts the remains of a loose cellular tissue. Externally to this is a cylinder of well-preserved, elongated, woody cells, without distinguishable pores, but with traces of very delicate spiral fibres. (Fig. 2 *g*, *h*, *i*, *k*.)

The structure and external appearance above described indicate affinities with the *Lycopodiaceæ*, and especially with the genus

*Psilotum**, with which these plants very closely correspond n all except their rhizomes and the circinate terminations of the branchlets. The name proposed above is intended to express this relation, as well as the most apparent distinction between these plants and those of the genera *Lycopodites* and *Selaginites*†. To the species above described I would give the name of *Psilophyton princeps*. I have attempted a restoration of its general appearance in fig. 1 *f*.

III

Fig. 2 *g*

Fig. 2 *h*

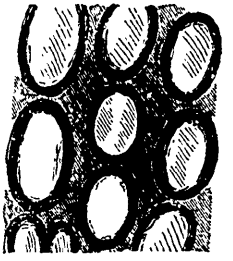


Fig. 2 *i*

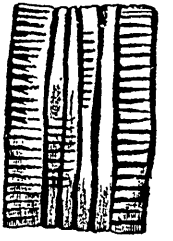


Fig. 2 *k*

Fig. 2 *g*, longitudinal section of stem, nat. size; *h*, cortical cells (300 diams.); *i*, parenchyma (300 diams.); *k*, scalariform tissue of axis (300 diams.)

Some of my specimens appear to indicate a second species, characterized by more robust stems, more finely ridged, and having slender alternate branches, which bifurcate frequently and usually bend downward. The specimens are not well preserved, but are very distinct from *P. princeps*, while probably generically related to it. I would name this species *P. robustius*.

---

* See Brongniart, Vég. Fos. vol. ii. pls. 6 & 11. I have been favoured by Prof. Gray, of Harvard College, with specimens of *P. flavidum* from Tahiti and *P. triquetrum* from Australia, which closely resemble the fossils in structure and surface-markings.

† I should have preferred the term "Psilotites;" but this has been preoccupied by a Jurassic plant, of which, however, I cannot find any detailed description. See Unger, Gen. et Spec, &c. p. 279; Brongniart, Tableau des Genres, p. 41.

Neither of the species exhibit distinct fructification. Certain obscurely cuneate carbonaceous spots attached to the sides of the branches of *P. princeps* are, perhaps, of this character; and the object represented in fig. 1 *e*, which appears to be thus attached, may be an example in better preservation than usual. It consists of four thick lanceolate leaves or bracts with single midrib, arising from a flattened carbonaceous patch, which shows traces of similar leaves on its surface. These leaves or bracts have evidently enclosed the fructification of some lycopodiaceous plant; and from their association with *Psilophyton princeps*, I regard it as highly probable, though by no means certain, that they belong to that species.

The rhizomata of *Psilophyton princeps* occur *in situ* in a number of argillaceous beds, in a manner which shows that they crept in immense numbers over flats of sandy clay, on which their graceful stems must have formed a thick, but delicate, herbage, rising to the height of from two to four feet. The rhizomes and the bases of the stems may possibly have been submerged; but I should infer, from the appearance and structure of the latter, that they were rigid, woody, and perhaps brittle. In many beds in which the rhizomes have not been distinctly preserved, the vertical rootlets remain, producing an appearance very similar to that of the Stigmarian under-clays of the coal-measures. Sir W. E. Logan has noted in his detailed sections numerous cases of this kind.

When broken into fragments and imperfectly preserved, *Psilophyton princeps* presents a variety of deceptive appearances. When perfectly compressed in such a manner as to obliterate the markings, it might be regarded as a dichotomous fucoid or a flattened root. When decorticated and exhibiting faint longitudinal striæ, it presents, especially when the more slender branchlets are broken off, the aspect of a frond of *Schizopteris* or *Trichomanites*. When rendered hollow by decay, it forms bifurcating tubules, which might be regarded as twigs of some tree with the pith removed. Lastly, the young plants might be mistaken for ferns in a state of vernation. In all conditions of preservation, the stems, rhizomes, and rootlets, if separated, might be referred to distinct genera. I have little doubt therefore that many imperfectly preserved Devonian plants of this general form, noticed under various names by authors, may belong to this genus, and some of them to the species above described. In particular I may refer

to certain dichotomous fucoids in the genera *Fucoides* and *Chondrites*; to a plant from the Hamilton Group of New York, figured by Vanuxem in his Report, p. 161; to the dichotomous roots from Orkney and Caithness described by Mr. Salter in the 'Proceedings' of this Society for last year; and to the bifurcating plants with curved tendril-like branchlets figured by Hugh Miller, 'Old Red Sandstone,' plate 7, and 'Testimony of the Rocks, p. 434. From the description in the former work, Chap. 5, it would appear that the author had observed not only the stems but the rhizomes with their Stigmaria-like areoles, though without suspecting them to belong to the same plant. I have little doubt therefore that materials exist in the Old Red Sandstone of Scotland for the reconstruction of at least one species of this genus. Various fragments which I have collected induce me to believe that it may be found also in the Lower Coal-measures.

I have noticed above the resemblance of flattened specimens of *Psilophyton* to ferns of the genus *Trichomanites* (Gœppert.) To this genus, indeed, I was disposed to refer the specimens, until I found that the internal structure was lycopodiaceous, and that the branching filaments are true branchlets covered with minute leaves. A comparison of the plants above described with *Trichomanites Beinertii* of Gœppert, and *Sphenophyllum* (*T.*) *bifidum* of Lindley and Hutton, will show at a glance the strong resemblance that subsists; and, since the specimens on which these species are founded do not appear to have exhibited internal structure or venation, I think it still admits of a doubt whether they are really ferns. By way of further caution on this point, I may remark that in flattened stems, either of *Psilotum* or of its ancient relative, the slender woody axis may leave a mark resembling the nervure of a leaf, and thus complete the resemblance to a frond of *Trichomanes*.

Since writing the above, Professor G. S. Newberry has kindly pointed out to me the close resemblance between the first species above described and *Haliserites Dechenianus* of Gœppert ('Flora der Uebergangsgebirges,' p. 88). I can scarcely doubt that this so-called fucoid is in reality a plant of the genus above described, but in such a state of compression that the stem appears like a narrow frond, and the woody axis as a midrib. As this plant is said to occur very abundantly at certain levels in the Devonian Series of the Rhine, if my suspicions as to its nature are correct

further examination might disclose its rhizomes, leaves, or fructification.*

2. Lepidodendron. (Fig. 3.)

A single species of this genus is found rather plentifully in the beds containing the plants just described, and is distinct from any that I have observed in the Coal-formation. The specimens observed were all of small size and fragmentary, nor was their state of preservation very good, though most of them were

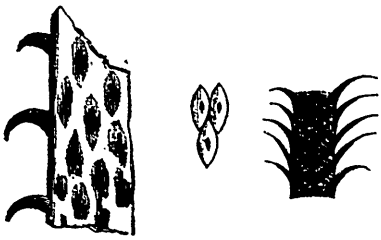


Fig. 3 *a* Fig. 3 *b* Fig. 3 *c*

Fig. 3. *Lepidodendron Gaspianum.* *a*, decorticated stem and leaves; *b*, areoles; *c*, small branch and leaves.

accompanied by the leaves. In specimens about two inches in diameter, the areoles are two lines in length and one in breadth, and placed closely together. They are elliptical, acuminate, with central leaf-scar, the form and markings of which could not be perceived. The leaves are thick at the base and short, slightly ascending, and then curving downward. The branches are slender, straight, and very uniform in thickness in the portions observed. This plant may be identical with the *L. Chemungense* of Hall, from the Devonian rocks of New York; but I am not aware that any specimens of that species hitherto observed show the leaf-scars or leaves; and, when these are obtained, should the present species prove distinct, I would name it *L. Gaspianum*†. Its characters, as above stated, are represented in figs. 3 *a–c*.

* It is possible that some of the fragments, from the Devonian of the Thüringerwald, included by Prof. Unger in his order *Rhachiopterideæ* may be allied to *Psilophyton*. (See Denkschr. Kais. Akad. Wissen. Wien, vol. xi. p. 139.)

† *L.* (*Sagenaria*) *Veltheimianum*, another ancient and widely distributed species, resembles the above in the form of the areoles and position of the scars; but the leaves and young branches differ, and my specimens show no median furrow in the areoles. *L. nothum* (Unger) also seems closely allied.

3. Prototaxites, gen. nov. (Fig. 4.)

Woody trunks with concentric rings of growth and medullary rays. Cells of pleurenchyma scarcely in regular series, thick-walled, and cylindrical, with a double series of spiral fibres. Disc-structure indistinct in the specimens observed.

I propose the above generic appellation for a tree having the spirally marked cells characteristic of the genera *Taxites* and *Spiropitys* of Gœppert, but differing from any conifer known to me in the cylindrical form and loose aggregation of the wood-cells, as seen in the cross-section, in which particular it more

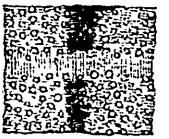


Fig. 4 *a*

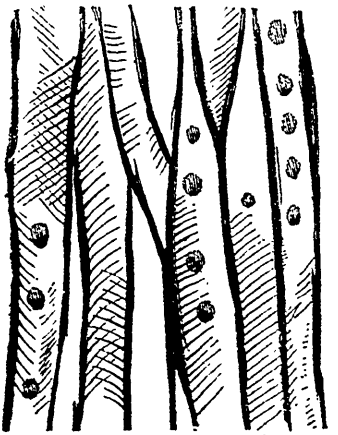


Fig. 5 *b*

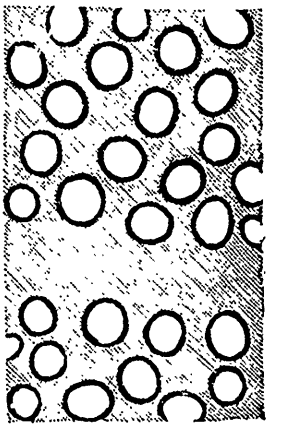


Fig. 5 *c*

Fig. 4. *Prototaxites Logani.* *a*, cross-section, magnified 40 diams., showing growth-line and medullary ray; *b*, longitudinal section (300 diams.); *c*, transverse section (300 diams.)

nearly resembles the young succulent twigs of some modern conifers than their mature wood. A fine silicified trunk of this tree was brought from Gaspé by Sir W. E. Logan, and was shortly described in the 'Proceedings of the American Association' for 1856.

The specimen is nine inches in diameter, and presents throughout a series of rings of growth, rather more than one-tenth of an inch in average thickness. Under the microscope, the cross-section exibits cells perfectly circular in outline, not crowded, but becoming much smaller at the margins of the rings of growth, where some large irregular openings perhaps represent resin-ducts. The medullary rays are marked by clear structureless spaces. In the longitudinal section, parallel to the medullary rays, the wood-cells are seen to be much elongated, and to terminate in conical points; and their sides are covered with the remains of a double series of spiral fibres, among which are a few scattered roundish spots, which perhaps indicate a single row of discs*. The cells of the medullary rays have been entirely disorganized; but the space which represents them in a tangential slice, shows that they must have consisted of several rows of cells. (Figs. 4 *a–c.*)

In my late visit to Gaspé, I was so fortunate as to find a second tree of this species imbedded in the strata, though having its structure in a less perfect state of preservation than the specimen above described. It was in a prostrate position, the trunk lying S. W. and N. E., in a thinly bedded, crumbling, pyritous sandstone. The trunk is silicified, one foot five inches in its greatest diameter, and eleven inches in its least, the difference being due to compression; a branch five inches in diameter sprang from its side. On the external surface was a thin layer of crumbling coal, probably representing the bark. No pith was perceptible; but there was a channel or depression along the upper surface, as if a pith-cavity had existed and, when the wood became softened by decay, had given way to pressure. The age of this tree, as indicated by its rings of growth, would be about one hundred and fifty years; so that, though the tissue appears lax, it was not of more rapid growth than in modern conifers. The growth-rings also in the specimen previously described, as well as in this, are well marked, indicating a decided difference of temperature in the seasons of the Devonian year. I cannot propose for this monarch of the old Devonian forests of Gaspé a better or more appropriate name than that of its discoverer, and shall therefore name it *Prototaxites Logani.*

---

* This disc-like structure was first pointed out to me by Mr. Poe, of Montreal, a very zealous and successful microscopist.

With respect to the affinities of the genus, I can only say that the markings on its wood-cells most nearly resemble those of the two genera of fossil Taxine trees above-mentioned, which are, however, found in much more modern geological formations. Among recent trees known to me by specimens or figures of their tissues, *Taxus baccata* and *Torreya taxifolia* most nearly resemble the Gaspé fossil. In the meantime, therefore, it may be included in the subfamily *Taxineæ*.

I could detect no leaves or fruit likely to belong to the species; but this is not wonderful, since in the Coal-formation the wood of conifers is very abundant, while their foliage is extremely rare.

Before leaving this ancient taxine conifer, it may be useful to notice the deceptive appearances which its wood presents when imperfectly preserved. In some parts of my second specimen the woody tissue has been entirely obliterated, and is replaced by a kind of oolitic concretionary structure, apparently connected with the presence of iron-pyrites. In other portions the wood seems to have been resolved into a homogeneous paste before silicification; and this, being moulded on minute granular crystals of quartz, assumes the aspect of a tissue of fine parenchymatous cells—a deceptive appearance very common in badly preserved fossils penetrated by calcareous or silicious matter. In other parts of the specimen the cell-walls remain, but in an opaque coaly condition, which conceals their spiral fibres and discs. I am not quite certain that this last form may not represent the natural state of the heart-wood of the tree. In the first specimen, obtained by Sir W. E. Logan, the whole trunk appears to be well preserved, with the exception of the medullary rays.

4. Poacites, Knorria (fig. 5), Carbonized Wood (fig. 6), etc.

In addition to the plants above described, the Gaspé sections contain, especially in the beds near the coal-seam, abundance of what seem to be long parallel-sided leaves, with delicate longitudinal striæ, and varying from a fourth of an inch to an inch, in breadth. They may be placed provisionally in the genus *Poacites*, but are perhaps leaves of *Nœggerathia* or *Cordaites*.

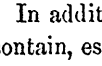


Fig. 5 *a*

Fig. 5 *b*

Fig. 5. *Knorria* ? *a*, nat. size; *b*, magnified.

There is also in the Collection of the Geological Survey of Canada a remarkable fragment, covered with sharp, flat, angular scales. Were it not for its carbonaceous character, I should be inclined

to regard it as of animal rather than vegetable origin. If a plant, it must, I presume, be referred to the genus *Knorria* (see fig. 5). In the same collection is a flattened and obscurely marked stem, from rocks of the same age at Kettle Point, Lake Huron. Its markings are scarcely sufficiently distinct for description, but cannot be distinguished from those of some of the varieties of *Knorria imbricata.*

Another suite of specimens in the Museum of the Geological Survey indicates the existence of a large plant, the precise nature of which it is perhaps at present impossible to determine. One of the specimens from Gaspé has the aspect of a long flattened trunk, having in a few places the remains of a carbonaceous coating, presenting longitudinal ribs like those of *Calamites.* It is crossed at intervals by markings not quite at right angles to the sides of the stem, each of which consists of a sharp ridge with a furrow at either side. The specimen is four inches in breadth and about four feet in length. Other specimens from Kettle Point vary from five inches to one inch in breadth; and some of them show traces of longitudinal ribs, but others are quite smooth, or marked only by the rhombic structure-lines of the coaly matter. All show transverse or diagonal ridges, though some of these seem to be merely cracks filled with mineral matter. Crushed Calamites, in a very bad state of preservation, might assume these appearances; but, until better specimens occur, the true nature of these plants must remain doubtful. They are very possibly of the same nature with the Calamite-like stems described by Miller in his 'Testimony of the Rocks,' p. 439.

In every part of the Gaspé sections, beds occur having their surfaces thickly covered with fragments of carbonized vegetable matter, evidently drifted by the currents which deposited the sand composing the beds. A large proportion of these comminuted plants belong to the genus *Psilophyton*; but many are fragments of the wood of larger vegetables. Nearly all are in a very imperfect state of preservation; and most of those that retain their structure show a scalariform tissue similar to that represented in fig. 6, and probably belong to the axis of *Lepidodendron.* Others exhibit elongated woody cells, without minute markings, perhaps

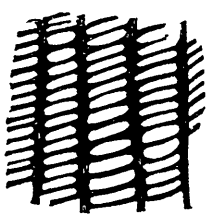


Fig. 6.

Fig. 6. Scalariform tissue (magnified 300 diams.)

from the cortical portion of the same genus, or possibly coniferous*. Another form of carbonaceous matter, abundant in some of the sandstones, consists of scaly fragments resembling the remains of decayed cones, probably *Lepidostrobi.*

The great abundance of vegetable fragments throughout an immense thickness of rock, indicates the existence of extensive land surfaces clothed with vegetation, though this apparently consisted of but a few species. The small bed of coal occurring in the lower part of the section, is composed entirely of irregularly laminated shining coaly matter without mineral charcoal. From its appearance and the vegetable remains in its underclay, I infer that it consists principally of the accumulated rhizomata of *Psilophyton, in situ.* Its roof-shale is filled with the Poacites-like leaves before mentioned, and with stems of *Psilophyton;* and it is remarkable that these last are in great part coiled up in the state of vernation, as if overwhelmed by a succession of spring floods.

5. Animal Remains, Rain-marks, etc.

The animal remains found in the plant-beds were *Entomostraca* (*Beyrichia*), *Spirorbis* (resembling that of the coal-measures), Worm-tracks, and Ichthyodorulites (*Onchus* and *Machæracanthus*†). In one of the beds above the coal Sir W. E. Logan found a few brachiopodous shells, apparently identical with those at the base of the series, and also some remarkable transversely marked furrows, which may have been produced by worms or by marine gasteropods.

Near the upper part of the section, where the plants become more rare, and the rocks are more abundantly tinged with the red peroxide of iron, the beds are plentifully and often very grotesquely marked with ripple-furrows, shrinkage-cracks, and current-lines. In one or two beds there are surfaces covered with rounded projections resembling casts of rain-marks; and in proof that this is their true character, the surface being irregular, we have not only the rain-marks themselves, but the little rills formed by the gathering drops as they rolled along, in this one of the most ancient showers of which we have as yet any geological record.

The general character of the conditions indicated by the Devonian rocks and flora of Gaspé does not differ materially from that

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* *Aporoxylon* (Unger).

† Prof. Newberry regards one of these as identical with his *Macha.acanthus sulcatus* from the Devonian of Ohio.

of the Carboniferous period, though the vegetation would appear to have been poorer in species and more exclusively Lycopodiaceous; in which respects it more nearly resembles that of the Lower than of the Middle or Upper Coal-measures. The general history is that of a sea-bottom elevated or filled up in such a manner as to afford sandy or muddy flats, on portions of which plants grew, and on other portions vegetable fragments were drifted, or bare surfaces were exposed to the alternate influences of aqueous deposition and aërial desiccation,—these various conditions being more or less prevalent throughout a long period, during which the area may have been gradually sinking, to be again disturbed and elevated at the commencement of the Carboniferous period.

In explanation of the siliceous and plant-bearing character of the Gaspé beds, as compared with their more calcareous and marine character in some other parts of America, I may point to their vicinity to the old Laurentian land on the north side of the Gulf of St. Lawrence, and to the possible existence of a nearer belt of Lower Silurian land, indicated by the unconformability, in this part of Canada, of the Lower and Upper Silurian rocks.

In the collection of Sir W. E. Logan there are some vegetable remains from the limestones of Cape Gaspé and its vicinity, which perhaps indicate a still older terrestrial flora than that above described. They afford, I think, evidence of the existence of at least one species of *Psilophyton* and one of *Nœggerathia* or *Poacites;* but whether identical or not with those above described, I cannot determine from the specimens. The beds in which they occur certainly underlie the Gaspé sandstones, and are probably Upper Silurian.

ARTICLE II.—*List of Plants found growing as indigenous in the neighbourhood of Prescott, C. W.; for the most part, collected in* 1859, by W. E. Billings. (Supplementary to Article 6, "Canadian Naturalist," February, 1858.)

Ranunculaceæ.

Anemone cylindrica, (Gray). Thickets; westward; common.
Hepatica triloba, (Chaix). Exposed rocky places; rare.
Ranunculus aquatilis (L.), var. divaricatus. Ponds, &c.; common.
" Purshii, (Richards). Railroad Bay; rare, but common northward.

Ranunculus flammula (L.), var. reptans. Ordnance lots, near Fort Wellington; on heavy soil, in exsiccated places; not frequent.

" Pennsylvanicus (L.) Flowering, August and November. Everywhere common in moist places.

Actæa spicata (L.), var. rubra. (Michx). Woods and thickets, affecting more exposed localities than var. alba.

Nymphæaceæ.

Nuphar advena, (Ait.) Everywhere common in still water.

" Kalmiana, (Pursh). Nation River, and common northward.

Fumariaceæ.

Corydalis glauca, (Pursh). Gneiss rocks, near Brockville; rare.

Cruciferæ.

Nasturtium lacustre, (Gray). Growing in crevices of rocks in shallow, running water; rare.

Cardamine hirsuta, (L.) Wet places; common, especially in shady swamps.

Sinapis nigra, (L.) In places where it was formerly cultivated.

Lepidium Virginicum, (L.) Waste, exposed, hard soil; very common.

Thlaspi arvense, (L.) West end of Dibble Street; rare.

Violaceæ.

Viola Canadensis, (L.) Rich woods, westward.

Cistaceæ.

Lechea minor, (Lam.) Banks of the St. Lawrence, westward.

Droseraceæ.

Drosera rotundifolia, (L.) Marsh near Prescott Junction; rare.

Hypericaceæ.

Hypericum mutilum, (L.) In wet, sandy places; common.

Caryophyllaceæ.

Arenaria serpyllifolia, (L.) A weed, in gardens and elsewhere; common.

Stellaria borealis, (Bigelow). Swamps northward.

Geraniaceæ.

Geranium Robertianum, (L.) Banks of Conway's Creeks, among loose rocks.

Rutaceæ.

Zanthoxylum Americanum, (Mill.) Woods westward; not frequent, but abundant northward and southward.

Anacardiaceæ.

Rhus Toxicodendron, (L.) In swamps and thickets; common.

" glabra, (L.) Northward in woods, and not often met with.

Leguminosæ.

Trifolium arvense, (L.) Conway's; not seen elsewhere.

Desmodium Canadense, (D. C.) Banks of the St. Lawrence, in thickets; rare.

Astragalus Canadensis, (L.) Wastes near Grand Trunk Railway gravel pit. Common on the rocky banks of the St. Lawrence near Brockville.

Lespedeza capitata, (Michx). Same localities as last, and more abundant.

Vicia sativa, (L.) Waste places; rare.

Lathyrus palustris, (L.), variety myrtifolius. Shaded banks along streams; rare.

Apios tuberosa, (Mœnch). Marsh near Blue Church, and common on the banks of streams inland.

Amphicarpæa, (Nutt.) Wood and thickets; abundant.

Rosaceæ.

Potentilla Canadensis, (L.) Dry, grassy places, but not common.

Rubus hispidus, (L.) Low woods; rare, but common northward.

Rosa blanda, (Ait.) Waste places; common, especially among rocks.

Cratægus Oxycantha, (L.) Rocky banks of the St. Lawrence, near Brockville.

Pyrus Americana, (D. C.) Wet woods, four miles north of Prescott.

Onagraceæ.

Epilobium palustre, (L.), var. lineare. Swamps and bogs; common.

Proserpinaca palustris, (L.) Swamps northward.

Hippuris vulgaris, (L.) In shallow water, near the banks of the St. Lawrence, Johnstown.

Grossulaceæ.

Ribes nirtellum, (Michx). Common in moist places.)

" lacustre, (Poir). Close, moist woods; common.

Crassulaceæ.

Sedum Telephium, (L.) Waste places; rare.

Saxifragaceæ.

Saxifraga Virginiensis, (Michx). Rocky banks of the St. Lawrence, westward; abundant.

" Pennsylvanica? (L.) Bog near Graveyard; not in flower.

Umbelliferæ.

Hydrocotyle Americana, (L.) Moist places; abundant.

Heracleum lanatum, (Michx). Waste places; banks of St. Lawrence westward.

Zizia integerrima, (D. C.) Sandy banks facing southward.

Araliaceæ.

Aralia hispida, (Michx). Sandy hill-sides; not common.

Cornaceæ.

Cornus circinata, (L'Her.) Rocky banks of the St. Lawrence, westward.

" sericea, (L.) Same locality as last.

" paniculata, (L'Her.) Grand Trunk Railway enclosures; westward.

Caprifoliaceæ.

Symphoricarpus occidentalis, (R. Br.) Rocky woods, near G. T. R. gravel-pit.

Viburnum opulus, (L.) Rare, but common on banks of streams northward.

Triosteum perfoliatum, (L.) May be looked for here, as it occurs on the banks of the Oswegatchie, three miles south of Prescott.

Rubiaceæ.

Galium lanceolatum, (Torr.), G. latifolium of former Art. Common in rich woods.

Dipsaceæ.

Scabiosa atropurpurea, (L.) Grassy bank of Railroad Bay, probably escaped from cultivation.

Compositæ.

Diplopappus umbellatus, (Torr. & Gr.) Thickets westward; rare.

Solidago squarrosa, (Muhl). Rocks, banks of the St. Lawrence. westward; rare.

" latifolia, (L.), S. Muhlenbergii of former Art. Common in shady places.

Rudbeckia laciniata, (L.) Grove near the Blue Church, and westward on the banks of the St. Lawrence; rather rare.

Bidens frondosa, (L.) Everywhere; common.

" Beckii, (L.) Railroad Bay, and streams northward, but rare.

Tanacetum vulgare, (L.) Waste places near dwellings.

Lobeliaceæ.

Lobelia syphilitica, (L.) Low grounds; not common.

" Kalmii, (L.) Banks of St. Lawrence westward, in damp soil

Ericaceæ.

Vaccinium Pennsylvanicum, (Lam.) Dry thickets and woods; frequent.

" Canadense, (Kalm). Moist woods and thickets; frequent.

" Corymbosum, (L.) Swamps northward; common.

Arctostaphylos Uva-ursi, (Spreng). Rocky banks of the St. Lawrence near Brockville.

Ledum latifolium, (L.) Marsh near the Junction.

Plantaginaceæ.

Plantago lanceolata, (L.) Fields; rare.

Lentibulaceæ.

Urticularia vulgaris, (L.) Abundant in Conway's Creek.

Scrophulariaceæ.

Ilysanthes gratioloides, (Benth). Marsh near the Junction.

Melampyrum Americanum, (Michx). Rocks, woods westward; abundant.

Labiatæ.

Mentha viridis, (L.) Wet places; not common.

Hedeoma pulegioides, (Pers.) Road-sides; very rare.

Monarda fistulosa, (L.) Banks of St. Lawrence westward.

Borraginaceæ.

Lithospermum arvense, (L.) Cultivated fields; rare.

Hydrophyllaceæ.

Hydrophyllum Virginicum, (L.) Rich woods, westward; rare.

Convolvulaceæ.

Convolvulus arvensis, (L.) Banks of the St. Lawrence, westward; rare.

Gentianaceæ.

Gentiana Andrewsii, (Griset). Moist thickets, northward; rare.

Menyanthes trifoliata, (L.) Marshes and swamps, northward; abundant.

Apocynaceæ.

Apocynum cannabinum, (L.) Sandy hill-sides, northward; rare.

Chenopodiaceæ.

Chenopodium hybridum, (L.) Very common.

" Botrys, (L.) Near Grand Trunk Station; rare.

Polygonaceæ.

Polygonum Pennsylvanicum, (L.) Exposed, waste places; common.

" hydropiperoides, (Michx). Nation river, in water; common.

" tenne, (Michx). Banks of the St. Lawrence, westward.

Fagopyrum esculentum, (Mœnch). Woods and fields, frequent.

Elæagnaceæ.

Shepherdia Canadensis, (Nutt.) Rocky banks of the St. Lawrence westward.

Ceratophyllaceæ.

Ceratophyllum demersum, (L.) St. Lawrence River, and Conway's Bay; very common.

Callitrichaceæ.

Callitriche verna, (L.) Ponds and small streams; rare.

" autumnalis, (L.) St. Lawrence, in shallow water; abundant.

Euphorbiaceæ.

Euphorbia maculata, (L.) Railway tracks, and hard soil in open places; rare.

" obtusata, (Pursh). Road-sides and waste places; very common.

Acalyphya Caroliniana, (Walt.) Similar situations as last, but rare.

Myricaceæ.

Myrica Gale, (L.) Rocky banks of the St. Lawrence, near Brockville; rare.

Comptonia asplenifolia, (Ait.) Woods and wastes near G. T. R'way gravel-pit; abundant.

Betulaceæ.

Betula alba, var. populifolia, (Spach). Rocky banks of the St. Lawrence, near Brockville.

Salicaceæ.

Salix candida (Willd). Marshes, and moist open places; common.

" longifolia, (Muhl). Very common.

" nigra, (Marshall). Rare, but large; one tree, about half a mile west of the town, in a swamp, measures seven feet at five feet from the roots.

Coniferæ.

Pinus rigida, (Miller). Rocky banks of the St. Lawrence, near Brockville.

Juniperus communis, (L.) Abundant, on the banks of the St. Lawrence, near Brockville.

Araceæ.

Arisæma triphyllum, (Torr.) Moist woods; very common.

Acorus Calamus, (L.) Margin of streams, in slow-running water common.

Typhaceæ.

Sparganum angustifolium? (Michx). Marshy places; common.

Lemnaceæ.

Lemna trisulca, (L.) Conway's Creek, and in ponds and streams in sluggish water, northward; abundant.

" minor, (L.) Upon the surface of stagnant water, in great abundance.

Naidaceæ.

Naias flexilis, (Rostk). Slow-running water of rivulets, northward.

Zannichella, palustris, (L.) Railroad Bay; not seen elsewhere.

Potamogeton pectinatus, (L.) St. Lawrence; very common.

" pusillus, (L.) Ponds, in clear water; common.

" compressus, (Lex Fries). Grows with the last.

" perfoliatus, (L.) St. Lawrence River, and in ponds, common.

" lucens, (L.) Nation River, in great abundance.

" natans, (L.) Railroad Bays.

" heterophyllus, (L.) "

Alismaceæ.

Scheuchzeria palustris, (L.) Close swamps and bogs northward, rather rare.

Hydrocharidaceæ.

Anacharis Canadensis, (Planchon). Ponds and sheltered bays of the St. Lawrence; very common.

Valisneria spiralis, (L.) In similar situations as last, but deeper water, and not as common.

Orchidaceæ.

Platanthera bracteata, (Torr.) Close, damp woods; not common.

" hyperborea, (Lindl.) " " "

" psycodes, (Gray). Open, moist places.

Calopogon pulchellus, (R. Brown). Bogs northward; rare.

Liparis Lœselii, (Richard). Open places; rare.

Aplectrum hyemale, (Nutt.) Rich, moist woods, westward; rare.

Liliaceæ.

Smilacina stellata, (Desf.) Rich, moist woods; rather rare.

Melanthaceæ.

Uvularia sessilifolia, (L.) Low, moist places, in woods.

Juncaceæ.

Luzula pilosa, (Willd). Pine grove, near Blue Church; not found elsewhere.

Pontederiaceæ.

Schollera graminea, (Wild). Railroad Bay, growing with Potomogeton.

Cyperaceæ.

Cyperus diandrus, (Torr.) Low grounds; common. C. inflexus of former list.

strigosus, (L.) Banks of the St. Lawrence, westward; rare.

Eleocharis compressa, (Sullivant). Wet places; common.
" acicularis, (R. Brown). " "
Scirpus pungens, (Vahl). St. Lawrence, westward; rare.
" sylvaticus, (L.) Wet places; common.
Eriophorum polystrachyon, (L.) In bogs, and everywhere common
Carex polytrichoides, (Muhl.) Bogs; common.
" Sartwellii, (Dew.) Grassy, wet places, northward; rare.
" teretiuscula, (Good.) Moist places; very common.
" stipata, (Muhl.) Common.
" sparganioides, (Muhl.) Woods and fields, in moist places; common.
" rosea, (Schk.) " " " common.
" chordorhiza, (Ehrh.) Grassy marshes; common.
" trisperma, (Dew.) Woods and swamps; "
" tenuiflora, (Wahl.) " " "
" canescens, (L.) Wet, open places.
" Deweyana, (Schw.) Copses; rare.
" stellulata, (Good). Abundant in wet places, presenting a variety of forms.
" sychnocephala, (Carey). The few plants I have seen of this species were growing in somewhat dry localities.
" scoparia, (Schk.) Wet places; very common.
" lagopoioides, (Schk.) With the last, and equally common.
" adusta, (Boott). Wastes, and along fences; "
" festucacea, (Schk.) With the last; common.
" stricta, (Lam.) Swamps and ditches; "
" aquatilis, (Wahl.) Conway's Creek, growing in water.
" crinita, (Lam.) Swamps and ditches; common.
" aurea, (Nutt.) Grassy fields; rare.
" Crawei, (Dew.) Field near Fort Wellington; not seen elsewhere.
" granularis, (Muhl.) Fields and waste places; very common.
" gracillima, (Schw.) Fields and woods, in moist places; common.
" plantaginea, (Lam.) Moist woods; rare.
" laxiflora, (laxiflora). Woods and fields, in moist places; common.
" pedunculata, (Muhl.) Rich, rocky woods, westward; abundant; flowering in April.
" Pennsylvanica, (Lam.) Same locality as last, and in full flower 8th May. Abundant.
" varia, (Muhl.) Dry wood; not so common as last.
" pubescens, (Muhl.) Woods; rather rare.
" arctata, (Boott). Woods and thickets; common.
" Œderi, (Ehrh.) Barren field near Fort Wellington; not common.
" filiformis, (L.) Marshes, northward; not frequent.
" lanuginosa, (Michx). Growing with the last, but not common.
" aristata, (Michx). Ponds, and along ditches holding water; common.
" comosa, (R. Brown). " " " " common.
" Pseudo-Cyperus, (L.) " " " "

Carex lupulina, (Muhl.) Wet places; common. About the latest flowering of the Carices.

" retrorsa, (Schw.) Conway's Creek. Spikes sometimes profusely branched.

Gramineæ.

Alopecurus aristulatus, (Michx). Wet places, growing in water; common.

Agrostis scabra, (Willd). Exsiccated places; very common.

Cinna arundinacea, (L.) Damp woods and thickets; common northward.

Muhlenbergia glomerata, (Trin.) Marsh near the Junction; rare.

" Mexicana, (Trin.) Wastes near the Junction; rare.

Brachyelytrum aristatum, (Beauv.) Woods; common.

Calamagrostis Canadensis, (Beauv.) Swamps and marshes generally, growing in water; common.

Poa annua, (L.) Roadside and waste places; frequent, and flowering from May to November.

Festuca nutans, (Willd). Rich woods, westward.

Bromus ciliatus, (L.) Banks of the St. Lawrence, westward; rather rare.

Phragmites communis, (Trin.) Swamp north of Junction; rare.

Elymus Virginicus, (L.) Banks of streams; rare.

" Canadensis, (L.) With the last, or in similar localities.

Aira flexuosa, (L.) Grove north of Capt. Miller's; rare.

Millium effusum, (L.) Close, damp woods; common.

Panicum glabrum, (Gandin). Sandy fields, eastward; common.

" clandestinum, (Muhl.) Waste places; common.

" xanthophysum, (Gray). Dry, sandy soil; common.

Andropogon furcatus, (Muhl.) Banks of the St. Lawrence, westward.

Sorghum nutans, (Gray). Banks of the St. Lawrence, near Brockville.

Equisetaceæ.

Equisetum limosum, (L.) Conway's Creek and elsewhere, growing in water; common.

Filices.

Polypodium vulgare, (L.) Rocky woods, westward; rare, but abundant on gneiss rocks, near Brockville.

" hexagonopterum, (Michx). Rich woods, westward; rare.

" Phegopteris, (L.) Woods, northward; rare.

Struthiopteris Germanica, (Willd.) Damp, rich soil, in shades; common.

Woodsia Ilvensis, (R. Brown). Rocks, near Brockvile.

Botrychium lunarioides, (Swartz). Mossy banks, in woods and fields; rare.

Lycopodiaceæ.

Lycopodium complanatum, (L.) Banks of the St. Lawrence, westward, and in an exposed situation.

Selaginella rupestris, (Spreng). Pine grove, westward, upon rocks; abundant upon rocks near Brockville.

Musci.

Sphagnum cymbifolium, (Dill.) Bogs and swamps; common.
" cyclophyllum, (Sulliv. & Lesqx.) Moist, open places; rather rare.
Dicranium varium, (Hedw.) Banks; very common.
" heteromallum, (Hedw.) On the ground, in most places very common.
" scoparium, (L.), var. pallidum. On the ground and decayed wood; common.
Ceratodon purpureus, (Brid.) On the ground; very common.
Fissidens polypodioides, (Hedw.) Woods, westward; growing on thin stratum of vegetable mould on boulders.
Trichostomum pallidum, (Hedw.) On the ground; common.
Barbula unguiculata, (Hedw.) Near Railroad Bay, and clay soils; frequent.
Orthotrichum strangulatum, (Beauv.) Bark of Ash and other trees; common.
" affine, (Schwart.) Rocks, and sometimes trees; common.
" leiocarpum, (Br. & Sch.) Trees; rare.
" Ludwigii, (Schwægr.) " "
" crispum, (Hedw.) Trees, very common, especially on the Beech.
Schistidium apocarpum, (Br. & Sch.) On boulders; common.
Hedgwigia ciliata, (Ehrh.) " "
Diphyscium foliosum, (Web. & Mohr.) On the ground, in woods.
Atrichum angustatum, (Beauv.) In woods; very common.
Polytrichum commune, (L.) Shady, moist places; very common.
Bryum argenteum, (L.) Exposed, hard soil, rocks, &c.; common.
Mnium cuspidatum, (Hedw.) Woods; common.
Anomodon obtusifolius, (Br. & Sch.) Trunks of trees, in moist woods; common.
Leskea rostrata, (Hedw.) Base of trees; common.
Neckera pennata, " Trees; very common.
Hypnum scitum, (Beauv.) Base of trees; common.
" splendens, (Hedw.) On the ground, in woods; abundant.
" deplanatum, (W. P. Sch.) Dry woods, at the base of trees; rare.
" albulum, (C. Mull.) Moist woods, on logs, &c.; common.
" Schreberi, (Willd). On the ground, in woods; common.
" fluitans, (L.) Swamps, in water; common.
" Crista-Castrensis, (L.) On the ground, and much-decayed wood; common.
" imponens, (Hedw.) On the ground, and decayed logs; very common.
" salebrosum, (Hoffm.) " " " "

Hepaticæ.

Fegatella conica, (Corda). Damp woods, on the ground and decayed logs; common.

Scapania nemorosa, (Nees). With moss, in moist places, on banks; rare.
Frullania Virginia, (Lehm.) On trees; very common.
Radula complanata, (Dumortier). On trees; "
Philidium ciliare, (Nees). On rotten wood, in swamps; common.
Trichocolea Tomentella, " On the ground, in moist places; rare.
Mastigobryum trilobatum, " " " " common.

Lichenes.

Usnea barbata, (Fr.), [Beard Moss]. Trees, rails, &c.; common.
Evernea jubata, " " Rails, stones and trees, especially the Pine; common.
Ramalina calicaris, (Fr.), [Beard Moss]. Trees, rails, &c.; common.
Cetraria ciliaris, (Ach.) Trees and rails; rare.
Peltigera aphthosa, (Hoffm.) Moist places, on the earth, among mosses common.
" rufescens, " Moist places, on the earth, decayed wood common.
Stricta scrobiculata, (Ach.) Trees; not common.
" pulmonaria, " Trees, especially the Maple; very com.
Parmelia crinita, " Trees; common.
" tiliacea, " " "
" lævigata, " " "
" colpodes, " " "
" conspersa, " Rocks and stones; common.
" parietina, (Fr.) Trees, &c.; common.
" stellaris, (Wallr.) Trees and stones; common.
" pallescens, (Fr.) Trees, &c.; very common.
" subfusca, " " " "
" varia, " " " "
Stereocaulon tomentosum, " On the earth and stones, in fields; com.
Cladonia pyxidata, " On the earth, rotten wood, &c.; "
" gracilis, " " " common.
" cornucopioides, " " " "
" Floerkiana, " On the earth, decayed logs, &c.; rare.
" rangiferina, (Hoffm.) On the earth, and much-decayed wood; common.
Biatora ocrophæa, (Tuckerm.) Trees; common.
Lecidea enterolenca, (Fr.) " "
Opegrapha scripta, (Ach. Schær.) Bark of trees; common.
Pertusaria purtusa, (Ach.) " " very common.
" faginea, " Trees, rocks, &c.; common.
Verrucaria epidermidis, (Fr.) Bark of trees, especially the Beech; common.

Characeæ.

Chara vulgaris. Common in bays and shoals of the St. Lawrence, in slow or stagnant water.

In this and the article above referred to, nearly all the Phenogamous plants in the neighborhood are enumerated, with the exception of a few Salices and Carices, the characters of which are too variable or obscure for me to determine them with confidence. No attempt has been made to give anything like a complete list of our Cryptogamia; and, little else than the more common forms are noticed.

ARTICLE III.—*On the Tubicolous Marine Worms of the Gulf of St. Lawrence, by* J. W. Dawson, LL.D., F.G.S.

Read before the Natural History Society of Montreal.

The legions of marine worms that haunt the borders of the sea are not usually very attractive to amateurs, nor have they received the attention that they merit from naturalists, yet there are few of the humbler animals that are more remarkable or interesting in their structure and habits. They constitute two orders, the errantia or vagrant sea worms, and the tubicolæ or tube dwellers. The former are the sea centipedes, sea mice, lobworms, mud worms, &c.; and though some of them are hideous in general aspect, they are all remarkable for the singular structure of their locomotive and respiratory apparatus, as well as for many curious points in their modes of life and reproduction. The report presented by Dr. Williamson to the British Association in 1851, on these creatures, is one of the most interesting zoological monographs that we possess.

The tube dwellers are simpler in the structure of their external appendages, though these are still very curious, and they are more sedentary in their habits; but their colour is often brilliant, and their shells, though generally inferior in beauty to those of the mollusks, are elegant in form, and have the advantage of being capable of easy preservation as permanent specimens.

The tubicolous worms constitute several well marked genera. Some, the *Amphitrites* and *Sabellæ*, construct fragile tubes of agglutinated grains of sand, others, the *Terebellæ*, are more select, and gather around them a tube of minute shells and shelly fragments cemented together, so that each of them is in his way a sort of little conchologist. Others secrete hard calcareous tubes, which may, as in the *Serpulæ*, be straight or irregularly curved, or, as in the *Spirorbes*, rolled into a regular spiral.

Genus *Spirorbis.*

A stroller by the sea side, searching for shells or algæ, is sure to meet with Sea weeds more or less thickly covered with little white shells, coiled up and attached firmly by one side to the weed. Sometimes they are so abundant that large fronds may have as many as a hundred on a square inch. If taken out of the sea while alive, and examined under a microscope, there may be seen to extend from the mouths of their tubes little conical buttons mounted on stalks, which are the stoppers or lids that close the orifices of their dwellings. These are followed by a group of little filaments, the gills of the animal, and amidst them is the simple suctorial mouth. These organs are slowly extended, but very rapidly withdrawn when the animal is alarmed by any agitation of the water or the vessel in which it is contained. If the animal is extracted from its tube it will be found to be a little jointed worm terminating in a point, and having at its sides minute hooks and bristles for enabling it to hold fast by the sides of its habitation and to ascend and descend at pleasure.

The species most commonly found on the shores of the gulf of St. Lawrence is the *Spirorbis spirillum—Serpula spirillum* of Linnæus. It is regularly spiral, with smooth rounded whorls, not enlarging rapidly nor much flattened at the lower side, but sometimes rising nearly into an erect position toward the mouth. Its favourite residence is on the fuci in shallow water. It is found on both sides of the Atlantic and as far north as Greenland.

On sea weeds and zoophytes from somewhat deeper water, we may often observe another species, smaller and more delicate in texture than *S. spirillum*, coiled less closely, and in the opposite way, or from right to left when the aperture of the shell is held from the observer. This is the *Spirorbis sinistrorsa.* It is not noted by Fabricius as a Greenland shell, but is found on zoophytes at Gaspé, and abounds on sea weed in deep water off the coast of Maine. This and the previous species are the only ones that an observer who confines his attention to the sea weeds of the shore may chance to meet with; but dredging in deep water will procure the following species.

Spirorbis nautiloides, the *Serpula spirorbis* of Linnæus, is of the same size with *S. Spirillum*, but is thicker, less smooth, transversely wrinkled, and more flattened at the base, so that when removed from its attachment it appears like a shell split into two equal halves. Its whorls also are more closely united and increase

in diameter more rapidly, so that there is a deep and narrow umbilical cavity in the centre. It is found both on stones and sea weeds in deep water. This is at least what I take to be the true *Serpula spirorbis* of Linnæus and Fabricius, though more recently some confusion between this shell and *S. spirillum* seems to have arisen. It was found by Fabricius in Greenland. I have it in a collection made in Labrador by Mr. Carpenter, missionary of the Canada Foreign Missionary Society, and Dr. Gould has obtained it on the American coast. I have it also on stones from the Banks of Newfoundland.

When old, this shell forms a few semi-erect turns, so as to cover up the previous whorls and the umbilicus, and terminates in a thick and slightly expanded mouth, sometimes as much as half a line in width. So completely does the shell in this condition differ from its immature state, that but for the appearances seen in sliced or broken specimens, I should have regarded it as a distinct species. A change of a somewhat similar character, though less marked, occurs in *S. cancellata*, and is represented in the figure of that species given below. Similar changes, though with differences in details, occur in *S. vitrea* and *S. porrecta*.

Spirorbis carinata (Mont.) is a deep water species, closely allied to *S. nautiloides*, if not a variety of it. It is distinguished by a keel or ridge running along the whorls, nearer the inner than the outer edge. In some old shells a second ridge appears, and then the shell very closely resembles *S. quadrangularis* of Stimpson. Young shells, on the other hand, are not distinguishable from those of the *S. nautiloides*. This species is not noted by Fabricius as a Greenland shell. It abounds in the collections of Mr. Bell of the Geological Survey, and in my own from Gaspé, where it occurred in deep water, attached to dead shells and stones. It was found at Labrador by Mr. Carpenter. I also have it on a stone taken up from the Banks of Newfoundland by a fisherman's hook, and presented to me by A. Dickson, Esq.

Spirorbis vitrea is like *S. sinistrorsa*, a reversed species, but is thick, semi-transparent, and has the whorls closely crowded, and in adult shells turned up and somewhat narrowed and thickened at the mouth. A group of these shells looks like a number of small drops of glass that had fallen on a stone and cooled there. Fabricius discovered this species in Greenland. It occurs in Mr. Bell's Gaspé collection, on the Banks of Newfoundland, and fossil

in the Pleistocene beds at Montreal and Beauport. It is noted by Stimpson as found in the Bay of Fundy.

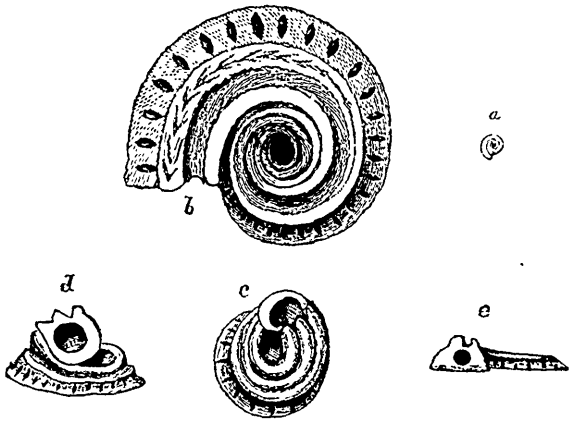

Fig. 1.—*Spirorbis cancellata.* *a* nat. size; *b* magnified; *c* older shell less magnified; *d*, *e* side views.

Spirorbis cancellata is in point of ornament the prince of our Spirorbes. It is thick, regularly spiral when young, but with the mouth tending upward when old. Above, it has two, or, in old shells, three strong ridges revolving with the whorls, and giving it an elegant fluted appearance, and the outer side presents a furrow crossed by strong transverse bars, or in other shells appears as a regular slope with a series of depressed spaces at regular intervals. The whole appearance of this shell in a perfect specimen is very elegant, and as I have not been able to find a good figure of it in any work that I have consulted, I have attempted to represent it in the figures on this page. It is a reversed species. *S. cancellata* abounds in Mr. Bell's Gaspé collection. It is one of the species found by Fabricius in Greenland and named by him, but I am not aware that it has been met with since, until dredged by Mr. Bell in about 60 fathoms on the Gaspé coast, where it lives attached to the valves of dead shells. It is also in Mr. Carpenter's collection from Labrador.

Spirorbis granulata, (Muller) resembles that last described, but wants the ornament around the margin, having only two furrow and three sharp elevated ridges on the upper side, and it is not reversed. Fabricius, who found it in Greenland, states that its animal is yellow, with a white stopper on a short stalk, and six respiratory filaments. It occurs, though rarely, in Mr. Carpenter's

collection from Labrador, on stones and bryozoa, and was found by Stimpson at Grand Manan.

Spirorbis porrecta differs from the others in having only a few spiral turns and then boldly standing erect. It is thin, shining, and round in its tube, and from its habit of growth resembles a serpula; but the animal is that of a spirorbis. Fabricius very clearly describes it as follows. It occupies when contracted only a third part of the length of the shell, is smooth, flattened on the abdomen and attenuated posteriorly. Its stopper is extended on a stem and at its base are six soft, short, white, conical respiratory processes. At the base of these the body is white, plicated, and armed with golden setæ or bristles, extending forward. The rest of the body is blood red above, lighter on the sides and below, and its colour can be seen through the semi-transparent shell. This species occurs at Gaspé on Zoophytes, and is recorded by Stimpson as found at Grand Manan.

It thus appears that of these curious little spiral worm shells, the precise use of which in nature it would perhaps be difficult to point out, but which no doubt enjoy life after their fashion, and afford food to other animals, we have no less than seven or eight species in the gulf of St. Lawrence.

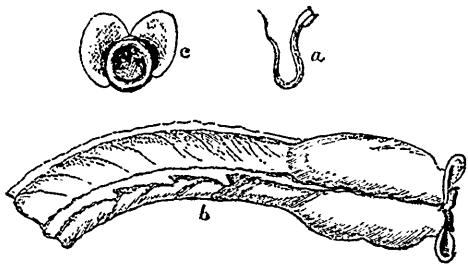

Fig. 2.—*Serpula (Vermilia) serrula?* *a* nat. size; *b* anterior part magnified; *c* aperture magnified.

Genus *Serpula.*

The true serpulæ are neither abundant nor large in the Gulf of St. Lawrence, in so far as my observation extends. The most common species, found both in Labrador and Gaspé, is of small size, about $\frac{1}{40}$th of an inch in diameter, wrinkled transversely and with a distinct and strongly denticulate keel on the back. It is adherent in its whole length, sometimes much and irregularly

bent, sometimes nearly straight. It corresponds exactly with the description of *S.* (*Vermilia*) *serrula* of Stimpson, from the Bay of Fundy. It also corresponds with the *S. triquetra* of Linnæus and Fabricius, except in its smaller size, and more delicate structure. In some specimens there is a structure which, so far as I am aware, has not been noticed in either of the above species. It consists of two lateral lobes, somewhat more than one-twentieth of an inch in length, attached to the sides of the anterior portion of the tube, and opening by narrow labiate mouths on each side of the principal orifice, so that there appear to be three orifices close together, the central one round, the lateral ones narrow and lunate. If the animal inhabiting this shell has the structure of *protula*, one may suppose that these lobes accommodate the lateral disk or expansion of the thorax. As they appear only in certain specimens, they may perhaps be connected with the function of reproduction, and be of the nature of ovi-capsules, or they may serve to enable a certain amount of respiration to proceed when the gills are retracted. It would be interesting to study the living animal with reference to these curious additions to its tube.

Serpula vermicularis is one of the shells which I have described in a former paper as found in the Pleistocene clay at Logan's Farm, but I have not seen it from the Gulf, nor is it noted by Fabricius. It is round, smooth, and tortuous.

Genus *Pectinaria.*

A shell, probably of this genus, made up of a single layer of grains of sand, is frequent on sandy shores. It is perhaps *P. Grœnlandica* Grube, *P. Belgica* Lam., but I have not seen the animal.

The *Serpula seminulum* of Fabricius is a foraminiferous shell, the *Miliolina seminulum* described in my previous papers on the Pleistocene deposits. The *S. stellaris* of Fabricius is the *Truncatulina lobata*, also a foraminiferous shell, parasitic on shells and zoophytes, found in the Gulf of St. Lawrence and in the Pleistocene beds. *Serpula contortuplicata*, a common Atlantic species, is also noted by Fabricius, but has not been found in the Gulf. This industrious observer has also, under the genera *Sabella*, *Nereis*, and *Tubularia*, several species of tube-dwelling worms, which are perhaps identical with species of *Sabella*, *Amphitrite*, &c., described by the naturalists of the United States, but which have not been observed in the Gulf of St. Lawrence.

The investigations recorded in the foregoing pages originated partly in the researches necessary to the study of the Pleistocene fossils of the St. Lawrence valley, and partly in the interest of the collections placed in the hands of the author by Mr. Bell and Mr. Carpenter. The most useful guide to the study of these collections has proved to be the old work of Otho Fabricius—the Fauna Grœnlandica, a wonderful monument of painstaking and accurate research, to which I hope ere long to direct the attention of Canadian naturalists in a comparative sketch of the marine fauna of Greenland, as described by Fabricius and others, and that of the Gulf of St. Lawrence and the tertiary beds on its margin. For access to this and some other scarce books, and for aid in the comparison of some doubtful species, I have to thank Dr. Gould of Boston and Mr. Stimpson.

ARTICLE IV.—*A Classified List of Marine Algæ from the Lower St. Lawrence, with an Introduction for Amateur Collectors.* By the Rev. Alex. F. Kemp.

This large and beautiful collection of Algæ, which we have here catalogued according to the most recent order of classification, has been put into our hands, for the most part, by a diligent and skillful collector (whose name we are not permitted to give), for the purpose of illustrating an interesting department of our Canadian Botany. The Lower St. Lawrence is, we believe, a field for research which has not yet been sufficiently explored. It has all the characteristics to render it the favorite habitat of a very wide range of genera and species. In the colder waters of the north shore, we may expect to find plants peculiar to the Arctic and Sub-Arctic zones, together with those that belong to the temperate shores of the world. Again, the somewhat warmer waters of the southern coast, as far east as Gaspé, with their peculiar shores and bays, will undoubtedly afford forms and species of marine plants, whose limits of geographical distribution reach far into the warmer regions of the south. Further, the junction of the fresh waters of the river with the salt waters of the gulf, will be found a favorite resort for some of the more beautiful and delicate species of Algæ. We have as yet seen no specimens from this middle region of our waters; but we have no doubt that somewhere about Grosse Isle, or on the shores of the counties L'Islet and Saguenay, a fine and as yet unexplored field lies open to some enthusiastic collector.

An idea is we fear somewhat prevalent that the collection and classification of sea-weeds is an employment only for children and idle people—that to give anything like earnest attention to this beautiful but comparatively useless class of plants, is to mis-spend one's valuable time. Now, we do not deny that this class of plants, from their rare beauty of form and colour and from the facility with which they may be prepared as articles of ornament, has become of late years a favourite source of amusement to young persons, and especially to young ladies. It is, however, certain that while they find amusement in collecting and preparing specimens, they also bring their minds into contact, in a most instructive way, with some of the most interesting and beautiful forms of Creative Wisdom. They, for example, become familiar with colours of gem-like lustre and with varieties of form and structure, which, for delicacy and beauty, far surpass the conceptions of human imagination or the skill of human hands. Especially this is the case if collectors examine and classify their specimens by the aid of a microscope, with powers ranging from 100 to 400 diameters. This will open up to them a world of wonders, and impart a deep and delicious pleasure to all their researches. Now that good microscopes are so cheap and so easily attainable, every collector of plants should have one, and should make it his constant companion. There is a large number of the Algæ, and these too the most beautiful and interesting, which can only be determined by a microscopic examination of their tissues and their modes of reproduction.

Let not any one imagine that these plants are of no use. They may, it is true, be of little use to us; but it is taking a low view of the utility of things to judge of it simply by our personal advantage. It is admitted that we can get very little to eat or to sell from the Algæ. We would not advise any one to attempt to make a living by collecting and preparing specimens. They are, nevertheless, not without their use. We get iodine, one of the most valuable of medicines, from the Fucaceæ; and the vast quantities of sea-weeds which are cast upon our shores are used extensively as a most excellent manure for our fields.

If we judge of the use of the Algæ, not by the direct benefits which we receive from them, but from the place which they occupy, and the work which they perform in the grand system of the organic kingdom, we shall see that these humble plants are entitled to most honorable consideration. If antiquity is any honor in

these days, the Algæ may say to their more lordly brethren of the woods and gardens, "Our forefathers lived many ages before the first of your tribe was born. We inhabited the shallow waters and the shores of the most ancient Silurian seas, and, in every subsequent age, for millions of years, we have borne silent testimony to the wisdom of the great Creator." Consider too, that if sea-weeds cannot to any great extent be eaten by us, that yet the tiny molluscs, the radiates and the smaller vertebrate fishes need food as well as we. These plants are the sources from which very many of them are sustained in life. Without them there would be famine in many families of the animal kingdom.

The marine plants perform, besides, the same sanitary work in the sea which the land plants perform on the land. Both are most important agents in purifying the atmosphere and preserving it in a healthy state for animal use. These apparently insignificant Algæ are indeed most busy and benevolent creatures. They swallow up much that is poisonous in the water, and labour hard to keep it pure and sweet. It is well known that the carbon arising from decaying vegetable or animal substances in water or on land, by combining with oxygen, forms carbonic acid gas, which is both very disagreeable to the organs of smell and very injurious to health. Were it not then for the provision which the good Creator has made, by means of land and sea-plants, to counteract this noxious vapour, many parts of the sea and land would be entirely unfit for the residence of animals. These marine plants have the peculiar faculty of absorbing from the carbonic acid gas all the noxious carbon, and setting free the healthy oxygen. They thus decompose that injurious compound, and render the waters suitable for animal life. In proof of this, we would adduce the fact, which those who are familiar with the sea-shore may have observed, that the Algæ are constantly covered with globules of air, which, like studs of brilliants, sparkle with great beauty, and sometimes shine like stars. These globules are the emancipated portions of oxygen, which, having been attracted into the bad society of carbon, are now set free by the benevolent action of the weeds; the result is, that, grateful for their liberty, they shine with evident joy.

We have said enough to show that the lowly Algæ are not so useless a class of plants as some people suppose, but that they fill an important place in the grand circle of creation; they, too, are evidences of that Divine wisdom which it is one of the employments of intelligent and good people to enquire into and admire. To

know their character and habits is to know the wisdom and goodness of our Father in Heaven.

Many young collectors, and admirers of these plants more mature in years, wish to obtain a more full acquaintance with them than that which their own unaided observations afford; but they are often at a loss to find out how this may be accomplished. Very few people in this country know anything about the scientific structure and classification of the Algæ. It is, therefore, a rare thing to find a personal instructor and guide. The next best thing is to procure good books; but then, where shall we find them? and what do they cost? are questions frequently put.

For the benefit of those who desire to cultivate, in a scientific way, this interesting department of botany, we beg to say that the books which will be of most service to them are neither difficult to obtain nor yet very costly. The best book for this country is a work by Dr. Harvey, of Dublin, recently published by the Smithsonian Institution of Washington. It can be had through any bookseller from the Messrs. Appleton, of New York, at the cost of $6. It is a large quarto size. The plates are most beautiful, and the classification most recent and complete. For a book of its kind, it is remarkably cheap. It is entitled "*Nereis Boreali-Americana.*" The next best book is Harvey's "*Atlas of British Sea-Weeds,*" with the little book which accompanies it. This work contains figures of almost every species found in the British waters, and comprises a great part of our American plants. Its cost is three guineas sterling in England, and though somewhat expensive, is really a most delightful and valuable book. "*Harvey's Manual of British Marine Algæ*" is a less costly book, and one better adapted for beginners, the last edition of which can be procured for about four dollars. A smaller and more elementary work, entitled "*Landsborough's Marine Algæ,*" very good and useful for beginners, may be obtained by any bookseller in this country, from Routledge the publisher, at a cost of two dollars. There are other books of a more expensive kind, which might be named; but these will enable any one to prosecute, with pleasure and profit, the study of the genera and species of the large subkingdom of the Marine Algæ.

The writer of this article will gladly determine any specimens for young collectors that they may find difficult or obscure. He will also be glad to receive for publication, in the *Naturalist,* any

new species that may be found in the St. Lawrence, or specimens of Algæ from the region at which the fresh and salt waters of the river and gulf come into contact.

Having made these few observations in a popular form, for the benefit of young readers, we shall now proceed with our detailed catalogue of the specimens referred to :—

The references to pages and plates are all, except when otherwise mentioned, to Harvey's "Nereis Boreali-Americana."

Sub-Class.—I. MELANOSPERMEÆ OR OLIVE-COLORED ALGÆ.

Order I.—FUCACEÆ.

Fucus *fastigiatus*, J. Ag. P. 68, pl. III *A*. North Shore of the St. Lawrence.

Fucus *nodosus*, Linn. P. 68. Abundant on all the shores of the North Atlantic.

Fucus *furcatus*, Ag. P. 70. St. Nicholas, in rock pools, within reach of the spray of high tides. This species is obtained in Newfoundland, and is apparently rare on our shores. Harvey says he is not acquainted with it.

Fucus *vesiculosus*, Linn. P. 71. Very abundant on all the North Atlantic shores; remarkable for its air-vessels, which are, however, often absent.

Order III.—LAMINARIACEÆ.

Alaria *Pylaii*, Grev. P. 89. On rocks near low water mark. This species was first described from a Newfoundland specimen, and no other locality is given by Harvey.

Laminaria *Fascia*, Ag. P. 91. On rocks near low water mark. "This species is widely distributed, being found on the Atlantic and Mediterranean shores of Europe, and at the Falkland Islands in the Southern Atlantic." —Harv.

Laminaria *dermatodea*, De la Pyl. P. 92. St. Nicholas and Point des Monts, North Shore. Newfoundland is the only habitat given by Harvey. On rocks at and below low-water mark.

Laminaria *longicruris*, De la Pyl. P. 93. Metis—a fragment from the collection of Mr. D. A. Poe.

Laminaria *Phyllitis*, Stack. Harvey's Manual. P. 31. On rocks near low water. This plant is not found in the Ner. Bor.-Am. Our specimen exactly corresponds with the description of the Manual; but Dr. Greville, Mrs. Griffiths, and Dr. Harvey doubt whether this beautiful plant may claim to rank as a species distinct from *L. saccharina*. "The more lanceolate form, delicate substance, and pale yellowish-green colour, constitute the chief marks of distinction."

Laminaria *digitata*, Lam. P. 94. Abundant as far south as Cape Cod.

Agarum *Turneri*, Post. & Rupr. P. 95, pl. V. On rocks below low water mark, Rimouski, South Shore. This plant is peculiar to the Atlantic and Pacific Shores of America. Its common name is Sea-Colander.

Chorda *filum*, Stack. P. 98. Murray Bay. A young specimen clothed with beautiful pellucid grass-green hairs—common on the Northern Shores of America.

Chorda *lomentaria*, Lyngb. P. 98. On rocks at mid-tide. This plant is not easily distinguishable from *Asperococcus echinatus*. "In habit it has more resemblance to it than to *C. filum*; but the structure of the walls is more in accordance with the latter, and it may always be known by its constricted joints."

Order IV.—DICTYOTACEÆ.

Dictyosiphon *fœniculaceus*, Grev. P. 114. On rocks at low water mark. "In a growing state every branch is clothed with long slender pellucid-jointed hairs, which give the plant, when seen under water, a beautiful feathery character."—Harv.

Punctaria *tenuissima*, Grev. P. 115. Parasitic on other Algæ.

Punctaria *plantaginea*, Grev. P. 115. On rocks and stones.

Asperococcus *echinatus*, Grev. P. 117. A plant nearly allied in appearance to *C. lomentaria*.

Asperococcus *compressus*, Griff. Harvey's Manual, p. 42. Murray Bay. This plant is not included in Harvey's

Ner. Bor.-Am.; but it exactly corresponds with the description in the Manual, and does not very much resemble *A. echinatus*. After careful consideration, we are disposed to add it to the American species.

Order V.—CHORDARIACEÆ.

Chordaria *flagelliformis*, Ag. P. 123. In rock pools mid-tide, Murray Bay. This is a remarkably prolific and robust specimen. Its branches are from 6 to 8 inches long.

Chordaria *divaricata*, Ag. P. 124, pl. XI *A*. In rock pools mid-tide, Murray Bay. This is also a remarkably fine specimen. It has shrunk greatly in drying.

Elachista *fucicola*, Fries. P. 131, pl. XI *B*. Parasitic on Fuci and Chordariæ. Metis.

Order VI.—ECTOCARPACEÆ.

Ectocarpus *brachiatus*, Harv. P. 138. Parasitic on *Fucus vesiculosus*. Murray Bay. Also in the collection of Mr. D. A. Poe from Metis.

Ectocarpus *littoralis*, Lyngb., p. 139. Abundant on *Fucus vesiculosus*. Murray Bay and St. Nicholas.

Ectocarpus *siliculosus*, Lyngb. P. 139. On stones and other Algæ at low water mark. Murray Bay; very abundant and the specimens are very fine.

Ectocarpus *fasciculatus*, Harv. P. 141. Parasitic on *Chordaria*. We are doubtful about this species. The specimen is so infested with Diatomaceæ, that it is very difficult to discover the fructification; but so far as it is discoverable, it has all the appearance of this species.

Sub-Class.—II. RHODOSPERMEÆ OR RED ALGÆ.

Order I.—RHODOMELACEÆ.

Odonthalia *dentata* Lyngb. P. 14. In great abundance at Bernaby Island, Rimouski, and frequently found at Murray Bay.

Odonthalia *angustifolia*, Suhr. P. 14. Abundant at Murray Bay. This is a very beautiful plant. It is not described in the Ner. Bor.-Am. Harvey only says of it

that seemingly it is the same as *O. Kamtchatica* Rupr. In appearance it is very distinct from the previous species. It may, we think, be added without hesitation to the North American Algæ.

Rhodomela *subfusca*, Ag. P. 26. On stones in sandy bays and on other Algæ. Point des Monts, North Shore, Rimouski and Metis. This is an exceedingly variable plant, the young fronds spring from the terminations of the old, and in summer give it a very bushy appearance. In its winter garb and in its old state, it is very scrubby and rigid in its branches

Rhodomela *lycopodioides*, Linn. Harv. Man. p. 78. The collector notes regarding this plant that "though common every where it is found in greatest beauty and size—in large bushy fronds of more than a foot and a half in length—at Murray Bay. Some pieces of iron removed from a wreck at Caribou Island were perfectly covered with this Alga." Although Harvey does not include this species in his Ner. Bor.-Am., we cannot doubt its identity with the British species of the name. Its peculiarly graceful branches and the monoliform character of its ultimate pinnæ, which are covered with tetraspores, distinguish it sufficiently from *L. subfusca*. It has no conceptacles.

Rhodomela *gracilis*, Kutz. P. 26, pl. XIII. *C*. This plant is remarkable for its fine pedicellate conceptacles. There is also an entire absence of tetraspores or stichidia. The branching is exceedingly graceful, approaching in appearance to that of *R. lycopodioides*.

Polysiphonia *urceolata*, Grev. P. 32. On stones and other Algæ below low water mark. Murray Bay and Metis.

Polysiphonia *formosa*, Suhr. P. 33. Murray Bay, Rimouski and Metis.

Polysiphonia *fibrillosa*, Grev. P. 43. On stones below low water mark, Point des Monts.

Polysiphonia *violacea*, Grev. P. 44. On other Algæ below low water mark, Murray Bay.

Polysiphonia *fastigiata*, Grev. P. 54. Parasitical on *F. nodosus*. Metis and Point des Monts. The collector remarks, "This plant makes its appearance first at Metis.

I have seen it in such abundance at Nahant that the sight of it here made me feel as if at the ocean side. The plant here is smaller."

Polysiphonia *variegata*, Ag. P. 45. Metis. In the collection of Mr. D. A. Poe.

Polysiphonia *nigrescens*, Grev. P. 49. In shallow rock pools, Metis.

Polysiphonia *nigrescens*, var. *fucoides*, Grev. On stones and other Algæ, Point des Monts.

Polysiphonia *nigrescens*, var. *affinis*, Grev. Parasitical on *Laminaria*, Rimouski.

Order III.—CORALLINACEÆ.

Corallina *officinalis*, Linn. P. 83. On stones and shells abundant.

Order IV.—SPHŒROCOCCOIDEÆ.

Delesseria *sinuosa*, Lam. P. 93. On rocks, Murray Bay. An exceedingly variable plant. "In deep waters the frond often becomes very narrow with filiform lobes produced into long tendrils. The margin of the frond which in most cases is merely denticulate, is occasionally bordered with slender simple or fimbricated lacinulæ, or fringed with great numbers of minute accessory frondlets." *Harv.* The fringed and narrow varieties are very common in the St. Lawrence. The collector notes regarding this plant, that "it is the only species of this genus I have found elsewhere than at Murray Bay. This place is the garden of the St. Lawrence."

Delesseria *fimbriata*, De la Pyl. P. 94. Parasitical on *Chœtomorpha*. Murray Bay. Newfoundland is the only other locality noted by Harvey who does not appear to have seen the plant. It is one of the most beautiful and curious of the genus. The laciniæ are densely fringed with delicate twisted leaflets.

Delesseria *denticulata*, Mont. P. 94. Parasitical on *Chœtomorpha*. Murray Bay, Shores of Labrador and Brandy Pot Island. The fronds are alternately branched.

Delesseria *alata*, Lam. P. 95. North shore of the St. Lawrence, collected by Mr. D. A. Poe. This seems a doubtful specimen, very like *D. fimbriata*, but its leaflets are shorter and entire on the margin. A narrower and more distinct specimen from Kakoona is in my collection.

Delesseria *angustissima*, Griff. P. 95. It is doubtful whether this be not a very extreme variety of the preceeding.

Delesseria *Hypoglossum*, Lam. P. 96. Murray Bay. Collected by Miss Taylor.

Nitophyllum *punctatum*, Grev. P. 104. Mingan Islands. Collected by George Barnston, Esq.

Nitophyllum *Bonnemaisoni*, Ag. Harv. Man. p. 117. Mingan Islands. Collected by George Barnston, Esq. This species is not in the Ner. Bor.-Am., and is new to the American shores.

Order V.—GELIDIACEÆ.

Hypnea *musciformis*, Lam. P. 123. Point des Monts.

Order X.—RHODYMENIACEÆ.

Rhodymenia *pertusa*, J. Ag. P. 147. North shore. Harvey gives also the Straits of St. Juan de Fuca and Greenland. Our specimens are not more than 4–6 inches long. In the more northern seas this plant attains the size of from 1–3 feet.

Rhodymenia *palmata*, Grev. P. 148. Regarding this fine plant the collector notes that it is "common on the south shore and Murray Bay, but not a trace of it is to be found so far north as St. Nicholas and Point des Monts."

Cordylecladia *irregularis*, Harv. P. 156. This plant seems to be very abundant on both shores of the St. Lawrence, but we are somewhat doubtful as to our determination. Both in structure and external appearance it approximates to the description of this species by Harvey. It is a pretty red plant and is remarkable for the secund character of its ultimate ramuli.

Order XI.—CRYPTONEMIACEÆ.

Phyllophora *Brodiæi*, J. Ag. P. 164. In rock pools near low water mark, Murray Bay.

Phyllophora *membranifolia*, J. Ag. P. 165. Murray Bay.

Cystoclonium *purpurascens*, Kutz. P. 170. Collected at Gaspé by Mr. Bell, of the Canada Geological Survey. Found also at Murray Bay. This plant is readily recognized by the nodose swellings in the ramuli. "It is common

throughout the north Atlantic extending on the European side from the glacial ocean to the southern shores of France." Harv.

Iridæa *edulis*, Stack. Harv. Man. p. 150. Not described among the American species in the Ner. Bor.-Am., the specimen before us is small, but the characters are well marked.

Halosaccion *ramentaceum*, J. Ag. P. 194. Common on every shore. Murray Bay, Point des Monts.

Furcellaria *fastigiata*, Lyngb. P. 195. In rock pools near low water mark. Murray Bay and Metis. A robust specimen was collected by Mr. Bell, Can. Geo. Sur. at Gaspé.

Furcellaria *divaricata*, Harv. MS. Deep water, Murray Bay. This plant is neither in the Manual nor the Ner. Bor.-Am. of Harvey, but is so named by him in MS.

Order XIII.—CERAMIACEÆ.

Ceramium *rubrum*, Ag. P. 213. Abundant on stones and other Algæ, Point des Monts. A most Protean plant.

Ceramium *fastigiatum*, Harv. P. 217. Metis.

Ceramium *Hooperi*, Harv. MS. On perpendicular sides of rocks. Murray Bay and St. Nicholas. Not Common.

Ceramium *gracillimum*, Kutz. Harv. Man. p. 163. Collected by Mr. D. A. Poe at Metis.

Ptilota *serrata*, Kutz. P. 222. Very abundant at Murray Bay.

Ptilota *elegans*, Bonnem. P. 224. In the collection of Mr. D. A. Poe. North shore.

Callithamnion *Pylaisæi*, Mont. P. 239. A most beautiful and delicate plant. Murray Bay. Our specimens are in fine fruit.

Sub-Class III.—CHLOROSPERMEÆ OR GREEN ALGÆ.

Order IV.—ULVACEÆ.

Porphyra *vulgaris*, Ag. P. 53. Very abundant on the rocks of both shores. *P. laciniata* is nothing more than a cleft variety of this plant, both are used in England in the preparation of *Marine Sauce*, or laver.

Bangia *fuscopurpurea*, Lyngb. P. 54. On top and within the seams of rocks near high water mark, Point des Monts.

Enteromorpha *compressa*, Grev. P. 57. Extremely common and variable. Under one or other of its many forms this species is found on all parts of our American coasts.

Enteromorpha *intestinalis*, Link. P. 57. In rills of fresh water covered at high tide. Murray Bay.

Enteromorpha *clathrata* var., *crecta*, Lyngb. Harv. Man. p. 214. In rock pools near low water. Murray Bay.

Enteromorpha *clathrata*, var., *ramulosa*, Grev. P. 57. Harv. Man. p. 215. In rock pools. In the Ner. Bor.-Am. Harvey agrees with Greville in considering E. *erecta* and *ramulosa* of authors as varieties, if not also synonyms of E. *clathrata*.

Ulva *Linza*, Linn. P. 59. Common on all the shores; easily known by its tapering base and linear lanceolate form.

Ulva *latissima*, Linn. P. 59. Verycommon. Form polymorphous.

Order VI.—CONFERVACEÆ.

Cladophora *arcta* Dillw. P. 75. On rocks near low water mark. Rimouski and St. Nicholas.

Cladophora *gracilis*, Griff. P. 81. Murray Bay.

Cladophora *lætevirens* Dillw. P. 82. In rock pools at low tide. Metis.

Chætomorpha *melagonium*, Web. & Mohr. P. 85. In rook pools near low water mark, North shore. This plant was formerly called *Conferva melagonium*, but Harv. in the latest of his publications thus designates the genus.

Chætomorpha *longiarticulata*, Harv. P. 86. Parasitical on *Halosaccion*. North shore.

Hormotrichum *Younganum*, Dillw. P. 89. From the iron bar of a buoy, Rimouski. The plants under this genus have hitherto been placed either in *Conferva* or *Lyngbya*.

Hormotrichum *Carmichœlii*, Harv. P. 90. On top of stones near high water mark, Murray Bay.

Rhizoclonium *riparium*, Roth. P. 92. In seams of rocks, Murray Bay. Also found in Greenland.

Order IX.—OSCILLATORIACEÆ.

Lyngbya *ferruginea*, Ag. P. 102. On top of rooks near low water mark, Bic.

RIVULARIÆ, Hass.

Raphidia *viridis*, Hass. British Fresh-water Algæ, p. 265, pl 64, fig. 3. In rock pools, Point des Monts. This plant bears some resemblance to the *Rivularia nitida* of Harvey's Man. p. 222; but although a salt-water species it is yet more like the *R. viridis* of Hass. which abounds in the fresh-water of the St. Lawrence.

ARTICLE V.—*Unusual modes of Gestation in Batrachians and Fishes.*

[Prof. Wyman of Harvard has lately returned from an excursion across North America, in the course of which he has collected many curious facts in natural history; among others, the following, which we extract from a communication to the Boston Society of Natural History.]

"Among Batrachians the circumstances under which the young are developed, though less varied than in some of the other classes of vertebrates, still present a considerable range. By most species the eggs are deposited in the water either upon aquatic plants or on the bottoms; by others, as in *Salamandra erythronota*, they are laid in damp places under logs or stones; with some the evolution of the embryo commences a short time previous to the laying of the egg and is completed subsequently, while there are species which are wholly viviparous.

"The most remarkable deviations from the ordinary modes are to be found in those instances in which the eggs, after being laid, are again brought into a more or less intimate relation with the parent, as in the "Swamp toads" (*Pipa Americana*) of Guiana, where each ovum is developed in a sac by itself on the back of the female, in *Notodelphys* of Venezuela, where all the eggs are lodged in one large sac, also on the back, and is analogous to the pouch of the Marsupials, and in *Alytes*, the "Obstetric toad" of Europe, where the eggs are wound in strings around the legs of the male, who takes care of them until they hatch.

"The species, the habits of which are noticed below, and which, in so far as I have been able to learn, have not attracted the attention of naturalists, adds another to the series just mentioned,

though the relation of the fœtus to the parent becomes less intimate than in any of the preceding cases.

"*Hylodes lineatus* (Dum. and Bib.) is very common in Dutch Guiana, and its peculiar habits are well known to the colonists. The first specimen with young which came to my notice had been preserved in alcohol, and was presented to me by Mr. G. O. Wacker, residing at Osembo, on the Para Creek, Surinam, and had been captured at some distance from the water. The young, ten or twelve in number, though separated from the parent, he assured me, when found, were attached to the back.

"In the month of May, 1857, during an excursion to the country inhabited by the Bush negroes, above Sara Creek on the upper Surinam River, I had an opportunity for the first time of seeing these animals carrying their young. The grass and bushes were quite wet from a recent fall of rain, and this seemed the inducement that led them from their hiding places, for when the ground was dry none had been seen. They were very quick in their movements, and when alarmed went at once into the grass and thick bushes. One of my companions, Mr. John Green, and myself succeeded in capturing some specimens, which, as we were just leaving the village, were placed at once in alcohol. In one instance the larvæ were retained permanently adherent to the back of the parent, in consequence of the coagulation of the mucus covering the surface of the body, and are still preserved in the Museum of Comparative Anatomy at Cambridge. The young, from twelve to twenty in number, were collected upon the back of the mother, their heads directed towards the middle line. They were about three-fourths of an inch in length. No limbs were developed, though in some of them the rudiments of a leg existed in the form of a small papilla on either side of the base of the tail. No especial organ was found to aid them in adhering to the back of the parent. The adhesion may have been effected by the mouth. This is rendered probable by the fact that all of them had the mouth in contact either with the skin of the parent or with that of another larva. A viscid mucus covering the integuments undoubtedly assisted in some measure to bring about the same results. However this may be, they retained their places perfectly well, and were not displaced when their mother, closely pursued, carried them through the grass.

"On dissection of the young nothing was found materially different to conditions of the larvæ of other Anoura. The external

gills had disappeared, but were replaced by internal ones, which were arranged as usual on three hyoid arches. The development of the lungs had commenced, and these were represented by a slender conical mass of cells, but not permeable to air. The mouth was provided with finely denticulated horny jaws, and the intestinal canal was shorter and less spirally convoluted than in ordinary larvæ of frogs and toads. The stomach was not so much developed as to be distinguished from the rest of the intestine; but this last, after passing the liver, was somewhat dilated, and contained, as was shown by the microscope, large quantities of yolk cells which had not been absorbed and which were adherent to its walls.

We have here then a larva, in all of the details of its structure, especially in the existence of gills and of a flattened tail, adapted to aquatic locomotion and respiration, yet passing a portion of its time at least on the back of its parent and at a distance from the water.

I was not able to ascertain whether the eggs were primarily deposited in the water or not, but it is well known to some of the colonists that after the larvæ have reached a certain degree of development they are carried about in the manner just described and they do not know them under any other circumstances. The existence of yolk cells in the intestine, shows that for a period at least they may have from these a supply of nutriment. But after this is exhausted, and it appeared to be nearly so in those which I have dissected, how do they obtain their food? In the absence of limbs adapted to terrestrial locomotion can they leave the body of the parent? and if they cannot, do they, as in the case of Pipa and probably in Notodelphys, depend upon a secretion from her?

Among Fishes, as far as at present known, the external conditions under which the eggs are developed are more varied than in any other class of Vertebrates. There are scarce any known conditions of the higher classes to which there are not analogies at least in the class of fishes. Besides the ordinary mode of depositing eggs upon the bottoms, some of the Salmonidæ, like the turtles, bury their eggs, the Lampreys (*Petromyzon*), the Breams, (*Pomotis*), the Hassars (*Callicthys*), the Stickle-backs, (*Gasterostei*), &c., build more or less complete nests. Among some of the Pipe Fishes, (*Syngnathidæ*), the eggs and subsequently the young, are carried in a pouch analogous to that of the opossums and other marsupial animals, and among some of the Sharks

there is a vitelline placenta analogous to the Allantoidian one of the Mammalia.*

To those species enumerated above where the eggs become more or less intimately connected with the body of the parent after they are laid may be added the Aspredos and some species of Bagrus, from Guiana.

Aspredo lævis (Cuv. and Val.), the "Trompetti" of the colonists, is about fifteen inches in length, and belongs to a remarkable genus of Siluroid fishes, which, in addition to several peculiarities of anatomical structure, are remarkable for carrying the eggs and young attached to the under surface of the body. These fishes are very abundant in the waters of the Surinam where they are taken in the nets with other kinds. They are not used as articles of food except by the negroes, who have a fancy for Siluroids generally, and in consequence these are known among the colonists as *Ningré fisi* or "nigger fish." A general account of the internal structure of Aspredo, is given in the Hist. Nat. des Poissons, by Cuvier and Valenciennes, T. XV, p. 35.

In the month of June the eggs are found adhering to the underside of the body, to the ventral and pectoral fins, and extend as far forward as the under lip, and as far backwards as the middle of the tail. In some however the distribution is much more limited. I was unable to learn anything with regard to the transfer of the ova from the genital orifice to the point of their attachment. The only organ which seems in any way adapted to such a purpose is the slender and flexible tail terminated by a delicate caudal fin. It is possible that the eggs may be deposited on the bottom of the river, and subsequently attached by pressing the underside of the body upon them.

In those individuals where the ova were still in the ovary, but approaching maturity, the integuments of the underside of the

* Prof. Owen (in Philos. Transactions, 1834,) has pointed out the vascular relations of the fœtal Kangaroo to the parent. The chorion is not vascular, but the umbilical vesicle is largely provided with blood vessels, and, as far as his investigations go, affords the principal vascular surface by means of which an interchange takes place between the fœtus and the parent. The vitelline circulation then, as in sharks, is the respiratory circulation. The allantois of the Marsupials appears to remain in a rudimentary condition, and does not form a connection with the parent. Thus the vascular relation of the fœtus of some of the sharks, as Carcharias, with the parent is identical with that of the Marsupials.

body gave no other indications of the changes about to take place than of being quite vascular; the skin was perfectly smooth, no "pores" were visible, but a large vessel was seen emerging from the region of the liver, and descending along the median line gave off branches quite freely to the integuments. This may have some relation to the future development of the pedicles which support the eggs and perhaps to the nutrition of the embryo as will be adverted to hereafter.

In all the specimens which I have had an opportunity of examining, the eggs were either somewhat advanced or quite mature; so that no observations could be made on the earlier conditions of the egg and the formation of its pedicle. The pedicle is a flexible outgrowth from the common integuments, is about two lines in length, is attached to the skin by a slightly expanded base, and spreads out at its summit into a shallow cup or "cupule," for the support of the egg. It is composed almost entirely of fibrous tissue, invested with a layer of tesselated epithelium. In some instances when the eggs were but little advanced, numerous fusiform cells were detected among the fibres. It is vascular, two or three vessels reaching to the cup, where they ramify and form a somewhat extended capillary plexus.

The eggs vary according to the degree of development from the 0.09 to 0.15 of an inch in diameter, and are covered with an external homogeneous membrane, containing minute punctiform depressions—within this is a second, of a brownish color and composed of epithelium. The embryos which were the most advanced and just ready to hatch, had not as yet completely absorbed the yolk, and were coiled up within the membranes, which in consequence of the irregularities of the mass formed by the embryo, had no longer a spherical form.

The eggs are retained in connection with the cup apparently by adhesion alone, for as soon as the fœtus escapes, the egg membranes become very easily detached from the pedicle, and this last as shown by some of the specimens undergoes absorption.

The relation of the embryo to the parent in this singular mode of gestation cannot be determined very accurately, but the vascular plexus in the cup, seems to be more than is necessary for the mere nutrition of the part. The egg increases in size during incubation, those ova in which the development had but slightly advanced measuring from 0.09 to 0.11 of an inch in diameter, while those nearly mature measured from 0.14 to 0.15 of an inch.

How this increase of size of the embryo over the original size of the egg is actually obtained I have no facts to show, but either of two suppositions are probable; it may be by absorption of materials from the water which surrounds it, or from the capillary plexus of the pedicles, and in this case in a manner analogous to that of Pipa.

Among the Siluroid fishes of Guiana there are several species, which at certain seasons of the year have their mouths and branchial cavities filled either with eggs or young, and as is believed for the purpose of incubation. My attention was first called to this singular habit by the late Dr. Francis W. Cragin, formerly U. S. Consul at Paramaribo, Surinam. In a letter dated August 1854, he says, "the eggs you will receive are from another fish. The different fishermen have repeatedly assured me, that these eggs in their nearly mature state are carried in the mouths of the parent, till the young are relieved by the bursting of the sac. Do you either know or believe this to be so, and if possible, where are the eggs conceived and how do they get into the mouth?"

In the month of April, 1857, on visiting the market of Paramaribo, I found that this statement, which at first seemed to be very improbable, was correct as to the existence of eggs in the mouths of several species of fish. In a tray of fish which a negro woman offered for sale, I found the mouths of several filled with either eggs or young, and subsequently an abundance of opportunities occurred for repeating the observation. The kinds most commonly known to the colonists, especially to the negroes, are *Jara-bakka*, *Njinge-njinge*, *Koepira*, *Makrede* and one or two others, all belonging either to the genus Bagrus or one nearly allied to it. The first two are quite common in the market and I have seen many specimens of them; for the last two I have the authorithy of negro fishermen but have never seen them myself. The eggs in my collection are of three different sizes, indicating so many species; one of the three having been brought to me without the fish from which they were taken.

The eggs become quite large before they leave the ovaries, and are arranged in three zones corresponding to three successive broods, and probably to be discharged in three successive years; the mature eggs of a Jara-bakka eighteen inches long, measure three-fourths of an inch in diameter, those of the second zone one fourth; and those of the third or very minute, about one sixteenth of an inch.

A careful examination of eight specimens of Njinge-njinge about nine inches long, gave the following results:

The eggs in all instances were carried in the mouths of the males. This protection, or gestation of the eggs by the males, corresponds with what has been long noticed with regard to other fishes, as for example, Syngnathus where the marsupial pouch for the eggs or young is found in the males only, and Gasterosteus where the male constructs the nest and protects the eggs during incubation, from the voracity of the females.

In some individuals the eggs had been recently laid, in others they were hatched, and the fœtus had grown at the expense of some other food than that derived from the yolk, as this last was not proportionally diminished in size, and the fœtus weighed more than the undeveloped egg. The number of eggs contained in the mouth was between twenty and thirty. The mouth and branchial cavities were very much distended, rounding out and distorting the whole hyoid and branchiostegal region. Some of the eggs even partially protruded from the mouth.

The ova were not bruised or torn as if they had been bitten, or forcibly held by the teeth. In many instances the fœtuses were still alive, though the parent had been dead for many hours.

No young or eggs were found in the stomach, although the mouth was crammed to its fullest capacity.

The above observations apply to Njinge-njinge. With regard to Jarra-bakka, I had but few opportunities for dissection, but in several instances the same conditions of the eggs were noticed as stated above; and in one instance, besides some nearly mature fœtuses contained in the mouth, two or three were squeezed apparently from the stomach; but not bearing any marks of violence or of the action of the gastric fluid. It is probable that these found their way into that last cavity after death, in consequence of the relaxation of the sphincter which separates the cavities of the mouth and the stomach. These facts lead to a conclusion that this is a mouth gestation, as the eggs are found there in all stages of development, and even for some time after they are hatched.

The question will be very naturally asked, how under such circumstances, these fishes are able to secure and swallow their food. I have made no observations bearing upon such a question. Unless the food consists of very minute particles, it would seem necessary that during the time of feeding the eggs should be disgorged. If this supposition be correct, it would give a very pro-

bable explanation of the only fact which might be considered at variance with the conclusion stated above, viz., that we have in these fishes a mouth gestation. In the mass of eggs with which the mouth is filled, I have occasionally found the eggs, rarely more than one or two, of another species. The only way in which their presence may be accounted for, it seems to me, is by the supposition that while feeding, the eggs are disgorged, and as these fishes are gregarious in their habits, when the ova are recovered, the stray egg of another species may be introduced into the mouth among those which naturally belong there.

ARTICLE VI.—*Description of some new species of Fossils from the Lower and Middle Silurian Rocks of Canada.* By E. Billings.

(*From the Report of the Geological Survey for* 1860.)

In the Silurian Rocks of Canada and the neighbouring countries there are many species or varieties of that group of the genus *Strophomena* of which *S. alternata* may be regarded as the typical form. These are all closely related and yet exhibit such differences that only those naturalists who entertain wide views upon the subject of the value and significance of specific distinctions, would feel inclined to unite them under one common name. The forms of this group most common in the Lower and Middle Silurian Rocks are *S. alternata*, *S. incrassata*, *S. deltoidea*, *S. camerata*, *S. tenuistriata* and some others to be described hereafter in this paper. The first of these ranges from the Chazy limestone upwards perhaps to the Niagara rocks but is most abundant in the Trenton limestone and Hudson River group. It is also very widely distributed, as it occurs in all parts of the Continent, where the last two formations have been recognized and is also found in the Lower Silurian in England and Ireland. *S. incrassata* has exactly the same form as some of the varieties of *S. alternata* but is never, as far as I have been able to ascertain, more than half the average size of this latter species. It seems to be confined to the Chazy and the Black River limestone or the lower part of the Trenton, and has therefore, a geological distribution different from that of *S. alternata*, a fact which would appear to constitute an additional ground for classifying it as a distinct species. *S. deltoidea* is a Trenton lime-

stone form abundant in certain localities, but not generally distributed. Thus in the State of New York, according to Professor Hall "it abounds at Trenton Falls and at Sugar River in Lewis County," but "is scarcely known as occuring in the Champlaim valley."* In Canada it is found at Lachine and at several other places, but there are hundreds of good exposures of the rock in the Province that have been carefully examined, where not a single specimen has been seen, although in all the localities *S. alternata* is more or less common. *S. camerata* occurs at one spot in the vicinity of Ottawa, but I have never met with it elsewhere. *S. tenuistriata* may be collected in the hard black limestone around the base of the mountain of Montreal, particularly in the neighbourhood of the McTavish monument and also at Ottawa and two or three other places, but does not occur at all in the majority of the localities of the Trenton limestone. These three species, therefore, must have been capable of existing in certain places only, on the bottom of the ocean during the period of the accumulation of this rock, while *S. alternata*, flourished everywhere. Whether or not, therefore, they are to be regarded as distinct species, this much at least seems probable, that they were by some peculiarity in their habits or in their organization, unfitted for so wide a range through the seas as that enjoyed by *S. alternata*.

The question, whether or not these supposed species are really distinct, cannot be answered until naturalists shall have discovered some general law of life by an appeal to which they may in all cases determine what is a species as distinguished from a mere variety. It is scarcely necessary to state that such a law if it do exist at all may remain unknown to man for ages, and in the meantime nearly all determinations of species from varieties where the forms are very closely related may be regarded as not positively established. The physical geologist is more interested in the results of investigations which show that certain forms are confined to particular geological horizons than in those, whose sole object is to determine the exact zoological relations of such forms. If it be true, for instance, that that particular form of the genus called *Strophomena incrassata* is confined to the limestones lying next under the Trenton in the fossiliferous series, it makes no difference to the geologist, whether it

* Palæontology of New York, vol. 1, page 107.

be in reality a distinct species of itself or only a variety of some other species. Its value to him as a guide, while tracing out the geographical distribution of these Rocks, is not at all affected by the zoological question. In demonstrating the physical structure of the country, he can reason upon varieties with as much safety as upon true species, provided that such varieties are confined to and consequently characteristic of particular portions of the geological edifice. It is therefore, of great importance, not only to ascertain to what particular level each variety is confined, but also to determine whether or not such species as range through several formations exhibit any and what change in form on passing from one group of rocks to another. Should it be hereafter, proved that the supposed species above quoted, constitute on purely zoological grounds, but one extensive and variable species still it would be convenient for geological purposes to have a separate name for each variety that can be shewn to be characteristic of a particular geological horizon.

Before entering upon the description of the new species, I shall give a general account of such characters as are common to all the forms of the group typified by *S. alternata.*

STROPHOMENA ALTERNATA, (Conrad.)

In all the forms of this important type, the convexity of the ventral valve has a peculiar contour which may be seen not only in the Lower Silurian but also in the Upper Silurian and even in such Devonian species as *S. Pattersoni*, *S. inequiradiata*, *S. demissa*, *S. concava* and others. That part of the valve which is usually called the visceral disc occupies all the central region of the shell and terminates in a point at the beak. Just in front of the beak it forms a more or less well defined low rounded umbo on each side of which there is a flattened or sub-concave depression extending obliquely outwards to the margin just in front of the cardinal angles. These latter are usually reflected or a little curved upwards from the plane of the lateral margins. The visceral disc is somewhat flattened, gently convex or only slightly elevated throughout the greater part of its extent. In the upper half of the shell it is bounded by the depressions that have been mentioned as existing between the umbo and cardinal angles, but in front and at the sides it terminates where the shell

begins to be bent down to form the deflected margin which runs all round the edge and becomes obsolete on approaching the cardinal angles. This margin varies in width from one-twelfth to two-thirds the whole length of the shell and therefore the disc in some of the varieties occupies nearly the whole superficies of the valve, bnt in others, less than half. In the very young shells in most of the specimens that I have seen, there is no deflected margin and occasionally adult individuals may be found, which on a side view give the outline of an uniform flattened arch from beak to front. In by far the greater number of the specimens however the deflected margin is well defined. The contour of the front of the visceral disc varies according to the form of the deflected margin and is thus either broadly rounded or more or less pointed. In *S. depressa*, which also belongs to this group, the front of the disc, and its sides also, are often nearly straight.

The dorsal valve is flat or only gently concave beneath the visceral disc of the ventral valve, but all round, its curvature conforms to that of the deflected margin.

In the true *S. alternata* the areas of the ventral and dorsal valves are inclined towards each other at an angle varying from 75° to 80°, but this angle never amounts to 90°. It will be observed that in some of the new species hereinafter described it is greater than 90°.

The surface in most of the species exhibits two sets of radiating striæ, the larger of which are about one-twelfth of a line wide in large specimens, and the smaller half that size, from one to ten of the smaller between each two of the larger, the more common numbers being from three to five. Sometimes also the shell is marked with a series of concentric wrinkles.

Of the above characters, those which are confined to the upper half of the shell such as the form of the beak, the umbo, the concave depressions or hollows on each side of the umbo, and the reflected cardinal extremities, are common to all the species and in order to avoid repetition will not be particularly dwelt upon in the following descriptions. The radiating striæ are also very constant in the aspect they present. The only parts which appear to afford permanent variations of much value are the front of the visceral disc the deflected margin and the hinge line. The proportional length and breadth of the shell seems also to be of much importance especially if accompanied by a variation in two or three of the other characters.

STROPHOMENA NITENS. N. S.

Fig. 1.—*Strophomena nitens.* *a* is a section shewing the curvature and obtuse angles formed by the inclination of the areas.

Description.—Transversely semi-oval, sides somewhat straight for one third or a little more of the length from the cardinal angles, and slightly converging towards each other; front angles broadly rounded; front margin gently convex or nearly straight for about one third the width in the middle portion. Width on hinge-line from nine to twelve lines. Length from six to eight lines.

The beak, umbo, depressions on each side of the umbo and the cardinal angles of the ventral valve the same as in *S. alternata.* The deflected margin forms an angle of between 100° and 110° with the general plane of the visceral disc, and occupies on the median line (in all the specimens I have seen) from one third to nearly one half the whole length of the shell.

The dorsal valve is quite flat, or even a little concave, just in front of the beak, but elsewhere curved to correspond with the ventral valve.

The area of the ventral valve lies nearly in the plane of the lateral margins, and the area of the dorsal valve forms with it an angle of about 95°. The height of the area of the ventral valve at the foramen is three fourths of a line in a specimen nine lines wide, and of the dorsal valve about one third of a line. Foramen of ventral valve partly closed by a V-shaped deltidium, the lower open part of which is closed by the strongly projecting deltidium of the dorsal valve.

The width of the foramen is about equal to its height.

The surface is the same as in *S. alternata*, and, when a little worn, presents a smooth shining silken lustre.

When compared with *S. incrassata*, *S. alternata*, *S. deltoidea*, *S. camerata*, or *S. tenuistriata*, it will be seen that this species is shorter in proportion to the width than any of them, and also that the inclination of the areas towards each other differs in forming an obtuse instead of an acute angle.

Locality and Formation.—This species occurs at Charleton Point, Anticosti, in the upper part of the Hudson River group.

Collector.—J. Richardson.

STROPHOMENA CERES. N. S.

Description.—Semi-oval, sides rather straight and a little converging for one third their length; front angles and margins broadly rounded. Width on hinge-line twelve to fifteen lines; length ten to twelve lines.

The ventral valve varies greatly in the amount of its convexity. In some specimens it is depressed convex, and these have almost precisely the aspect of the more flattened forms of *S. alternata.* Others are strongly convex, nearly hemispherical, uniformly arched from beak to front, no deflected margin distinct from the visceral disc, the latter occupying the whole of the shell except a small triangular space at the hinge-angles. Between these two extremes there are individuals which present all the intermediate degrees of convexity, and some in which the deflected margin can be detected with a width equal to half the whole length of the shell.

The surface is the same as that of *S. alternata.*

The area of the ventral valve is one line high in a specimen fourteen lines wide, and lies very nearly in the plane of the lateral margin. The foramen is as wide as high, and closed by a strongly convex deltidium, the lower margin of which is concave to admit the equally convex deltidium of the dorsal valve, whose area is almost half a line wide and forms an obtuse angle of between 90° and 100° with that of the ventral valve. The beak of the ventral valve exhibits in some specimens a small round perforation.

This species differs from *S. nitens* in being in general a little longer proportionally, larger, and more uniformly convex, with scarcely a distinct deflected margin. In *S. nitens* the length is in general only two thirds of the width, but in this species it is always over five sixths.

The angle formed by the inclination of the areas being obtuse instead of acute furnishes the only character as far as I can ascertain by which it can be separated from *S. alternata.*

Locality and Formation.—Charleton Point, Hudson River group, and also at East Point in the Middle Silurian, Anticosti.

Collector.—J. Richardson.

STROPHOMENA LEDA. N. S.

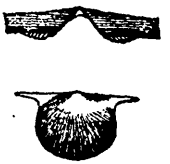

Fig. 2.

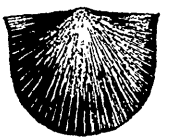

Fig. 3.

Fig. 2.—*Strophomena Leda* with a portion of the hinge area of the ventral valve enlarged to shew the striated teeth.
3.—A specimen without ears supposed to be of the same species.

Description.—Shell rather small and thin, semi-oval, the front and front angles regularly rounded, sometimes a little narrower at the base of the ears than at one third the length from the hinge line, the latter usually exceeding the greatest width of the shell, and forming projecting spiniform ears. Width excluding the ears, five to nine lines; length five-sixths of the width; ears one line and a half in length each, in a well preserved specimen five lines wide.

The ventral valve is in the small specimens, depressed convex and nearly uniformly arched from beak to front; the umbo well defined, but the concave depressions on each side rather obscure; no deflected margin. The large specimens (nine lines wide) are sometimes strongly convex. Dorsal valve concave, its curvature corresponding to that of the ventral valve. Surface as in *S. alternata.*

Area of ventral valve half a in line height in a specimen seven lines wide, lying nearly in the plane of the margin, apparently a little sloping outwards, forming an angle of about 100° with that of the dorsal valve, which latter is scarcely one-fourth of a line wide. Foramen not distinctly observed but apparently wider than high.

The detached and empty ventral valves exhibit two rather large triangular hinge teeth, one on each side of the foramen, covered with striæ on the outside in a manner similar to that of the area of those species to which Professor Hall has given the generic name of *Strophodonta.*

The spiniform ears are often either broken or worn away.

Varieties.—Several specimens nine lines wide without ears, and others of the same size strongly convex, and with an indis-

tinct deflected margin, occupying from one-third to one-half the length of the shell, appear to belong to this species.

This species when the ears are broken away has exactly the appearance of *S. alternata*, only that it is never more than half the size. The characters of the hinge areas and teeth taken together with the small size, and hinge ears are abundantly sufficient to show that it is distinct from *S. alternata*. It is a longer shell than *S. nitens*, and is in general destitute of a deflected margin. It is smaller, thinner and less convex than *S. Ceres*.

Locality and Formation.—Anticosti, in strata situated from 800 to 1000 feet above the base of the Middle Silurian, and 250 feet below the rocks containing *Pentamerus oblongus*.

Collector.—J. Richardson.

STROPHOMENA PHILOMELA. N. S.

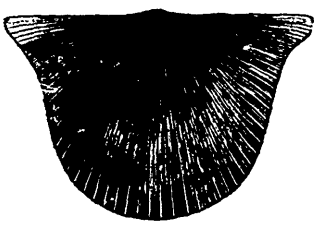

Fig. 4.

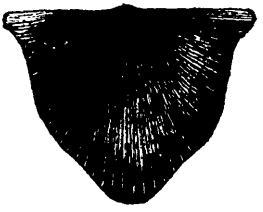

Fig. 5.

Fig. 4.—*Strophomena Philomela.*
5.—The same with a mesial fold.

Description.—Shell rather large; hinge line exceeding the greatest width, forming short rounded ears; sides gently convex, converging towards each other; front margin and angles regularly rounded, sometimes with a projecting lobe in the middle. Width on hinge line from eighteen to twenty four lines. Length from two-thirds to four-fifths the width.

In the ventral valve the umbo and depressions on each side are well defined and exactly like those of the convex form of *S. alternata*. The visceral disc is moderately and broadly convex; the deflected margin from one-fourth to one-third the whole length of the shell, passing into the disc with a short rounded curve. Dorsal valve with the curvature corresponding to that of the ventral valve.

The area of the ventral valve is a little more than half a line in height at the foramen in a specimen two inches wide, and it in-

clines a little outwards apparently forming an angle of from 160° to 170°, with the plane of the lateral margins. The foramen appears to be almost completely closed, but this character has not been ascertained with certainty owing to the imperfection of the specimens examined. The hinge teeth are striated as in *S. Leda.* The area of the dorsal valve is almost linear, or at the most not half the width of that of the ventral valve.

The surface does not differ from that of *S. alternata*, so far as I have been able to ascertain.

Varieties.—One specimen has been found associated with the others of this species in which the length and breadth are almost equal. It has no ears, although it is longer in proportion to the width, and yet it does not appear to differ sufficiently to constitute a distinct species. Another specimen has a rounded fold in the front margin which becomes obsolete at one third the length of the shell.

This species by its projecting ears, narrow areas and striated hinge teeth is most closely related to *S. Leda*, from which it differs in being four times the size. It has so much of the aspect of *S. alternata*, that at present we have no means of distinguishing it from that species without an examination of the hinge area and teeth.

Locality and formation.—Middle Silurian Anticosti, associated with *Pentamerus oblongus.*

Collector.—J. Richardson.

The above four species, *S. nitens*, *S. Ceres*, *S. Leda*, and *S. Philomela* are closely allied to *S. alternata.* The three following have the ventral valve concave, and belong to a very different group, of which *S. filitexta* (Hall) may be regarded as a typical form.

STROPHOMENA FLUCTUOSA. N. S.

Description.—Triangular, or semi-oval, usually widest at the hinge-line, and more or less narrowly rounded, pointed, trilobed, or nasute in front.

Dorsal valve convex, the visceral disc being in general equal to one third the superfices of the whole valve, nearly flat, the remainder abruptly curved down all round so that the lower half of the length of the shell is sometimes at right angles with the upper half. The cardinal angles more or less compressed and often a little reflected, usually forming angular or

narrowly rounded ears. Ventral valve concave, the curvature corresponding to that of the dorsal valve.

Area of dorsal valve lying in the plane of the lateral margin, about one third of a line high. Area of ventral valve forming a right angle with the marginal plane, in large specimens one line or a little more in height at the beak, and gradually decreasing towards the extremities of the hinge-line.

Foramen of ventral valve triangular; the width at the base somewhat exceeding the height, completely closed by a convex deltidium, the basal margin of which is rendered a little concave by the convex margin of the similar deltidium which closes the foramen of the dorsal valve.

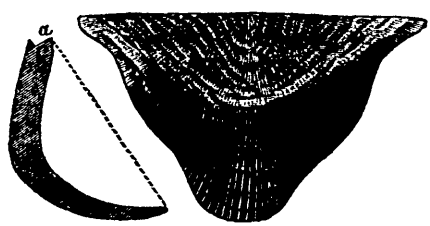

Fig. 6.—*Strophomena fluctuosa. a*, section, the dotted line represents the plane of the lateral margin, and it is drawn to shew that the area of the concave or ventral valve is at a right angle to it.

Surface with a set of fine rounded elevated radiating striæ distant from each other usually about half a line, sometimes a little less and occasionally one line. Between each two of these there are from two to ten much finer striæ; the whole crossed by fine crowded concentric lines. In most of the specimens the whole of the upper half of the shell is covered with short undulating wrinkles, which sometimes have a concentric arrangement and often form concentric rows converging from the hinge-line towards the centre of the shell, crossing each other. The specimens from the Trenton limestone are usually without these undulations, but in those from the Hudson River group this character is prominently exhibited.

This shell is somewhat variable in its characters. The visceral disc of the dorsal valve is sometimes confined to a small area around and in front of the beak and along the hinge-line, and in such cases the deflection takes place at one fifth or one fourth the length from the beak. Occasionally a broad rounded elevated

mesial fold extended into a linguiform projection of the middle of the front margin gives to the dorsal valve a trilobate character. The area of the ventral valve is in general at right angles to the plane of the lateral margins, but sometimes it slopes a little forward. In some the hinge-line is greatly extended, the cardinal extremities forming projecting triangular ears.

Width on hinge-line from one inch to one inch and a half. Length variable, from two thirds of the width to four fifths or a little more.

Strophomena deltoidea (Conrad) has the ventral valve convex and may be always distinguished from this even when the hinge-line cannot be seen by the small rounded umbo close to the beak. *S. camerata* and *S. tenuistriata* (Conrad) have also the ventral valve convex. (See Plate 31 A, Vol. I. Pal. N. Y.)

Locality and Formation.—Trenton limestone, City of Ottawa, rare; more common in the Hudson River group, Anticosti.

Collectors.—E. Billings, F. Richardson.

STROPHOMENA THALIA. N. S.

Description.—Semi-oval or sub-triangular, often narrowly rounded or somewhat pointed in front, hinge-line usually greatly exceeding the width of the shell, and forming with the sides an angle of from 70° to 80°. Width at hinge-line from one to two inches, length about five eighths the width.

Dorsal valve moderately convex, depressed towards the cardinal angles, which are a little recurved; umbo flat. On a side-view the outline forms a gentle and nearly uniform curve from the front for about four fifths the length, when it descends with a flat slope to the beak, which it reaches at an angle of from 45° to 60°.

Ventral valve concave, the greatest depth about the middle or a little nearer the beak.

Area of ventral valve moderate, forming an angle of about 100° with the plane of the margin, its height in a specimen two inches wide, one line; foramen triangular, closed by a convex deltidium, its width at the base about one fifth greater than the height. The beak is not perforated in any specimen that I have seen. Area of dorsal valve nearly in the plane of the margin, its width about one third of that of the ventral valve.

Surface with moderately coarse radiating striæ, which increase both by bifurcation and interstitial addition, usually un-

equal but sometimes uniform in size, from ten to fifteen in the width of two lines, crossed by excessively fine crowded concentric lines.

This species is allied to *S. fluctuosa*, but differs in having the areas of the ventral and dorsal valves inclined at an angle which is rather less than a right angle. In its outline it forms nearly an uniform arch instead of being abruptly bent like *S. fluctuosa*.

The dorsal valve of *S. recta* (Conrad) is said to have a slight mesial depression, while the ventral valve is flat. *S. plano-convexa* (Hall) has also a slight mesial depression in the dorsal valve, and is flat or even a little convex in front of the beak of the ventral valve, where this species is concave. It has also a perforated beak, and an area more approximated to the plane of the lateral margins that it is in *S. Thalia*. The three species are, however, notwithstanding these differences, closely related.

Locality and Formation.—Trenton limestone, City of Ottawa.

Collector.—E. Billings.

STROPHOMENA HECUBA. N. S.

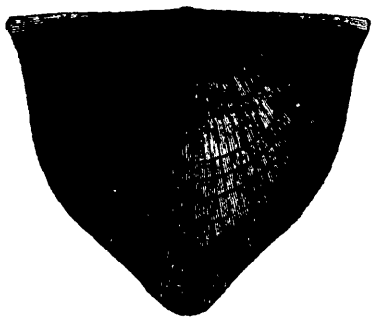

Fig. 7.—*Strophomena Hecuba*, dorsal valve.

Description.—Subtriangular with usually a linguiform projection in front. Width on hinge-line about two inches; length varying from a little less to a little more than the width.

Dorsal valve very convex, nearly regularly arched from beak to front, only a small space at the hinge extremities compressed, the whole of the remainder of the shell exceedingly ventricose, usually a rounded fold in front which becomes obsolete at one fourth the length, area sublinear, scarcely half a line in width in the largest specimens.

Ventral valve depressed convex near the beak, and concave all round near the margin, area about one line wide and forming an angle of about 115° with the plane of the lateral margins. Foramen not observed.

Surface marked with fine radiating striæ, ten or twelve in the width of one line, every third, fourth or fifth one of which is twice the size of the intermediate fine ones. The whole surface is besides (in most specimens) ornamented with indistinct concentric wrinkles from one fourth of a line to two lines in width. There are probably fine concentratic striæ, although I have not, (owing to the partially exfoliated state of the specimens examined) been able to detect them.

This species varies considerably in the amount of the convexity of the dorsal valve and in the size of the mesial fold in front. Some have a wide flat space in the umbonia region, and in such, on a side-view, the outline of the shell rises from the beak at an angle of about 45° only, while in others, which are more ventricose this angle is full 60° with the plane of the margin.

Sometimes the sides are strongly compressed, so that the shell becomes subcylindrical and greatly produced in front, the length exceeding the width. In some specimens the striæ are nearly all of the same size, but in general they alternate as in the finest marked specimens of *S. alternata.*

Resembles *S. Thalia,* but that species has the ventral valve concave nearly to the beak. It is more uniformly gibbous than *S. fluctuosa.*

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

Dalmanites Bebryx. N. s.

Description.—Elongate-oval, tapering from the head to the somewhat pointed tail. Length of the two specimens examined $1\frac{1}{2}$ inches each, length of head 5 lines, of thorax about 8 lines, of pygidium $5\frac{1}{2}$ lines.

The head is broadly rounded in front and appears to terminate in short spines at the posterior angles. The glabella is broad in front, narrowed behind and covered with small but prominent rounded tubercles about $\frac{1}{8}$ or $\frac{1}{16}$ of a line in diameter and of which there are from 10 to 15 in an area of one line square. The anterior lobe of the glabella is transversely sub-oval and its width about equal to the whole length of the head. It is separated from

the posterior portion of the glabella by strong deep furrows directed obliquely forward and outward. The distance between the inner extremities of these furrows is about $1\frac{1}{4}$ lines in a specimen $1\frac{1}{2}$ inches in length. The second and third lobes are united into one large obliquely triangular lobe with a small transverse pit at the inner margin representing the second furrow. The fourth or posterior pair of lobes are obscurely preserved in the specimens, but they appear to be small. The neck furrow seems to be strongly marked quite across the base of the glabella and the neck segment rather prominent. The eyes as partly exhibited in one of the specimens are rather small, their diameter being one line or perhaps rather more. They appear to be distant a little more than their own length from the posterior margin of the head.

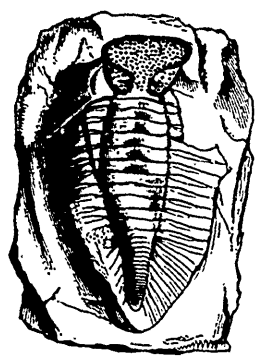

Fig. 8.—*Dalmanites Bebryx.*

The segments of the thorax are not well preserved in the specimens, but there appear to be eleven. The axis when crushed flat four lines wide at the fifth segment and three lines at the last.

The pygidium is triangular; the middle lobe convex, elongate conical, and with from fifteen to twenty segments becoming gradually more numerous in a given space as they approach the posterior extremity. The side lobes have each about ten pleura all of which are distinctly grooved along the middle. The pygidium appears to terminate in a rounded point a little turned upwards. I have not seen the margin of the pygidium and have not therefore ascertained its characters.

From the appearance of the specimens I think it almost certain that the posterior angles of the head are produced into short spines.

Several specimens of the pygidium of this rare species and one individual nearly entire but flattened by pressure have been found at Ottawa and are now in the collection of the Survey. I am indebted to Col. Jewett, of Albany, for the loan of the specimen figured. It is more perfect than any of ours.

Locality and formation.—City of Ottawa, Trenton limestone. Occurs also in the State of New York in the same Rock.

Collector.—E. Billings.

DALMANITES ACHATES. N. s.

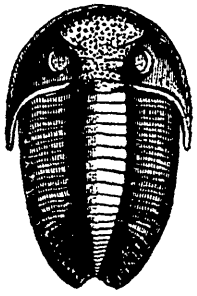

Fig. 9.—*Dalmanites Achates,*

Description.—Elongate-oval, posterior angles of head produced into short spines, proportional length of head thorax and pygidium apparently 5, 7½, 5, total length about one inch and a half.

Head, excluding the spines, very nearly a perfect semi-circle, with a shallow concave marginal groove all round the front and sides, and a strongly defined neck-furrow extending across at less than one line from the posterior margin; glabella equal to the whole length of the head, moderately convex in front, the anterior lobe transversely oval, twice the width of the neck-segment, not defined at the sides in front, but confluent with the surface of the cheeks. The anterior furrows have their inner extremities separated by a space equal to their own length, extending obliquely outwards to points situated a little forward of the inner front angles of the eyes. The middle furrows have their outer extremities opposite the mid-length of the eyes and extend inward in a direction gently inclined forward until their inner extremities are a little within one third the width of the glabella at mid-length from each other. The third furrows are opposite the posterior angles of the eyes, parallel or nearly so with the middle pair and about the same length. The neck furrow is well defined quite

across the glabella. The sides of the glabella are curved a little inward at the posterior lobes and then outwards to the outer extremities of the anterior furrows. The neck segment is large and has its posterior margin rather strongly elevated. The cheeks are moderately tumid. The eyes are semicircular, prominent, one fourth the whole length of the head, about their own length from the posterior and a little more than their length from the anterior margin; the distance between their centres appears to be about one twelfth or one fifteenth greater than the length of the head. The surface of the glabella is ornamented with small rounded tubercles of various sizes, the largest being about one fifth of a line in diameter at the base and, in general, distant once or twice their own width from each other. Surface of cheeks not yet distinctly observed but appears to be smooth. In none of the specimens are the lenses of the eyes preserved.

Thorax with eleven segments; axis well defined and apparently as wide as the side lobes, but this character cannot be sufficiently determined, as all the specimens are crushed. Length of the thorax once and a half the length of the head.

The pygidium in the only specimen that I have seen in which any considerable portion of it remains attached to the body, has the posterior extremity broken away. Judging however from the curves of the posterior margin I think it probable that there is no terminal spine as there is in most of the species of this genus. There are about ten segments in the axis and apparently ten in the side lobes. If the pygidium have no terminal spine the proportional lengths of the specimen figured would be very nearly as follows:

Head,.....	5 lines.
Thorax, ...	7½ lines.
Pygidium,...	5 lines.
Total	17½ lines.

On comparison it will be seen that this species differs from *D Bebryx* in the form of the glabella and in the number of segments in the central lobe of the pygidium.

Locality and Formation.—City of Ottawa, Trenton limestone, very rare. *Collector.*—E. Billings.

PHACOPS ORESTES, N. s.

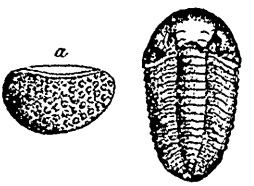

Fig. 10.—*Phacops Orestes.* *a* the eye enlarged.

Description.—Oval, about one inch and a quarter in length. Head somewhat semicircular or sub-crescentiform, the front convex and the posterior margin concave, the angles rather pointed but not produced into spines. Glabella moderately tumid, depressed convex on the top abruptly descending to the front margin, separated from the eyes by a narrow deep furrow, the anterior angles spreading out and becoming obsolete in front of the centres of the eyes, an indistinct marginal groove round the front which does not extend to the cheeks beyond the anterior angles of the glabella. The neck segment is strongly elevated, connected with the main body of the glabella by a narrow convex neck-like ridge with a small rounded tubercle on each side. All of the glabellar furrows are but slightly impressed; the two anterior are situated close to the inner front angles of the eyes, their direction forming with the longitudinal axis of the body an angle of 45°; they slope forward and outward and are short, a little curved and so faintly impressed that they can be seen on very perfect specimens only. The middle furrows lie in a line drawn across the head cutting the eyes at points a little less than one fourth of their length from their front angles; in some specimens these two furrows appear to be straight but in others a little curved the convex side towards the front. The posterior furrows lie a little behind a line drawn through the centres of the eyes. The sides of the glabella are straight or nearly so from the two neck tubercles to the inner front angles of the eyes when they curve a little outwards and become obsolete on approaching the ill-defined anterior angles (of the glabella) which are situated midway between the eyes and the anterior margin.

The eyes are very large, sub-semicircular, the lens-bearing surface not vertical but above sloping a little inwards, more elevated at the anterior than at the posterior extremity; lenses about seventy five arranged in vertical rows in general five in each row. Length

of the eye half the length of the glabella including the neck segment. There is a wide concave groove around the base of the eye outside and a narrow one behind. The cheeks outside of the groove are smooth slightly convex and with no marginal furrow.

The thorax consists of eleven segments, the axis semi-cylindrical gently tapering backwards, about one third the whole width of the thorax when the pleuræ are curved in their natural position but one fourth less than the length of a pleuron straightened out. The fulcrum or bend of the pleuræ is distant from the axis about one half the width of latter.

The pygidium is broadly rounded behind with six or seven ribs on the prominent conical axis and four or five broad flat indistinct ones each divided along the middle in the lateral lobes. The ribs on the axis become more and more indistinct backwards and those on the sides extend scarcely two thirds from it thus leaving a broad smooth margin all round.

The posterior extremity of the axis is not well preserved in any of the specimens that I have seen and I have not therefore ascertained whether or not it is well defined or confluent with the general surface. The surface appears to be smooth but as the best specimens seem to have been a little worn it may be that the glabella is tubercular. It is difficult to get accurate measurements from rolled up specimens, but the following appear to be early the proportions as shewn in two individuals.

	No. 1.	No. 2.
Length of head.....	3	4 lines.
" of thorax	6?	8? lines.
" of pygidium ..	$2\frac{1}{3}$	3 lines.
Total.....	$11\frac{1}{3}$	15

The width of the head measured between the posterior angles is about twice the length.

This species somewhat resembles *P. Stokesii* (Milne Edwards) but that species has the lens-bearing surface of the eye broadest behind while in ours it is broadest in front. There are from six to nine lenses in the vertical rows of *P. Stokesii* but in *Phacops Orestes* only five at the most.

Locality and formation.—Middle Silurian Anticosti and Gaspé.

Collectors.—J. Richardson, Sir W. E. Logan.

CHEIRURUS ICARUS. N. s.

Fig. 11.—*Cheirurus Icarus.*

Description.—Oblong oval, proportional lengths of head, thorax, and pygidium about as $3\frac{1}{3}$, 6, 2.

Head transversely sub-semicircular or sub-triangular, posterior angles terminating in short spines. Glabella oblong, sides parallel, obtusely rounded in front, neck segment elevated at the posterior margin, neck furrow in its middle third narrow deep and parallel with the posterior margin; at each end for one third the length sloping backwards. The posterior lobes of the glabella transversely oval, completely isolated; the median furrows lying nearly in a line drawn across the glabella at mid-length, nearly straight, at right angles to the longitudinal axis of the body, their inner extremities separated by about one third the width of the glabella; the anterior pair at a little more than one fourth the length from the front, a little curved backwards and inwards. The glabella extends the whole length of the head, being separated from the front margin by a very narrow groove only. Cheeks depressed convex; eyes rather small, nearly semicircular at the base, situated their own length from the posterior margin and half their length from the sides of the glabella. The neck furrow is extended in a sharp groove on the cheeks near to and sub-parallel with the posterior margin, and appears also to run round the sides of the head.

Thorax nearly twice the length of the glabella, of eleven segments; the axis less than one third the whole width, gently tapering backwards; the pleural groove short, in length about one half the width of the axis, crossing the pleuræ obliquely outwards and downwards at an angle of about 45°.

The pygidium is about half the length of the glabella, composed of three articulations, the backward curving extremities of which form six short obtuse points.

Surface not well preserved, but apparently somewhat smooth.

This species apparently resembles *C. bimucronatus* (Murchison),

but differs by having the glabella parallel-sided instead of broadest in front, the terminal points of the tail obtusely instead of sharply pointed, and the eyes further forward, being opposite the second instead of the third pair of glabellar lobes.

The largest specimen I have seen is about eleven lines in length.

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

PROETUS ALARICUS. N. S.

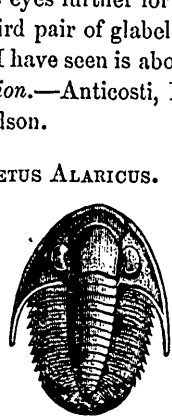

Fig. 12.—*Proetus Alaricus*, enlarged 2½ diameters.

Description.—Oval, proportional lengths of head, thorax, and pygidium about as 2, 2, 1.

Head excluding the spines semicircular with a broad shallow marginal groove all round; spines extending backwards to the sixth pleura. Glabella obtusely conical, about three fourths the length of the head, width at neck segment four fifths the length (of the glabella), sides parallel or very slightly inclining towards each other for five sixths of the length, then curving round to form the obtusely rounded front, neck furrow deep and narrow. Eyes large, obtusely conical, half the length of the glabella, their posterior angles on a line with the neck furrow, a little more than their own length from the front margin, their bases on the inside only separated from the glabella by an angular furrow.

Thorax with the axis prominent, semicylindrical, gradually tapering backwards, about one third the whole width of the body. There appear to be ten segments in the thorax.

Pygidium semicircular with a prominent conical axis, which is well defined at its posterior extremity and exhibits five or six segments. The side lobes of the pygidium appear to have five or six ribs.

The only specimen I have seen is five lines in length but perfect. About the size and shape of *P. latifrons* (McCoy), but in that

species there is a row of tubercles along the dorsal furrows, and a very strong one at each end of the neck segment, and, besides, the glabella is more narrowed towards the front than it is in our species.

The surface appears to be smooth.

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

ARTICLE VII.—*Description of a new Palæozoic Starfish of the genus* PALÆASTER, *from Nova Scotia.* By E. BILLINGS.

PALÆASTER PARVIUSCULUS. N. s.

Description.—The specimen is about six lines in diameter. The rays are two lines in length and one line and a half in width at the base, tapering at an angle of a little less than 45°. The five oral plates are sub-pentagonal about half a line in width. The first adambulacral plates of each pair of adjacent rays are in contact with each other outside of the oral plates, and not completely separated as they are in *P. Niagarensis.* There are six or seven adambulacral plates on each side of the ambulacral groove in each ray, and they gradually decrease in size from the oral plate outwards to the point of the ray. The width of the ambulacral groove is equal to one-third the width of the ray and consequently the adambulacral rows of plates are also each equal to one-third the whole width of the ray. In each groove there are two rows of small and apparently nearly square ambulacral plates, twelve or fourteen in each row, and they seem to be continued round on the inner margin of the oral plates; the mouth is about one line wide.

This species differs from *P. Niagarensis,* (Hall), (Pal. N. Y., Vol. 2, page 247, pl. 51, figs. 21, 22, 23,) in being smaller, the rays not so slender, and more importantly in the junction of the adambulacral plates outside of the oral plates.

In the 3rd Decade of the Geological Survey I have defined the genus *Stenaster* as differing from *Palæaster,* by the possession of

ten oral plates instead of five. The discovery of a second species with only five oral plates confirms the opinion there expressed that *Palæaster* is a genus quite distinct from *Stenaster*.

For the privilege of describing this highly interesting fossil I am indebted to Dr. J. W. Dawson, LL.D., to whose cabinet it belongs. It was found by the Rev. D. Honeyman, at Arisaig, in Nova Scotia.

Locality and Formation.—Arisaig, Nova Scotia,—The specimen is a nearly perfect impression of the underside of the fossil in a small water worn fragment of slate, of the lower Arisaig series, supposed to be of middle Silurian age.

Miscellanies.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

C—GEOLOGY.

President.—Sir CHARLES LYELL, L. L. D.; D. C. L.; F. R. S.

The Prince Consort having entered the Section Room, Sir C. Lyell spoke as follows:—

ANTIQUITY OF THE HUMAN RACE.

No subject has lately exited more curiosity and general interest among geologists and the public than the question of the antiquity of the human race; whether or no we have sufficient evidence to prove the former co-existence of Man with certain extinct mammalia in caves or in the superficial deposits commonly called drift or "diluvium." For the last quarter of a century, the occasional occurence in various parts of Europe, of the bones of man or the works of his hands, in cave-breccias and stalactites associated with the remains of the extinct hyæna, bear, elephant, or rhinoceros, have given rise to a suspicion that the date of man must be carried further back than we had heretofore imagined. On the other hand, extreme reluctance was naturally felt on the part of scientific reasoners, to admit the validity of such evidence, seeing that so many caves have been inhabited by a succession of tenants, and have been selected by man, as a place not only of domicile, but of sepulture,

while some caves have also served as the channels through which the waters of flooded rivers have flowed, so that the remains of living beings which have peopled the district at more than one era may have subsequently been mingled in such caverns and confounded together in one and the same deposit. The facts, however recently brought to light during the systematic investigation, as reported on by Falconer, of the Brixham Cave, must, I think, have prepared you to admit that scepticism in regard to the cave-evidence in favor of the antiquity of man had previously been pushed to an extreme. To escape from what I now consider was a legitimate deduction from the facts already accumulated, we were obliged to resort to hypotheses requiring great changes in the relative levels and drainage of valleys, and, in short, the whole physical geography of the respective regions where the caves are situated —changes that would alone imply a remote antiquity for the human fossil remains, and makes it probable that man was old enough to have coexisted, at least, with the Siberian mammoth. But, in the course of the last fifteen years, another class of proofs have been advanced, in France, in confirmation of man's antiquity, into two of which I have personally examined in the course of the present summer, and to which I shall now briefly advert. First, so long ago as the year 1844, M. Aymard, an eminent palæontologist and antiquary, published an account of the discovery in the volcanic district of Central France, of portions of two human skeletons (the skulls, teeth, and bones), embedded in a volcanic breccia, found in the mountain of Denise, in the environs of Le Puy en Velay, a breccia anterior in date to one at least, of the latest eruptions of that volcanic mountain. On the opposite side of the same hill, the remains of a large number of mammalia, most of them of extinct species, have been detected in tufaceous strata believed, and, I think, correctly, to be of the same age. The authenticity of the human fossils was from the first disputed by several geologists, but admitted by the majority of those who visited Le Puy and saw, with their own eyes, the original specimen now in the museum of that town. Among others, M. Pictet, so well known to you by his excellent work on palæontology, declared after his visit to the spot, his adhesion to the opinions previously expressed by Aymard. My friend, Mr. Scrope, in the second edition of his volcanoes of Central France, lately published, also adopted the same conclusion, although after accompanying me this year to Le Puy, he has seen reason to modify his views. The result of our joint examination,

a result which, I believe essentially coincides with that arrived at by M. M. Hébert and Lartet, names well known to Science, who have also this year gone into this enquiry on the spot, may thus be stated. We are by no means prepared to maintain that the specimen in the museum at Le Puy, (which unfortunately was never seen in situ by any scientific observer), is a fabrication. On the contrary we incline to believe that the human fossils in this and some other specimens from the same hill, were really imbedded by natural causes in their present matrix. But the rock in which they are entombed consists of two parts, one of which is a compact, and for the most part thinly laminated stone, into which none of the human bones penetrate; the other containing bones, is a lighter, and much more porous stone, without lamination, to which we could find nothing similar in the Mountain of Denise, although both M. Hébert and I, made several excavations on the alleged site of the fossils. M. Hébert therefore suggested to me that this more porous stone which resembles in colour and mineral composition, though not in structure, parts of the genuine old breccia of Denise, may be made up of the older rock broken up and afterwards re-deposited, or as the French say 'remané,' and therefore of much newer date.—An hypothesis which well deserves consideration but I feel that we are at present so ignorant of the precise circumstances and position under which these celebrated human fossils were found, that I ought not to waste time in speculating on their probable mode of interment, but simply declare that in my opinion they afford no demonstration of Man having witnessed the last volcanic eruptions of Central France. The skulls, according to the judgment of the most competent osteologists who have yet seen them, do not seem to depart in a marked manner from the modern European, or Caucasian type, and the human bones are in a fresher state than those of the *Elephas meridionalis* and other quadrupeds found in any breccia of Denise which can be referred to the period even of the latest volcanic eruptions.

But while I have thus failed to obtain satisfactory evidence in favour of the remote origin assigned to the human fossils of Le Puy, I am fully prepared to corroborate the conclusions which have been recently laid before the Royal Society by Mr Prestwich, in regard to the age of the flint implements associated in undisturbed gravel, in the north of France, with the bones of Elephants, at Abbeville, and Amiens. These were first noticed at Abbeville, and their true geological position assigned to them by M. Boucher

de Perthes, in 1849, in his 'Antiquités Celtiques,' while those of Amiens were afterwards described in 1855, by the late Dr. Rigollet. For a clear statement of the facts, I may refer you to the abstract of Mr. Prestwich's Memoir, in the Proceedings of the Royal Society for 1859, and have only to add that I have myself obtained abundance of Flint Implements (some of which are laid upon the table) during a short visit to Amiens and Abbeville. Two of the worked Flints of Amiens were discovered in the gravel-pits of St. Acheul—one at the deph of 10, and the other of 17 feet below the surface, at the time of my visit; and M. Georges Poucht, of Rouen, author of a work on the 'Races of Man,' who has since visited the spot, has extracted with his own hands one of these implements, as Messrs Prestwich and Flower had done before him. The stratified gravel resting immediately on the chalk in which these rudely fashioned instruments are buried, belongs to the post-pliocene period, all the fresh water and land shells which accompany them being of existing species. The great number of the fossil instruments which have been likened to hatchets, spearheads, and wedges, is truly wonderful. More than a thousand of them have already been met with in the last ten years, in the valley of the Somme, in an area 15 miles in length. I infer that a tribe of savages, to whom the use of iron was unknown, made a long sojourn in this region; and I am reminded of a large Indian Mound, which I saw in St. Simond's Island, in Georgia—a mound 10 acres in area, and having an average height of five feet, chiefly composed of cast-away oyster shells, throughout which arrow-heads, stone-axes, and Indian pottery are dispersed. If the neighbouring river, the Alatamaha, or the sea which is at hand, should invade, sweep away, and stratify the contents of this mound, it might produce a very analogous accumulation of human implements, unmixed perhaps with human bones. Although the accompanying shells are of living species, I believe the antiquity of the Abbeville and Amiens flint instruments to be great indeed if compared to the times of history or tradition. I consider the gravel to be of fluviatile origin, but I could detect nothing in the structure of its several parts indicating cataclysmal action, nothing that might not be due to such river-floods as we have witnessed in Scotland during the last half century. It must have required a long period for the wearing down of the chalk which supplied the broken flints for the formation of so much gravel at various heights, sometimes 100 feet above the present level of the Somme, for the deposition of fine

sediment including entire shells, both terrestrical and aquatic, and also for the denudation which the entire mass of stratified drift has undergone, portions having been swept away, so that what remains of it often terminates abruptly in old river cliffs, besides being covered by a newer unstratified drift. To explain these changes I should infer considerable oscillations of the land in that part of France—slow movements of upheaval and subsidence, deranging but not wholly displacing the course of the ancient rivers. Lastly, the disappearance of the Elephant, Rhinoceros, and other genera of quadrupeds now foreign to Europe implies, in like manner, a vast lapse of ages, separating the era in which the fossil implements were framed and that of the invasion of Gaul by the Romans.

Among the problems of high theoretical interest which the recent progress of Geology and Natural History has brought into notice, no one is more prominant, and, at the same time, more obscure, than that relating to the origin of species. On this difficult and mysterious subjects a work will very shortly appear, by Mr. Charles Darwin, the result of twenty years of observation and experiment in Zoology, Botany and Geology, by which he has been led to the conclusion that those powers of nature which give rise to races and permanent varieties in animals and plants, are the same as those which in much longer periods, produce species, and, in a still longer series of ages, give rise to differences of generic rank. He appears to me to have succeeded, by his investigations and reasonings, to have thrown a flood light on many classes of phenomena, connected with the affinities, geographical distribution, and geological succession of organic beings, for which no other hypothesis has been able, or has even attempted, to account.

Among the communications sent in to this Section, I have received from Dr. Dawson, of Montreal, one confirming the discovery which he and I formerly announced, of a land shell, or pupa, in the coal formation of Nova Scotia. When we contemplate the vast series of formations intervening between the Tertiary and Carboniferous Strata, all destitute of air-breathing mollusca, at least of the terrestrial class, such a discovery affords an important illustration of the extreme defectiveness of the geological records. It has always appeared to me that the advocates of progressive development have too much overlooked the imperfection of these records, and that, consequently a large part of the generalization in which they have indulged in regard to the first appearance of the different classes of animals, especially of air-breathers, will have to be modi-

fied or abandoned. Nevertheless, that the doctrine of progressive development may contain in it the germs of a true theory, I am far from denying. The consideration of this question will came before you when the age of the White Sandstone of Elgin is discussed—a rock hitherto referred to the Old Red, or Devonian formation, but now ascertained to contain several reptilian forms, of so high an organisation as to raise a doubt in the minds of many geologists whether so old a place in the series can correctly be assigned to it.

The Late Professor George Wilson of Edinburgh.

We observe with deep regret the announcement of the decease of this excellent and able man. In the great work of wedding science to the useful arts, and in the power of making its hardest truths intelligible and acceptable to the common mind he has left few equals and no superior. We copy the following notice from the "Scottish Press":

THE death of Professor George Wilson is an event with cannot but be deeply and widely felt. By many amongst us it will be deplored as a grievous personal loss, to the interests of science generally, it is great indeed, but to the University of Edinburgh it may almost be said to be irreparable. We have no wish to magnify the acquirements of the dead at the expense of those of the living, nor would we wish it to be thought that we write under a sense of despondency occasioned by the removal of one who was ao wise and kind a counsellor; but Dr. George Wilson's connection with the University and the department of science in which he laboured so ardently until the close of his life was in one sense so peculiar as to justify the remark we have made. The Chair of Technology which he was destined to fill for so short a time, was not so much created for him as by him. The foundation of his Professorship was, so to speak, only the recognition of his untiring efforts for the advancement of truth and the application of science to the industrial arts. It was felt not only that he was the best man who could be selected, but that he was the only man who fulfilled all the conditions necessary to render such a professorship as that of Technology permanently effective. The saying that thoroughly original men not only make their own instru-

ments, but, humanly speaking, create occasion for the use of them, was never more clearly illustrated than in the case of Dr. George Wilson. And it is because we know that everything, or nearly everything, connected with the position from which death has just called him, owed its existence to his wisdom, his zeal, and his never flagging energy that we feel his death to be so great a public loss. It will never be possible to estimate with anything like correctness the amount of physical and mental labour which he endured in order to fulfil the objects contemplated in the foundation of his Professorship, and to carry out the projected Industrial Museum of which he was appointed curator. His duties in the class-room, arduous as they were, did not represent a tithe of that labour. The clearness of his mind, the warmth of his heart, the graces of his style, and the natural buoyancy of his temperament, made his duties as a teacher seem as light as they were pleasant. No man better knew how to make the portals of the temple of knowledge inviting, and in a secular as well as a sacred sense, wisdom's ways were ways of pleasantness to him and all whom he sought to teach. Duty, "the stern lawgiver," ev were a smile for him, and his works abundantly prove that while he laboured as comparatively few are capable of labouring to extend the boundaries of knowledge, he never ceased to look forward, with the eye of steady faith, to that state of things in which we shall no longer see darkly as through a glass. It was his delight to think that those who reverently sought to know something of the Creator's work here, had begun studies that would never end, and he was wont to say that "the shortest lesson in heaven will teach more than the longest upon earth.

A brief notice like this affords us no opportunity of saying anything satisfactory as to the position to which Dr. George Wilson attained as a man of science and of letters. But it is scarcely necessary that anything should be said, for the sense of his loss attests the value of his scientific labours, and his books afford abundant evidence of the fine tone of his mind. His "Chemistry of the Electric Telegraph," and "Chemistry of the Stars" though scientific treatises in the best sense of the word, are felt by those who read them to be something more than this; they are the products of a highly poetical, as well as an accurate and well-balanced mind. His fertile imagination, and lively fancy, enabled him to impart not only lucidity, but attractiveness

to themes which by others have been rendered obscure and uninviting. His delicate and often subtle humour, too, played around such themes relaxing their gravity and lighting them up. Above all these characteristics of his literary works, is the steadfast faith and deep religious feeling which pervades them. In none is this so manifest, as in his Life of Dr. John Reid, one of the most delightful examples of biography within our knowledge. To Dr. George Wilson, religion was not only not a gloomy thing, but it was the brightness of existence. It not only cheered him in many days of prostration from severe bodily affliction, but it was an element in almost all his studies, and a thing of his daily laborious life. And we have reason to know, that during his last days on earth, he felt it to be indeed the peace of God, and the firm anchor of his soul.

REVIEWS AND NOTICES OF BOOKS.

HANDBOOK OF GEOLOGICAL TERMS AND GEOLOGY, by DAVID PAGE, E.G.S., Author of the Advanced Text Book of Geology. *Edinburgh* and *London:* W. Blackwood & Sons. *Montreal:* B. Dawson & Son. pp. 416, $2.

Such a Handbook as this is has long been a great desideratum to the reading public. The "hard words and forbidding technicalities" of science which appear to beginners of so difficult acquirement, are here explained and made intelligible in brief and simple language. The ordinary reader will find the information he requires, generally in the first and second sentences of a definition, while what follows is more especially addressed to students and other professional enquirers. This book is just the thing for students, and for those who attend geological lectures, or read geological books. As the first book of the kind that has yet appeared, it is a most meritorious production. Although far from complete it yet contains nearly every term to be met with in ordinary books on geology. In no other single work can the same information be obtained. The defintions may be received with perfect confidence. The author is well known as a most painstaking and careful practical geologist.

EVENINGS AT THE MICROSCOPE; or Researches among the Minuter Organs and Forms of Animal Life. By P. H. GOSSE, F.R.S. *New York:* D. Appleton & Co. *Montreal:* B. Dawson & Son. pp. 480.

Little need be said in commendation of this new work by Mr. Gosse. His popular writings in the department of Zoology are so well known and highly valued by Students of Natural History, that any thing on his favorite science, which he may now publish, is sure to meet with a favorable reception. To open the path to the myriad wonders of creation which, altogether unseen by the unassisted eye, are made cognisable to sight by the aid of the microscope is the aim and scope of this volume. The revelations of the microscope in the department of the organic world are of the most wonderful and interesting kind, and may well attract the attention of all intelligent and educated persons. The staple of this book consists of original observations by the author. He has set down simply what he himself has seen and what may be seen by any one with the aid of a microscope of ordinary power. He has relieved the dryness of technical description by a colloqial and familiar style in a series of imaginary microscopical *conversaziones*. The precision essential to science has, however, never been sacrificed. Throughout the work considerable information is given on the selecting, securing and preparing objects for examination under the microscope, which cannot fail to be highly useful to those who have not books at hand containing special directions on these points. In almost every instance the objects selected for illustration are common things, such as any one with access to the sea-shore or country-side may easily obtain. The book contains one hundred and thirteen illustrations, all of which, with the exception of eighteen, are from the author's own pencil They are also, even in this American edition of the work, engraved with much accuracy and beauty. To the young we cannot too highly commend this book. With the aid of a microscope its interest will be greatly increased, but with or without such a companion it cannot fail to prove highly instructive.

DURA DEN; a Monograph of the Yellow Sandstone and its remarkable Fossil remains. By the Rev. JOHN ANDERSON, D.D., F.G.S., &c. With illustrations. *Edinburgh:* Thos. Constable & Co. *Montreal:* B. Dawson & Sc p. 8 vo. pp. 96, $3·50.

This is a truly sumptuous book which any geologist will regard as a real luxury. The illustrations are in the highest style of

lithographic art and artistic beauty. The two finest and largest are drawn by the fair hand of Lady Kinnaird, and are of unquestionable excellence. The writer is well known as a distinguished amateur geologist. His name is associated with some important discoveries in this department of Science. Lately the remarkably well preserved fossils of a district in Fifeshire, Scotland, called Dura Den, has attracted the attention of geologists and led to an interesting determination of the position of the rocks in which they are embedded. The fossils are now regarded, on almost unquestionable evidence, to belong to the Devonian or old red Sandstone formation. At first, from their contiguity to the coal fields of Fifeshire, these rocks were supposed to have some relation to the lower members of the Carboniferous system, but the careful examination of their fossils and the related strata have led the chiefs of geological science to regard the Yellow Sandstone of Dura Den, as a curious and most interesting section of the great Devonian System. We cordially recommend this book to those interested in the progress of Geological Science.

NUGGETS FROM THE OLDEST DIGGINGS OR RESEARCHES IN THE MOSAIC CREATION. By R. W. VANDYK. *Edinburgh:* Thos. Constable & Co. *Montreal:* B. Dawson & Son.

This is another book on the great question of the reconciliation of the Mosaic Narrative of Creation, with the facts of physical science. Notwithstanding the uncouth title, the book is written with much vigour and eloquence. There is no pretension to a critical examination of the text with this branch of the subject our author does not intermeddle. Nor does he claim any higher acquaintance with science than that which may be obtained from a careful study of good books. The author persuades himself that he has made a grand discovery which removes all the difficulties which have hitherto perplexed the wisest of men, and sheds a perfect flood of light upon the scripture narrative. He is evidently in a very happy frame of mind, and writes in a style of delightful enthusiasm. "Happy is he who knoweth the causes of things." Our authors' idea is that, with the exception of the very first act, which was the creation of the substance of the universe, the whole events narrated in Genesis i. were truly effects of the laws given to the created mass, showing themselves gradually and in succession, and by a process

which, if witnessed, would have appeared to be exactly the same natural and unmiraculous operation of cause and effect with which we are familiar. After the first creative act, what is described is the formation of earth and its tenants out of a disorderly mass of matter; and this is represented as having been accomplished by movements within the mass itself, that is to say, by means of second causes." This is the theory which the book works out with some ability and ingenuity. If it is not altogether new, it is at least modern. We cannot say we are convinced of its truth. We have no faith in unscientific treatments of the physical phenomena of the universe, or in unlearned criticisms of the sacred text. No man should attempt the discussions of the topics contained in this book who has not had practical acquaintance with the subjects which it involves. The idea of all pervading law in the production of physical phenomena is that which Baden Powell attempts to demonstrate with rare ability in his recent works. We do not recognise any special feature in the "Nuggets from the oldest Diggins" that entitles it to a very high rank in the literature of the subject on which it treats. It may be read with interest by the curious, and be regarded as another addition to the unsuccessful attempts to settle the disputed interpretation of the Mosaic cosmogony.

ON THE ORIGIN OF SPECIES BY MEANS OF NATURAL SELECTIONS, OR THE PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE. By CH. DARWIN, M.A., &c., &c. *New York:* D. Appleton & Co. *Montreal:* B. Dawson & Son.

This is an abstract of a larger work in course of preparation. It is entitled to most careful perusal. The author is a well known and distinguished Naturalist. He has given much attention to and spent now twenty years of his life in the prosecution of the subject of this book. The title is a good description of its contents. It deals with questions of Natural History in a way most masterly and profound. That its views will meet with much opposition is to be expected. Few will be disposed to go the sweeping length to which our author is disposed to go in the logical issue of his theory. We merely call attention to this able work in the mean time. It promises to create quite a furor in the minds of scientific enquirers. We hope to present our readers with a thorough review of the work either from the pen of one of the Editors, or from the pages of one of the earliest scientific magazines of Europe or America.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF DECEMBER, 1859.

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

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

Day of Month.	Barometer, corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			RAIN.	SNOW.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	Amount of, in inches.	Amount of, in inches.	6 a. m.	2 p. m.	10 p. m.
1	29.681	29.520	29.568	20.2	35.0	42.1	.091	.190	.261	.88	.95	.98	N. E. by E.	W. by N.	S. S. W.	3.00	0.69	14.12	Inapp.	.....	Cu. Str. 10.	Cu. Str. 10.	Rain.
2	30.111	30.062	30.096	22.3	17.6	9.0	.084	.072	.051	.71	.75	.77	N. N. W.	N. by E.	E. by S.	16.27	4.30	4.46	.....	1.90	" 10.	" 10.	Snow.
3	625	661	724	−12.0	10.0	−3.0	.019	.054	.032	.56	.78	.82	W. by S.	E. by N.	N. E.	16.21	4.01	0.71	.....	.....	Clear.	Clear.	C. C. Str. 10. Lunar Halo.
4	575	586	361	−3.0	15.4	10.9	.032	.089	.054	83	91	78	N. E. by E.	N. E. by E.	N. E. by E.	15.17	12.43	28.30	.....	3.50	Snow.	Snow.	Snow.
5	323	220	232	11.0	23.7	24.2	.062	.117	.123	89	90	93	N. E. by E.	N. E. by E.	N. E. by E.	11.93	8.12	4.02	.....	.....	"Verglas."	Rain.	Rain.
6	099	29.934	29.782	26.1	36.4	39.2	.140	.191	.232	98	90	96	N. E. by E.	E. S. E.	S. E. by E.	0.71	3.42	6.94	0.360	.....	Rain.	"	"
7	29.605	616	950	35.0	32.6	27.4	.197	.176	.129	95	93	88	S. S. W.	S. W.	W. by S.	14.42	4.41	14.70	0.946	.....	"	"	Cu. Str. 8.
8	30.109	30.201	30.214	−0.9	12.2	3.2	.036	.045	.043	84	60	80	W. by S.	W. by S	S. E. by E.	18.42	2.65	2.41	.....	.....	Clear.	Clear.	" 2.
9	177	29.950	29.823	1.1	19.1	19.0	.040	.077	.081	85	76	78	S. E. by E.	S. E. by E.	S. E. by E.	1.41	4.46	8.22	.....	0.70	Cu. Str. 2.	Snow.	Snow.
10	29.937	30.136	30.186	17.1	9.2	1.0	.084	.050	.040	91	70	85	W. by S.	W. by S.	S. S. W.	9.92	1.51	16.75	.....	2.60	Snow.	Cn. Str. 4.	Clear.
11	845	29.788	29.466	1.0	9.0	12.2	.010	.051	.066	85	77	91	N. E. by E.	N. E. by E.	N. E. by E.	1.22	2.43	2.65	.....	1.10	Cu. Str. 10.	" 10.	Snow.
12	500	663	810	−2.0	−6.6	−10.6	.034	.028	.021	84	81	77	W.	W. by S.	S. S. W.	21.48	15.42	7.82	.....	.....	Clear.	Clear.	Clear.
13	30.118	30.228	30.337	−13.9	6.9	−10.0	.120	.046	.032	76	76	79	S.	S. by W.	N. N. W.	8.41	1.48	0.80	.....	.....	"	"	"
14	318	100	201	−2.5	8.5	2.8	.032	.057	.044	85	88	86	N. E. by E.	N. E. by E.	N. E. by E.	10.95	2.92	6.27	.....	0.70	Cu. Str. 10.	Cu. Str. 10.	Snow.
15	29.936	29.937	139	11.0	19.7	14.3	.062	.081	.072	89	77	88	S. W.	S. by W.	S. W.	26.96	7.30	4.60	.....	.....	" 10.	Clear.	Clear.
16	30.138	30.102	223	18.1	23.8	16.1	.084	.100	.074	90	80	83	S.	N. E.	N. E. by E.	1.00	0.01	0.08	.....	.....	" 10.	C. Str. 9.	Clear.
17	235	214	118	13.6	20.2	19.1	.063	.074	.087	80	69	83	N. E. by E.	N. E. by E.	N. E. by E.	0.00	3.50	12.08	.....	.....	Clear.	Clear.	Clear.
18	29.923	29.782	29.763	18.9	20.1	20.1	.088	.096	.096	85	84	84	N. E. by E.	N. E. by E.	N. E. by E.	11.41	15.62	15.06	.....	4.40	Cu. Str. 10.	Snow.	Cu. Str. 10
19	712	701	695	21.1	28.4	31.9	.096	.129	.162	85	83	89	N. E. by E.	S. W.	S. by W.	17.20	0.88	1.85	.....	0.20	Snow.	"	" 10.
20	740	600	410	30.0	34.1	38.3	.154	.155	.224	91	79	90	S. W. by S.	N. E. by E.	N. E. by E.	7.40	0.21	5.41	.....	0.90	Cu. Str. 10.	"	Snow.
21	500	627	796	20.1	21.1	10.9	.097	.100	.058	92	85	80	W. S. W.	W. by S.	S.	3.30	11.72	23.07	.....	1.70	" 10.	Cu. Str. 8.	Cu. Str. 2. [Zodiacal Light.
22	859	800	808	5.0	20.1	−0.2	.041	.085	.034	74	83	80	S. by E.	S. S. E.	S. S. E.	6.99	1.62	1.40	.....	.....	" 4.	Clear.	Clear. Faint Aur. Borealis. Bright
23	681	580	573	5.0	22.8	19.0	.041	.095	.090	76	75	90	N. E.	S. E.	S. by E.	0.33	0.45	7.79	1.40	.....	" 10.	Cu. Str. 10	Snow.
24	692	803	895	−10.0	−7.8	−16.9	.024	.021	.015	79	76	71	W.	W.	W. S. W.	25.56	0.10	4.50	.....	.....	" 2.	Clear.	Clear. Zodiacal Light, bright.
25	890	816	838	−20.1	−0.5	−4.0	.012	.023	.032	67	88	86	N. by E.	S. E.	N. E. by E.	0.50	0.01	6.17	.....	0.75	" 10.	Cu. Str. 8.	Snow.
26	628	520	700	−6.4	5.6	6.6	.028	.049	.048	81	87	88	N. E.	N. E. by E.	N. E.	21.36	6.70	5.20	.....	1.06	Snow.	Snow.	Clear. Aurora Borealis.
27	30.076	30.270	30.397	−9.1	−1.3	−16.5	.019	.034	.015	60	86	71	W.	N. W.	W.	19.60	11.05	7.32	.....	.....	Clear.	Clear.	Clear. Zodiacal Light visible.
28	460	440	533	−29.2	−0.5	−23.5	.007	.034	.010	53	80	60	W.	S. W.	N. W. by W.	0.42	0.00	0.00	.....	.....	"	"	Clear. Faint Aurora Borealis.
29	452	269	088	−32.6	−9.9	−14.6	.008	.017	.015	52	57	70	S. S'E.	E. S. E.	E. by S.	0.01	1.00	2.22	.....	.....	"	"	Clear.
30	29.781	29.710	29.709	−4.0	8.0	6.3	.031	.056	.051	80	82	87	N. E. by E.	E. by N.	S. W.	17.37	3.67	1.30	.....	2.96	Snow.	Snow.	Cu. Str. 10.
31	907	823	965	3.2	9.0	2.8	.036	.046	.042	72	76	86	W.	W.	W. by S.	15.16	7.01	4.10	.....	.....	Cu. Str. 10.	Clear.	Cu. Str. 2.

REPORT FOR THE MONTH OF JANUARY, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours.	OZONE.	RAIN.	SNOW.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	(In Miles.)	Mean amount of.	Amount of, in inches.	Amount of, in inches.	6 a. m.	2. p. m.	10 p. m.
1	29.912	30.001	30.038	−12.0	−2.1	−16.9	.020	.034	.015	.76	.83	.70	W. N. W.	N. W.	W. by S.	5.30	0.6	.....	.....	Clear.	Clear.	Clear.
2	30.240	278	337	−21.9	−1.0	−13.0	.009	.028	.019	.40	.68	.70	W. by S.	W. by S.	W. by S.	172.60	1.0	.....	.....	"	Cu. Str. 7.	Clear.
3	439	241	105	−25.4	−14.2	−6.8	.008	.013	.026	.38	.51	.80	W. by S.	N. E. by E.	N. E. by E.	19.80	1.0	.....	1.30	Cu. Str. 4.	" 10.	Snow.
4	29.930	29.926	135	−2.0	16.0	−2.0	.036	.067	.028	84	68	68	N. E.	N. E. by E.	W. N. W.	74.10	1.3	.....	1.51	Snow.	Snow.	Cu. Str. 4.
5	30.313	30.298	298	−14.6	8.0	0.0	.017	.048	.038	70	77	55	W.	W. by S.	S. S. W.	104.70	1.6	.....	.....	Cu. Str. 4.	Clear.	Cu. Str. 10.
6	236	067	29.893	8.4	24.4	21.0	.057	.088	.085	88	67	78	S. W.	S. S. W.	S. S. W.	152.80	2.6	.....	.....	" 10.	Cu. Str. 10.	Cu. Str. 10.
7	29.874	29.681	583	19.2	33.4	36.9	.087	.162	.199	83	84	90	S.	S. by W.	W. S. W.	8.50	3.3	0.110	Inapp.	" 10.	Cu. Str. 10.	Rain.
8	597	630	723	32.4	38.8	37.0	.168	.201	.178	92	85	81	S. W. by S.	S. W.	W. N. W.	220.00	4.3	.....	.....	" 10.	Cu. Str. 10.	Cu. Str. 10.
9	30.165	30.049	30.073	21.0	28.9	20.9	.085	.123	.085	78	77	78	W. N. W.	S. W. by S.	N. E. by E.	116.10	0.6	.....	.....	Clear.	Clear.	Cu. Str. 10.
10	29.851	29.746	29.750	31.4	36.6	35.0	.068	.200	.197	95	93	94	S. by E.	E. by S.	S. by E.	69.40	3.3	Inapp.	2.11	Cu. Str. 10.	Rain.	Cu. Str. 10.
11	649	754	30.103	33.7	19.8	8.0	.182	.092	.046	94	92	85	W. by S.	N. E. by E.	W. N. W.	55.90	4.3	0.210	0.75	Rain.	Snow.	Cu. Str. 10.
12	30.107	30.158	29.843	−6.8	15 1	21.0	.028	.070	.085	81	81	78	N. by W.	S. W. by S.	S. W. by W.	152.80	1.0	.....	.....	Clear.	Cu. Str. 10.	Cu. Str. 9.
13	458	406	30.342	−24.6	−3.2	−6.7	.009	.025	.021	60	61	62	N. N. W.	E.	N. E. by E.	202.70	0.6	.....	.....	"	Clear.	Cu. Str. 10.
14	177	29.946	29.694	−8.4	2.0	7.0	.025	.036	.049	80	72	86	N. E. by E.	N. E. by E.	N. E.	114.40	1.0	.....	0.75	Cu. Str. 10.	Clear.	Clear.
15	29.436	220	319	5.1	25.5	32.1	.041	.111	.162	74	81	89	N. E. by E.	W.	N. W. by N.	106.70	3.0	.....	0.46	" 10.	Cu. Str. 8.	Cu Str. 10.
16	304	276	460	32.0	40.1	33.8	.168	.225	.162	89	90	84	W. S. W.	W. S. W.	W.	235.30	4.6	.....	.....	" 8.	Cu. Str. 9.	Clear.
17	694	710	785	10.1	12.0	0.0	.054	.051	.038	78	70	85	W.	W.	W.	169.50	2.6	.....	.....	" 8.	Clear.	Clear.
18	805	794	708	−12.2	6.0	3.0	.016	.043	.040	70	75	85	S. S. W.	N. E. by E.	N. E. by E.	61.30	1.0	.....	0.60	" 4.	Cu. Str. 9.	Snow.
19	642	710	756	2.4	14.2	17.1	.040	.067	.078	86	80	81	N. E. by E.	W. S. W.	W. S. W.	172.20	1.3	.....	1.00	" 10.	Clear.	Cu. Str. 10.
20	560	510	454	24.6	33.4	29.0	.105	.162	.142	80	84	88	W.	W. S. W.	S. E.	122.30	1.3	.....	0.70	" 10.	Cu. Str. 4.	Cu. Str. 2. Aurora Borealis.
21	320	314	680	28.4	38.3	34.3	.129	.201	.190	83	86	98	W. S. W.	W. by N.	W. by S.	116.10	4.3	.....	.....	" 4.	Cu. Str. 10.	Cu. Str. 4.
22	691	497	614	24.2	31.9	29.1	.106	.148	.142	83	80	88	N. E. by E.	N. E. by E.	S. S. E.	197.50	2.3	.....	.....	" 10.	Cu. Str. 10.	Clear.
23	976	918	30.029	18.4	33.3	20.3	.072	.162	.084	82	84	80	W.	S. W.	N. E. by E.	166.10	3.0	.....	.....	" 4.	C. Cu. Str. 4.	Clear.
24	970	464	29.301	20.9	36.4	35.6	.097	.191	.197	85	90	95	S. S. E.	S. E. by E.	N. E. by E.	19.00	3.6	.....	0.50	" 10.	Cu. Str. 10.	Cu. Str. 10.
25	280	314	639	33.2	32.2	22.1	.179	.167	.084	98	98	71	W. by S.	W. by S.	W. N. W.	549.20	5.0	0.140	.....	Rain.	Cu. Str. 8.	Cu. Str. 8.
26	914	974	981	20.0	16.2	6.1	.091	.068	.048	85	76	75	W. by N.	W. by S.	S. W.	340.30	1.3	0.014	.....	Clear.	Cu. Str. 4.	Clear.
27	979	709	794	−2.0	13.0	7.0	.034	.054	.050	84	71	88	S. S. E.	N. E. by E.	N. N. W.	22.80	2.0	.....	.....	"	Clear.	Cu. Str. 10.
28	775	594	904	1.0	12.2	0.5	.032	.045	.030	70	60	69	W.	W. by S.	W. by S.	132.90	1.0	.....	0.52	Snow.	C. C. Str. 4.	Clear. Solar Halo.
29	30.057	880	615	−7.4	23.3	22.9	.024	.078	.098	79	59	79	W. S. W.	S. S. W.	S. by W.	84.80	2.0	.....	.....	Clear.	Clear.	Cu. Str. 10.
30	29.320	437	421	28.4	28.2	28.7	.129	.117	.129	82/	75	82	W. N. W.	W by N.	S. S. W.	294.50	5.0	.....	0.70	C. Str. 10.	Snow.	Cu. Str. 10.
31	942	30.067	30.239	2.0	0.0	−4.0	.034	.032	.031	71	70	83	W. by S.	W. N. W.	N. W.	453.30	3.0	.....	1.00	" 6.	Cu. Str. 10.	Cirri 4. Lunar Halo.

REMARKS FOR DECEMBER, 1859.

Barometer ..... Highest, the 3rd day, 30·726 inches. Lowest, the 20th day, 29.410 " Monthly Mean, 29.971 " " Range, 1.316 "

Thermometer ... Highest, the 1st day, 42°1. Lowest, the 29th day, −32°6. Monthly Mean, 8°93. Monthly Range, 74°7.

Greatest intensity of the Sun's rays, 38°0.
Lowest point of terrestrial radiation, −36°6.
Mean of humidity, .808.
Rain fell on 3 days, amounting to 1.480 inches; it was raining 26 hours and 20 minutes.
Snow fell on 14 days, amounting to 23.87 inches; it was snowing 150 hours and 30 minutes.
Most prevalent wind, the N. E. by E.
Least prevalent wind, the S.
Most windy day, the 4th day; mean miles per hour, 15.30.
Least windy day, the 28th day; mean miles per hour, 0.14.
Aurora Borealis visible on 3 nights.
Lunar Halo visible on 1 night.
Zodiacal Light visible and bright.
The Electrical state of the atmosphere has indicated high tension.
Ozone was present in large quantity.

REMARKS FOR JANUARY, 1860.

Barometer. ..... Highest, the 13th day, 30.455 inches. Lowest, the 21st day, 29.314 " Monthly Mean, 29.861 " Monthly Range, 1.141

Thermometer. Highest, the 16th day, 46°4. Lowest, the 3rd day, −25°4. Monthly Mean, 13°15. Monthly Range, 71°8.

Greatest intensity of the Sun's rays, 66°4.
Lowest point of terrestrial radiation, −27°1.
Mean of humidity, .786.
Rain fell on 5 days, amounting to 0.474 inches; it was raining 24 hours 40 minutes.
Snow fell on 14 days, amounting to 11.90 inches; it was snowing 74 hours 40 minutes.
Most prevalent wind, the W. by S.
Least prevalent wind, the E.
Most windy day, the 25th day; mean miles per hour, 22.88.
Least windy day, the 1st day; mean miles per hour, 0.21.
Aurora Borealis visible on 1 night.
Solar Halo visible on 1 day.
Lunar Halo visible on 1 night.
The Electrical state of the atmosphere has indicated moderate intensity.