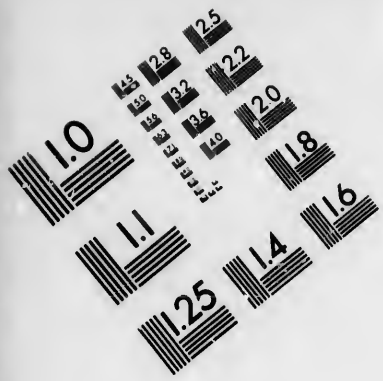

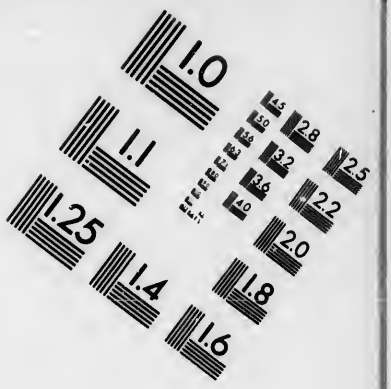

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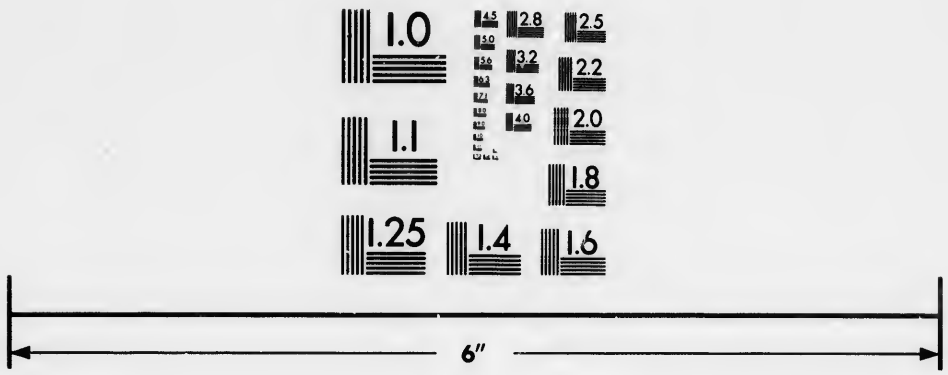

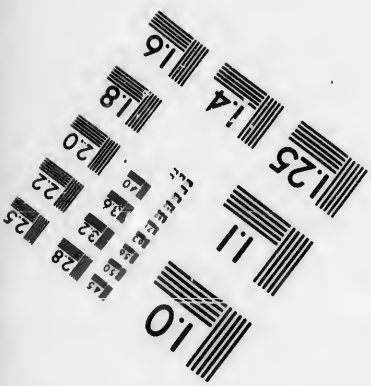

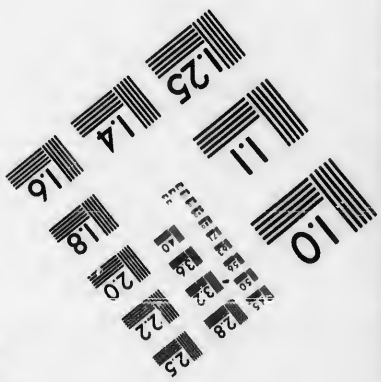

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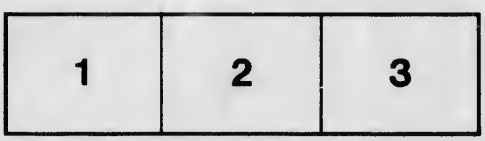

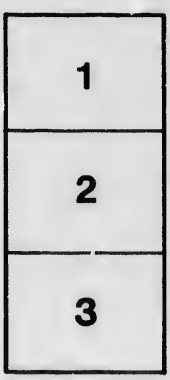

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ADDITIONAL NOTES

ON THE

POST-PLIOCENE DEPOSITS

OF THE

ST. LAWRENCE VALLEY.

BY. J. W. DAWSON, LL.D., F.G.S., &c.,
PRINCIPAL OF M'GILL COLLEGE.

Read before the Natural History Society of Montreal.

(*Extracted from the* CANADIAN NATURALIST *for February*, 1859.)

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POST-PLIOCENE DEPOSITS

OF THE

ST. LAWRENCE VALLEY.

In a paper on the Newer Pliocene and Post Pliocene deposits of the vicinity of Montreal, communicated to the Natural History Society last winter, I promised to follow up the subject, especially in the direction of the more minute organisms of these deposits, and the comparison of the stratigraphical arrangements near Montreal with those in other parts of the Province. In fulfilment of this promise, I now proceed to state a number of facts which I have ascertained or which have been communicated to me in the past summer.

I. Foraminifera and Bryozoa.

The Foraminifera are creatures almost at the extreme limit of simplicity of structure in the animal kingdom. Generally microscopic in dimensions and consisting of a soft and apparently homogeneous jelly, they present no appreciable organs, except little thread-like extensions of their bodies, which appear to be their organs of prehension and locomotion. Such creatures might at first sight be supposed incapable of being preserved among the medals of creation. They have, however, the power of secreting for their protection delicate and beautiful calcareous cells, divided into a number of chambers which are added successively in the

progress of growth, and communicate with each other and with the outer world by minute orifices; and as these creatures abound everywhere in the ocean, their shells are constantly accumulating on its bottom, so as in some cases to form thick beds of calcareous matter. The Bryozoa, equally minute in size, are far more complex in structure; presenting, with a general polyp form, complicated digestive and muscular apparatus. which place them far in advance of the hydroid polyps, and have induced the majority of modern zoologists to arrange them with the mollusks. They occupy horny or calcareous cells, which usually have wide openings for the extension of the arms or tentacles which procure the food of the inmates. These cells are arranged in branching or flat and circular groups, which form a large proportion of the zoophytes of the older naturalists, and are to be found everywhere on submerged stones, shells, and sea-weeds.

I place these two tribes, in their structure so dissimilar, together, because they are found together in the drift deposits; and because, owing to this and to their microscopic size, they can be conveniently studied in connection.

Before proceeding to describe the species found, I may mention that though the minute dimensions of these objects may cause them to escape the notice of many collectors, they are, when studied with the aid of the microscope, not inferior in interest and beauty to any other fossils found in our tertiary plains. The Foraminifera may easily be detected by examining the clays in which fossil shells occur, and particularly those holding *Fusus tornatus* and the spicula of *Tethea Logani*,* with the aid of a pocket lens. When they are thus ascertained to be present, a quantity of the clay should be well dried, broken into small pieces, and stirred in a quantity of water, when the clay will subside and the little shells may be skimmed from the surface. When dry they may be spread on a tray or on dark-colored paper, and examined with the lens to ascertain what forms are present. They may then be picked up with a moist camel's-hair pencil, and placed separately in small boxes for more minute examina-

* For notices of these and other fossils referred to in these pages, see my former paper, Canad. Nat. vol. 2.

tion. For the microscope, they may be mounted either on a dark ground as opaque objects, or in Canada balsam as transparent objects; and should be studied in both of these ways. With the foraminifera, the collector will usually find valves of *Cytheridea*, some of the smaller univalves, and detached cells of *Lepralia*.

(1.) *Position of Foraminifera and Bryozoa in the Post-Pliocene Deposits.*

Logan's Farm.—In the last volume of the Naturalist, I described a number of species of fossils from Logan's farm, and stated what I believed to be their relative position. By the kindness of Mr. Logan, I have since been enabled to make an excavation in the spot where these remains are most abundant, and obtained the following section:—

	ft.	in.
Soil and sand,	1	9
Tough reddish clay,	0	0½
Gray sand, a few specimens of *Saxicava rugosa*, *Mytilus edulis*, *Tellina Grœnlandica*, and *Mya arenaria*, the valves generally united,	0	8
Tough reddish clay, a few shells of *Astarte Laurentiana*, and *Leda Portlandica*,	1	1
Gray sand, containing detached valves of *Saxicava rugosa*, *Mya truncata*, and *Tellina Grœnlandica*; also *Trichotropis borealis*, and *Balanus crenatus*: the shells in three thin layers	0	8
Sand and clay, with a few shells, principally *Saxicava* in detached valves	1	3
Band of sandy clay, full of *Natica clausa*, *Trichotropis borealis*, *Fusus tornatus*, *Buccinum undatum*, *Astarte Laurentiana*, *Balanus crenatus*, &c. &c., sponges and *Foraminifera*. Nearly all the rare and deep-sea shells of this locality occur in this band,	0	3
Sand and clay, a few shells of *Astarte* and *Saxicava*, and remains of sea-weeds with *Lepralia* attached; also *Foraminifera*,	2	0
Stony clay, boulder clay.		

It thus appears that at Logan's farm we have littoral species at top, and that all the rare and deep-water fossils, as well as the *Lepraliæ* and *Foraminifera* occur in a comparatively thin band near the base of the deposit. This corresponds precisely with the

order observed elsewhere in the vicinity of Montreal; though at Logan's Farm the arrangement is somewhat more complex than in other localities.

Tanneries.—At the brick-yards near the village of the Tanneries, near Montreal, the surface of the Leda clay is well stored with *Leda Portlandica*, *Astarte Laurentiana*, *Natica clausa*, *Tellina Grœnlandica*, and some other shells. It also contains sponge spicula and foraminifera. The shells at this place, though by no means so numerous as at Logan's farm, are remarkable for their excellent state of preservation.

Beauport.—I visited this celebrated deposit for the first time last autumn. At first sight it consists of a mass of stratified sand and gravel, equivalent to the Saxicava sand of Montreal, and resting on boulder clay. The overlying mass is filled with *Saxicava Tellinæ* &c.; and the underlying boulder clay as usual contains no fossils. My experience in the Montreal deposits, however, led me to expect a bed, however thin, representing the Leda clay, between these; and on searching at the junction of the two great beds above mentioned, I was gratified by finding a layer of sand about three inches in thickness, filled with the rarer shells of the deposit, characteristic of its deeper waters, such as *Fusus tornatus*, *Pecten Islandicus*, *Buccinum ciliatum*, *Modiolaria discors*, &c.* The *Rhynconella psittacea* occurs only in this layer, and in such a manner as to leave no doubt that it is buried here in situ, in the very spot where it lay anchored to the stones of the surface of the drift. On these stones, however, I found a new and interesting field for observation. In the thin layer above referred to, all the stones, as well as those that lay on the surface of the boulder clay or partly imbedded in it, were covered with the remains of marine creatures, especially *Balanus crenatus*, *Spirorbis sinistrorsa*, *Spirorbis spirillium*, *Lepralia* and *Hippothoa*. This layer, in short, evidently represented a time when the surface of the boulder clay, covered only by a thin layer of sand and stones, constituted the bottom of clear and deep water, before it

* Sir C. Lyell notices the fact that these shells are more abundant in the lower part of the mass than above.

became covered by the Saxicava sand. This bottom, although no clay has been deposited on it, represents the Leda clay at Montreal, and is exceedingly rich in the fossils usually found at the surface of that bed. *Foraminifera* occur in it, but they are comparatively rare, and, so far as I could find, only of species common at Montreal.

(2.) *Species of Foraminifera.*

In my paper of last year a few of these were figured, but the nomenclature of these creatures was in a state so unsettled that I hesitated to attach names to them or to identify them with described species. I am now relieved of the greater part of this difficulty by the appearance of Williamson's excellent monograph on the British Foraminifera, the nomenclature of which I shall follow in noticing our Canadian species.

Fig. 1.

1. *Polystomella umbilicatula*, Walker (Fig. 1).*—Nine tenths of the foraminifera from the Montreal clays belong to this species, which also occurs at Beauport, and in equal proportionate abundance living in Gaspé Bay. The specimens all belong to the variety *incerta* of Williamson; and as among many hundreds of specimens I can find none that present the typical characters of the species, and as the general form is also less compressed than in the typical specimens as described and figured by Williamson, I should be inclined to believe this so-called variety in reality a distinct species, were it not for the fact, that, while these curious

* See also paper in Can. Nat. Vol. 2, Fig. 17.

little creatures are almost indefinitely variable, there is a remarkable persistency of certain varieties in particular localities. The modern specimens from Gaspé correspond precisely with their ancient progenitors of the Post-Pliocene clays. The size of the fossil specimens is large for the species; the diameter of some individuals being $\frac{1}{30}$th of an inch.

Localities.—Logan's farm, Montreal; Brick-yards at Tanneries, Montreal; Beauport; also recent in Gaspé Bay.

2. *Nonionina crassula*, Walker.—Among the fossil specimens of the last species, there are many not distinguishable from it in external form, in which I cannot find, either when viewed as opaque or transparent objects, the characteristic septal apertures of Polystomella. These specimens are usually smaller, more hyaline, and smoother than those showing the apertures. If distinct, they must belong to the species above named. I found no individuals of this description among my recent specimens from Gaspé.

3. *Polymorphina lactea* (Figs. 2, 3, also paper in Canad. Nat. vol 2). This is perhaps the second species in relative importance, though much less plentiful than *Polystomella umbilicatula*. The greater number of the specimens belong to the variety "*typica*" of Williamson (Fig. 2). Others appears to be an exaggerated form of the variety "*oblonga*" (Fig. 3), and many others, especially the smaller examples, are of the variety "*communis*." A similar range of varieties exists in the modern specimens from Gaspé. Size $\frac{1}{30}$ to $\frac{1}{50}$.

Localities.—Logan's farm; Tanneries; recent in Gaspé.

Fig. 2. Fig. 3.

4. *Miliolina seminulum* (Lin.)—(For figure, see paper in Can. Nat. Vol. 2, Fig. 18.) In my paper of last year this species was noticed as *Quinqueloculina occidentalis*, Bailey; and I still believe it to be identical with the shell so named; but I presume that it, as well as many other supposed species of the genus *Quinqueloculina* of D'Orbigny, must be included in *Miliolina Seminulum*, as extended by Williamson. This shell is not infrequent in the clays at Montreal, and it also occurs in Gaspé Bay. It approaches very nearly to the typical form of the species, but is usually of small size, not exceeding $\frac{1}{50}$th of an inch in length.

Locality.—Logan's farm.

Fig. 4.

Fig. 5.

5. *Entosolenia globosa* (Fig. 4, 5).—This species is not uncommon in the clay at Montreal. Fig, 21 of my paper of last year is referable to it, as I had not then observed the internal tube, and supposed it in consequence to be an Orbulina. Figs, 4 and 5 show this internal structure. This species is very small, scarcely exceeding $\frac{1}{100}$th of an inch, and is very smooth and translucent.

Locality.—Logan's farm; Tanneries.

Fig. 6. Fig. 7.

6. *Entosolenia costata*, Williamson (Figs. 6, 7; also Fig. 22 in paper of last year.)—This beautiful little shell differs from that last described only in the possession of longitudinal narrow ribs.

Williamson, who had seen only two or three examples, establishes it as a separate species with some doubt; and since in my specimens from the Montreal clays the number and distinctness of the ribs are very variable, I think it probable that this shell is only a variety of *E. globosa*.

Locality as above.

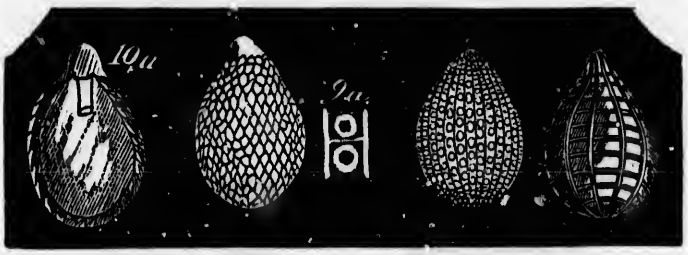

Fig. 10. Fig. 9. Fig. 8.

7. *Entosolenia Squamosa* (Figs. 8, 9, 10).—This, the most elegant of all our Post-Policene foraminifera, presents several beautifully ornamented varieties. In the last species the sides are marked by simple longitudinal ribs. In the simple varieties of this the ribs are crossed by more slender transverse bands. In others the rectangular spaces thus formed appear to have circles inscribed in them. In others the distinction of longitudinal and transverse ribs disappears, and the whole surface becomes covered with a regular hexagonal network of raised lines of various degrees of fineness. I have endeavoured to represent several of these forms in the figures; but there are many intermediate varieties, and my wood-cut representations fall far short of the exquisite beauty of the shells themselves, which appear under the microscope as if worked in pure translucent porcelain. Size $\frac{1}{100}$ to $\frac{1}{60}$.

Parker and Jones regard the three species last described as identical. Williamson also leans to this view; and since in my specimens there is a gradation from those that are smooth to those that are ribbed, and from these to those that are netted, I can scarcely hesitate to adopt the same conclusion, in which case the two last species must be regarded as varieties of *E. globosa*.

Fig. 11.

8. *Biloculina ringens*, D'Orb. (Fig. 11).—I have found only two specimens of this species, and neither revealed much of its real character until mounted as a transparent object. I have figured one of them as it appears in this way; and it well shows the manner in which the successive cells are added, the orifice being alternately at opposite ends of the shell. Size about $\frac{1}{50}$.

Locality.—Tanneries.

All the species of Foraminifera above noticed are found living as well as fossil. Three of them have been obtained by myself from Gaspé Bay, and the others may probably be found there. The species most abundant in the tertiary clays is also that which prevails in Gaspé Bay, and the conditions of life in both are the same. The Gaspé specimens were found in mud, in from 10 to 15 fathoms, and holding *Leda limatula*, *Tellina calcarea*, and *Astarte sulcata*, so that it may be regarded as strictly equivalent to our Montreal Leda clay, in or at the surface of which the Foraminifera chiefly occur. Two species found at Gaspé have not as yet been recognized in the tertiary clays. One is a globular shell, probably *Orbulina Universa*, the other a rough, punctured, yellowish species, probably *Bulimina scabra*.

All the species found in Canadian tertiary clays are widely distributed in the North Atlantic, and some of them still more extensively. *Polymorphina lactea* is found in the British crag,* and *Entosotenia globosa* in Miocene deposits at Petersburgh, U.S.†

* Wood

† Bailey.

They afford little indication of climate. *Miliolina seminulum*, for instance, extending in the present seas from Greenland to Cuba. With respect to depth of water, their indications are probably more precise, though on this subject I can find little reliable information. One fact is certain, that in Gaspé at present, a depth of 10 to 20 fathoms corresponds bathymetrically, in so far as these creatures are concerned, with that represented by the upper layers of the Leda clay, or brick-clay of Montreal. I have obtained, however, at least one indication that there are still lower depths, not represented as yet by the fossils of our tertiary deposits.

I owe to the kindness of Capt. Orlebar, R.N., two small specimens of fine clay, taken up by the sounding-lead from depths of 187 and 196 fathoms, off Mount Camille, near Bic Island, in the River St. Lawrence. On carefully levigating these specimens, I found in them three species of Foraminifera, all distinct from those of the tertiary clays and of Gaspé, and the silicious shields of a number of microscopic plants (*Diatomaceæ*). The Foraminifera I refer to the following species:—

Rotalina turgida, Williamson. (Fig. 20.)
Spiroloculina depressa, D'Orbigny. (Fig. 21.)
Bulimina auriculata. Bailey. (Fig. 22.)

Fig. 20.

Fig. 21

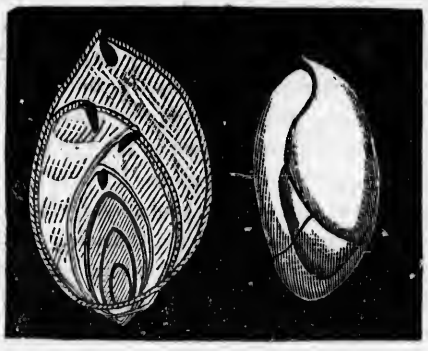

Fig. 22.

The Diatomaceæ associated with these shells include *Coscinodiscus lineatus* and species of *Gallionella*, *Eunotia*, *Cocconeis* and *Achnanthes*, most of them apparently identical with forms figured by Bailey. There are also minute acicular spicula of sponges.

Since the highest points at which raised beaches have been found in Canada scarcely reach an elevation of 80 fathoms above the sea level, we can scarcely expect to find on the present land evidence of depths equal to those represented by these soundings. Their containing distinct species from those in the tertiary clays is, however, an interesting fact, and I figure these as a guide to collectors who may be so fortunate as to find them in a fossil state.

(3.) *Species of Bryozoa.*

From the abundance of the remains of these creatures on stones at the surface of the boulder clay at Beauport, I have no doubt that a number of species might reward a diligent search. My time however at this locality was very limited, and although I brought thence single pebbles with as many as four or five species attached to them, I have no doubt that my collection includes only a small fraction of the species occurring there. The specimens are also in many instances in a defective state of preservation; and as collectors of these objects well know, even in recent specimens it is often very difficult to determine species from the dead cells alone. I am therefore able to name at present only a few species, but these, I trust, may be relied on with some certainty.

1. *Hippothoa catenularia*, Fleming. (Fig. 12.)—This pretty little organism spreads its chains of cells over the tertiary pebbles at Beauport just as it now does in the Gulf of St. Lawrence; and being of a dense and strong texture, is remarkably well preserved. It belongs at present to the Laminarian and Coralline zones, and is found abundantly in Gaspé Bay in nine fathoms.

2. *Hippothoa divaricata*, Lamour. (Fig. 13.)—This smaller and more delicate species is very abundant at Beauport; but from its minuteness and its similarity in color to the grey, weathered pebbles, may easily escape observation. It differs from the

typical form of the species in having the cells united to each other directly, instead of by a slender calcareous thread; but as Johnston* mentions this as sometimes occuring in recent specimens it may be regarded as merely the characteristic of a variety. I have not yet found this species living in the Gulf of St. Lawrence.

Fig. 12.

Fig. 13.

Fig. 14.

3. *Tubulipora flabellaris*, Fabricius. (Fig. 14.)—I refer—with some doubt—to this species the organism represented in fig. 14, which occurs sparingly and not in good preservation on stones at Beauport. Fabricius found this species in Greenland, and it occurs in various parts of the North Atlantic. I have not found it living, but it may be the same with the *T. divisa*, a species closely allied to *flabellaris*, found by Stimpson in the Bay of Fundy.

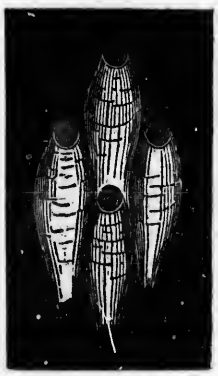

Fig. 15.

Fig. 16.

* British Zoophytes, page 292.

4. *Lepralia hyalina*, Lin. (Fig. 15.)—The organism represented in fig. 15 must, I think, be referred to this species. It is found sparingly on stones at Beauport, often nearly covered with the remains of its ovicapsules. It now lives in the Gulf of St. Lawrence and the Banks of Newfoundland.

5. *Lepralia pertusa*, Johnston. (Fig. 16.)—This species is very abundant at Beauport, and, as usual with it, is very variable. The cells represented in fig. 16 belong to the most regular and beautiful variety, which occurs in a state of preservation quite equal to recent specimens. *L. pertusa* is still one of the most abundant forms on the American coast; and the study of the diverse forms of cells which occur in the same patch, is very instructive in relation to the errors likely to arise from basing specific distinctions in these creatures on minute differences in the forms of the cells.

The two last species appear to the naked eye on the stones of the drift, as flat, roundish, white patches, somewhat roughened, like shagreen; and under a lens of low power disclose the forms of their cells.

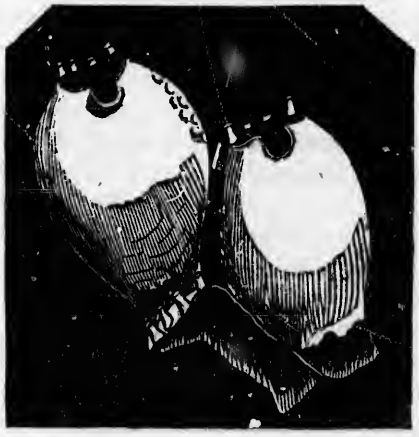

Fig. 17.

7. *Lepralia quadricornuta.* N. S. (Fig. 17.)—This is a large species, the cells being about $\frac{1}{25}$th of an inch in length. It is quite distinct from any species known to me. Its description is

as follows:—Cells arranged alternately, ovate, ventricose, smooth on the greater part of the surface, but toward the lower end finely marked with radiating and transverse lines, and at the margins roughened with scaly projections; aperture narrowed, flattened at the distal margin, and armed with four hollow spines, those at the angles strongest; proximal margin deeply sinuated and projecting.

The specimens occur abundantly in the lowest part of the deposit at Logan's farm, and are arranged in such a manner as to show that they were attached to fronds of algæ which have entirely disappeared. Being imbedded in soft clay, it is much more difficult to secure perfect specimens than in the case of the species attached to stones. From the position of this Lepralia in the deposit, I infer that it lived in very deep water; and it is possible that when we are better acquainted with the deeper parts of the Gulf of St. Lawrence, it may be found there. Having searched in vain for any described species corresponding with it, I propose for it the name of *L. quadricornuta*, founded on its most obvious distinctive character, which is of more importance here than in the case of a recent species, owing to the circumstance that the specimens in the clay usually split in such a manner as to show only the inside of the cells, on which the four horns generally remain sufficiently distinct.

Patches of this Lepralia one inch in length and half an inch in breadth were found at Logan's farm, and the cells were remarkably uniform in size and shape. If found in a living state, its large size and elegant vase-like form will render it one of our finest species. Its nearest allies appear to be *L. ventricosa*, Hassell, *L. trispinosa*, Johnston, and *L. crassispina*, Stimpson.

Before leaving the Bryozoa, it may be well to name the additional species known to me as living in the Gulf of St. Lawrence and likely to occur in the drift:—

Membranipora pilosa, Gaspé, Nova Scotia.
Membranipora, another species, Gaspé.
Flustra Murrayana, Gaspé, Metis, Miss Carey's collection.
Tubulipora patina, Gaspé, Metis, Nova Scotia.
T.——— *penicellata*, Gaspé.

Idmonea Atlantica, Gaspé.
Cellularia neritina, Miss Carey's collection.
Cellularia, another species, Gaspé.

Through the kindness of Andrew Dickson, Esq., I was lately favored with the inspection of a flat stone taken up by the hook of a fisherman on the Banks of Newfoundland, which wonderfully resembles, in its assemblage of species, the stones in the drift at Beauport. It has at one end a group of *Balanus crenatus* of the precise variety so common in the drift; and over various parts of the surface are abundant shells of *Spirorbis sinistrorsa*, with at few of another species not as yet found in the drift. Large portions of the surface are covered with *Lepralia pertusa hyalina*, &c.; and there is also a *Tubulipora* closely resembling that found at *Beauport*. The shell of a dead *Balanus* contained a little fine sand, among which were small and much rubbed specimens of a *Polystomella* or *Nonionina*, and fragments of spines of *Echini*. This stone is indeed almost a precise modern counterpart of those buried in the drift at Beauport; and they, like it, probably lay in the bottom of a sea loaded in spring with boulder-bearing ice.

I had almost omitted to mention that some of the stones from Beauport, with *Balanus*, *Bryozoa*, &c., bear on their surfaces distinct marks of glacial action, in their polish and striation; and that just as in exposed situations in modern seas, their animal tenants have evidently selected the re-entering angles, and least exposed surfaces for their habitations.

II. Fresh-water Shells in the Post-pliocene Deposits.

I have on several occasions found specimens of *Limnea* in the Post-pliocene clays, but always suspected some accidental intermixture. I have been favoured in the past summer, by Andrew Dickson, Esq., with specimens of land and fresh-water shells from the bank of a brook emptying into the Mississippi, a tributary of the Ottawa, two miles below Pakenham Mills, and at an elevation of about 266 feet above Lake St. Peter. They were found in sand and gravel containing *Tellina Grœnlandica*, and which Mr. Dickson thinks is an undisturbed tertiary deposit. The specimens furnished to me afford many internal evidences which would lead me to the same conclusion. The species present are :—

Valvata tricarinata,	*Planorbis parvus,*
Planorbis bicarinata,	*Amnicola porata,*
Planorbis trivolvis,	*Helix striatella ?*

Lymnea elodes ?

As may be seen by reference to the paper by Mr. Billings in the first volume of this journal, all these shells now exist in the Ottawa valley. Proof of their existence there in the Post-pliocene era would be of great interest; and though I am fully aware of the many chances that may cause recent fresh-water shells to be mixed with older deposits, I am strongly inclined to believe that these deposits at Pakenham afford such evidence. Their occurrence is at least deserving of notice, that the attention of geologists may be attracted to the locality.

III. Land Plants.

I am indebted to Andrew Dickson, Esq., for the opportunity of studying a large number of nodules containing plants, collected by him at Green's Creek, on the Ottawa. They contain numerous vegetable fragments, which appear to have been originally distributed over the surface of a tract of clay and covered by similar material, a layer of calcareous nodules subsequently forming along the plane of deposition and imbedding and preserving the remains, which are very little changed, though some of them appear to have been in an advanced state of decomposition before being imbedded. Among them I can recognize leaves or fragments of leaves of the *Populus balsamifera*—which seems to be a very abundant plant at this locality—leaves and stems of grasses, needles of pines, and a moss apparently of the family *Fontinaleæ* or *Hypneæ*.* There is also a well preserved small *dicotyledonous* leaf, which I have not yet been able to identify.

The most curious point in connection with these remains is their association with what seem to be remains of *Algæ*, and with shells of *Leda Portlandica* having the valves cohering. They would thus appear to have been deposited in the sea and in deep water. I observed something of the same kind in Gaspé Bay, where, at the mouth of the North-west river, I found *Leda limatula* living in dark-coloured mud containing vegetable matter, much of it no doubt washed down by streams from the land.

* Sullivant, in a note just received, says it is probably not far from *Hypnum riparium*,

IV. Miscellaneous Fossils.

Ophiocoma.—In my paper of last year I mentioned an organism in a nodule from Ottawa which seemed to be the remains of an ophiuroid star-fish. I have since found similar remains in the Leda clay at the Tanneries, near Montreal. The specimens are entirely disintegrated, but show the internal joints of the rays and also the external plates and spines. From their form I judge that they may have belonged to a small Ophiocoma, not very dissimilar from the *O. bellis* now found in the Gulf of St. Lawrence; but whether identical with that species, or with that found by Sir W. E. Logan at Ottawa, I cannot certainly determine. I figure some of the remains merely to direct the attention of other observers to these curious objects. (Figs. 18, 19.)

Figs. 18 and 19.—*Joints of Ophiocoma, magnified.*

Modiola glandula.—A single valve of this pretty little shell has been found at Logan's farm. It now inhabits deep water in the Gulf of St. Lawrence. I may also mention that I have found perfect specimens of *Modiolaria discors* both at Logan's farm and Beauport, which quite confirm Dr. Gould's identification of my fragment of last year with that species.

Fusus (*Clavatula*) *turricula.*—Specimens of this shell have been found by Mr. R. Ramsay at the Brick-yards at the Tanneries. It occurs extensively in the North Atlantic, and fossil in the British Crag.

Rissoa.—Since the publication of my last paper, Mr. Bell of the Geological Survey, has shewn to me in that collection a *Rissoa* with five distinct revolving bands, separated by a flattish space from the suture. On comparison of this shell with my specimens referred last year to *R. minuta*, I am inclined to think that they are the same, but that the latter were worn, so as to present a smooth surface. It is not unlike *R. obsoleta* of Wood's Crag Mollusca. I have another little shell which closely resembles *Alvania ascaris* of the same author, but it is too incomplete for its certain identification.

Spirorbis spirillum.—This common species is found of small size, attached to pebbles, at Beauport.

V. General Remarks.

In so far as general conclusions in Geology are concerned, the observations of the past year do not in any way conflict with the conclusions stated in my former paper.

The arrangement of the deposits at Logan's farm and Beauport, confirms the subdivision which I have attempted to establish, of an underlying non-fossiliferous boulder clay, a deep-water bed of clay or sand (the Leda clay of Montreal), and overlying shallow-water sands and gravels, the Saxicava sand of my former paper. This arrangement shows a gradual upheaval of the land from its state of depression in the boulder-clay period, corresponding with what has been deduced from similar appearances in the Old World. "The upheaval of the bed of the glacial sea," says Forbes, "was not sudden but gradual. The phenomena so well described by Prof. Forchhammer in his essays on the Danish drift, indicating a conversion of a muddy sea of some depth into one choked up with sand-banks, are, though not universal, equally evident in the British Isles, especially in Ireland and the Isle of Man."*

We now have in all, exclusive of doubtful forms, sixty-three species of Marine Invertebrates from the Post-Pliocene or Pleistocene clays of the St. Lawrence valley. All, except four or five species belonging to the older or deep-water part of the deposit, are known as living shells of the Arctic or Boreal regions of the Atlantic. About half of the species are fossil in the Pleistocene of Great Britain. A majority of the whole are now living in the Gulf of St. Lawrence and on the neighbouring coasts; and I have reason to believe that the dredging operations carried on by the officers of the Geological Survey in the past summer, will enable us to recognize all but a few as living Canadian species. In so far, then, as marine life is concerned, the modern period in this country is connected with that of the boulder clay by an unbroken chain of animal existence. These deposits in Lower Canada afford no indications of the terrestrial fauna; but the remains of *Elephas Primigenius* in beds of similar age in Upper Canada,† show that during the period in question great changes occurred among the animals of the land; and we may hope to find similar evidences in Lower Canada, especially in localities where, as on the Ottawa, the debris of land-plants and land-shells occur in the marine deposits.

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* Memoirs of Geological Survey.

† Reports of Geol. Survey; Lyell's Travels.