

TRANSACTIONS
OF THE
Nova Scotian Institute of Natural Science.

ART. I. — NOVA SCOTIAN GEOLOGY. — DIGBY AND YARMOUTH COUNTIES.—REV. D. HONEYMAN, D. C. L., F. S. A., &c.,
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(Read Nov. 8, 1880.)

INTRODUCTION.

As the investigation of the Geology of the Counties of Digby and Yarmouth is an extension of the work already done in the Counties of King's and Annapolis, I deemed it advisable, as I found it convenient, to take a second look at the fossiliferous rocks lying between Moose River and Bear River.

IRON MINE.

The Rev. Mr. Godfrey and I revisited the Iron Mine of Moose River, sometimes called the New Iron Mine. The ore here is *Magnetyte*. Its fossils, especially the gigantic trilobite *Asaphus ditmarsiae*, and those of the associate strata are considered to be unquestionable evidence of Pre-Devonian and Pre-Upper Silurian and therefore Middle Silurian age. *Vide Transactions, 1878-9-80.* Here, as formerly, I collected fossils, e. g., additional specimens of the Cyathophylloid coral. *Petraia sp?* South of these mines and of the Hessian Line (road) fossiliferous *quartzites* were previously observed, apparently lying next to the Archæan Granites. These are considered to be an extension of fossiliferous

rocks at Bear River, on the north side of the bridge. The latter are seen to be synclinal to the extension of the iron mine strata at Bear River. *Trans. 1879-80.*

GREENLAND.

South of the "Old Mine" (Milner's) the Greenland road branches off the Hessian Line road. Traversing the former we descend and then ascend a ridge having outcropping strata. Here there is abundance of fossils, but the metamorphism and extreme hardness of the rock interfered materially with the collecting of fossils, so that no remarkable forms were secured. These are undoubtedly passage rocks of the Bear River and Moose River sections, already referred to. Crossing the strata of the ridge, we reached Greenland. This Greenland is a settlement evidently overlying granites. The analogy of the Moose River section, the soil and the abounding granite boulders scattered on the fields and on the surface of the ground as far as the eye can reach, are sufficiently convincing. Proceeding westward through the settlement toward Bear River, nothing was observed but granite masses. Turning northward we crossed 1st fossiliferous strata, the extension of Rice Mill strata, Bear River W, or of the Moose River quartzite E, and of Greenland road crossed on the way to Greenland. 2nd, A great and interesting exposure of strata which I noticed in my paper of last session as occurring on both sides of Bear River (Annapolis and Digby). These and the first met on this road are synclinal to the continuation of the New Mines' strata already noticed. The second or upper outcrop produced specimens of *Petraia sp.*, similar to that of the New Mines. These, therefore, may be regarded as of the same age as the *Asaphus ditmarsiae* strata (middle silurian). The latter succeeds the Archæan granites.

BEAR RIVER.

Proceeding up the river (south) on the Annapolis side, we recrossed the fossiliferous strata, already crossed and recrossed, until we came in front of Rice's Mill. Crossing the bridge over to the Digby side of the river, I re-examined the massive quartzose rocks at Rice's Mill but did not succeed in securing any well

marked fossils from them. The rocks are only exposed in a section, being otherwise covered with soil. Their dip is nearly vertical; their strike E. and W. Between Rice's Mill and Bear River village, on the Digby side of the river, the only exposure of strata found is at a ship yard. These, like the strata on the Annapolis side of the river, are of Middle Silurian age.

The next outcrop is on the north side of the village, and of the syncline. Here we have the western extension of the strata of the New Mines, with an intrusive *diorite*. These were particularly noticed in my Paper of last session.—*Trans.* Keeping to the same side of the river and proceeding northward, I did not observe any rock exposures until we came to the hill opposite the great quartzite on the other side of the river. This quartzite is succeeded by slates having fossils, which were considered to be of the same age as *Asaphus ditmarsiae*—*loc. cit.* (middle silurian). The quartzite is not distinguishable from Bogart's quartzite, and might claim the specimen which has the fossils—*Arthrostauros Godfreyi* and *Maclurea sp.* The strata on the hill exposed by several outcrops, may be considered to be a continuation of those on the opposite side just referred to, and, consequently, to be of the same age (Lower Silurian). Still farther on we meet with other outcrops of strata, corresponding with those on the other side, and then come to the Victoria Bridge, Digby road.

I examined the fine section of rocks below the bridge, on the Digby side of the river and towards its mouth. I found the rocks to be quartzites of enormous thickness and diorite of great width. I consider the quartzite to be, like the quartzite already referred to, of Lower Silurian age, and the diorites as intrusive rocks of Devonian age. We found the *diorite* outcropping to a distance of three miles, towards Digby. Another set of strata was observed at our turning point. These also appear at the bridge near Digby. They lie on the north of the *Diorite*.

DIGBY AND YARMOUTH RAILWAY.

JORDAN STATION.

The first appearance of Silurian rocks on the railway occurs near the Jordan station—black shales appear in a small cutting.

NORTH RANGE STATION.

Abundance of quartzite and diorite masses were observed on the sides of the railway. These led me to infer that the quartzites and diorites of Victoria Bridge extend thus far and pass onward.

WEYMOUTH.

About a mile short of the station a cutting of rocks appears. They seem to be quartzites of which there are considerable exposures to the left, which I subsequently examined. Thus far the examination was rather cursory. It was evident that the rocks are an extension of the Moose and Bear River formations. The course of the railway being to a large extent in the general strike of the rocks, only a comparatively small width of the series was crossed, consequently little variety occurred.

From Weymouth onward to Yarmouth I had an excellent opportunity of making a satisfactory examination of any exposures that occur on or near the line of railway. Through the kindness of Mr. Murphy, Government Engineer, and Mr. Murphy, contractor, I made an examination by *trawley*.

Between Weymouth and Church Point we passed through three cuttings of slates and quartzites on three several grades.

METEGHAN STATION.

Here and about a mile beyond are cuttings of slates still belonging to the series which I regard as Middle and Lower Silurian. Succeeding are three and a half miles of obscurity, then we came to a fine cutting, having the rocks bold on either side of the road. This is the familiar quartzite of our Halifax metamorphic rocks. Its associate on the north side is a fine micaceous argillite. The obscure interval occurring between this and the Meteghan slates is disappointing. I had anticipated a more satisfactory state of things in my railway examination. Believing that the granites did not extend thus far westward, I had expected that the railway would reveal some approach to a junction of the two grand series of metamorphic stratified rocks with manifest conformability or unconformability.

I shall revert to this subject.

Proceeding onwards we crossed the county line (Digby and Yarmouth) coming to Salmon River and Lake Annis, without observing anything remarkable. Near Four Mile Lake a cutting showed that we had passed from quartzites into coarse mica schists. Masses show the micaceous character of the underlying rocks. They also show *garnets* and *staurolites*. After this masses of quartz were observed indicating a vein or veins of considerable thickness. At Ohio and Hebron rocks were observed and specimens secured. The rocks are more or less hornblendic. This is their character onward to Yarmouth.

METEGHAN.

On the day following I returned by railway to Meteghan station, for the purpose of investigating the *transition* between the formations already noticed, supposing that there might be a section on the shore which might aid in filling up the gap made by the 3½ miles of obscurity already referred to. Proceeding to Meteghan I crossed a branch of Meteghan River, where bold exposures of the station strata were observed in a position not particularly inviting. Their extension was found near Meteghan Point on the shore, exposed in a manner that left nothing to be desired. On the south side of this point is a cove, Turk's Cove. Here the rocks are seen in great magnificence. There is an outer and an inner band. The one is much harder and more resisting than the other. Of the former the two points of the cove are formed. The north side of the cove has been penetrated by the sea, and a cave has been formed which is said to extend over two hundred feet. This is constantly occupied by the sea. I searched in both bands of rocks for fossils without success. They are highly metamorphic and contain numerous quartz veins. These bands continue exposed along the shore toward Cape St. Mary's, making a rugged coast with numerous coves of character similar to that already described. The same strata were also frequently observed, exposed on the road side. I did not follow the rock exposures on the shore beyond two or three miles. I took a short cut to Cape St. Mary's by following the road to Cape Cove.

The first rock met with of decided character, on the Railway,

after leaving the diorites of North Range, was the grey quartzite which followed the obscurity, on which I am now endeavouring to throw some light. Beyond adding a certain *quota* to the filling up of the gap of rocks, of a like undecided character, the Meteghan section did little additional service. The lithological character of the rocks is so different from that of Moose and Bear River rocks, that the two, when viewed separate, might be regarded as belonging to different series and different periods.

My observations at Moose and Bear Rivers led me to forecast the occurrence of rocks of corresponding age as far south as Cape Cove, on the coast of St. Mary's Bay, and to regard this as their probable termination. My *hypothetical* line, extending S. 40 W. from the end of Moose River section through the corresponding point on Greenland road, Bear River road and Rice's mill to Cape Cove, also indicated the probable southerly position on the Digby and Yarmouth Railway, in the *obscurity* beyond Meteghan station.

When coming near Cape Cove I was agreeably surprised to meet an old acquaintance, the familiar *diorite* of Nictaux, Moose and Bear River. This *diorite* outcropping boldly on the left side of the road, with a very hard quartzite in contact on its south side, is seen to extend in high elevation eastward (toward the line of railway,) about half a mile. Westward in Cape Cove it is seen exposed, but not so compact as in the west, having a somewhat slaty aspect, yet coarsely crystalline. Here it is seen to occupy the *normal position* as at Nictaux, Moose River and Bear River. The quartzite observed on its south side at the road does not appear at the cove. All the strata exposed are on its north side. There are slates and shales of varying colours, fawn, grey and black. The strike of the strata is S. 70 W., N. 70 E., the dip is vertical. This is precisely as at Nictaux and Moose River where strata occur in contact, or approximately so, with *diorite* e. g., Bloomington Road, Nictaux.

The black slates at the extremity of the cove or Cape St. Mary's are elevated and very picturesque. On the shore below the light house milky quartz is scattered profusely, contrasting with the black slaty *debris*. It is evident that the existence of

Cape St. Mary and Meteghan is dependent upon the resisting power of the diorite. It has been an effective breakwater in the past as it is in Cape Cove at the present. Beyond the cove are flats, swamps and meadows. About a mile from the cove the ground becomes elevated, and black slates are seen outcropping containing veins of white quartz. As seen at Z. Deveu's they are not distinguishable from the black slate of Cape St. Mary with milky quartz already referred to. At this time I was not aware of their true character, I supposed that they *corresponded* with the Cape St. Mary's strata, considering that the two formed an anticlinal having the diorite for its centre. Dr. Selwyn seems to consider the Cape St. Mary's slates as corresponding in age with the black slates of Jebogue Point. In regarding them as corresponding with Deveu's black slates, I was unwittingly and indirectly doing as Dr. Selwyn had done, while I was regarding both as occupying the lowest position in the Middle and Lower Silurian series of Moose and Bear River. On the following day I returned to Yarmouth expecting to resume investigations at Cape Cove, with a view to the further filling up of the railway gap, the extension of the quartzite succeeding not yet having made its appearance on the shore.

YARMOUTH.

I have to acknowledge my obligations to the Hon. Loran E. Baker and S. M. Ryerson, Esq., for making arrangements by which I was enabled to make a very satisfactory examination of a considerable extent of the interesting rocks of Yarmouth and Digby in a comparatively short time.

SUNDAY POINT.

This was the first place near Yarmouth that I examined. Mr. Ryerson took me there. The rocks at this point are very interesting, they are Porphyrite and Diorite.

This is the first time that I have seen porphyrites and diorites in our auriferous formation. They have been frequently found in the Archæan and later formations, at Arisaig, the Cobequid Mountains, McLellan's, Sutherland's River Mountains. Diorites

are also of frequent occurrence as noticed in this and preceding papers in our *Middle and Lower Silurian*. They are here pervaded by quartz veins of varying thickness.

They have also abundance of *mica* in their constitution. In this they differ from porphyrites and diorites observed elsewhere. I have no doubt that these, like most others, are igneous rocks, and intrusive if not contemporaneous.

The rocks of Sunday Point have a strike N. E. and S. W. An exposure of these with their numerous veins of quartz N. E. from Sunday Point is a reputed gold field.

We also examined outcrops of black quartzose rocks in the cemetery. These have the same strike, N. E. and S. W.

CRANBERRY HEAD.

Next day Mr. Ryerson took me to this point to see the gold mines. I examined outcrops of hornblendic rocks on the way. Some of these have been already referred to as occurring at Hebron and Ohio, on the line of Railway, the extension of the rocks of the latter running in this direction.

Before reaching the mine we visited the quartz crushing mill which was undergoing repairs. Large quantities of quartz from the mines were there ready for operations. The mines were found to be interesting. The quartz containing the gold did not appear different from what I had seen elsewhere. The containing rock is decidedly different; it is very soft magnesian (?) slate. *Arsenopyrite* is very abundant in crystals. The quartz is singularly free from this mineral, and the gold is rarely visible. I received from the superintendent of the mines four specimens showing gold very distinctly, associated with *Calchopyrite* and *Galenite*.

JEBOGUE POINT.

Mr. Ryerson next took me to this locality, where I found a very interesting series of rocks, beautifully exposed. I observed

1st. The grey quartzites, compact and shaly with quartz veins. These have a strike N. 30° E., S. 30° W., and a high northerly dip.

2nd. A basaltic dyke compact and amygdaloidal. Of this we have a vertical and a horizontal section. On either side of this dyke the strata are tilted and much contorted. The dyke is parted in the middle. On the sides of this parting the rock is amygdaloidal. The amygdals are of quartz. The rock appears to be a dolerite. On either side between the dyke and the strata is a soft tuff. This crystalline rock is unquestionably of igneous origin, and it is plainly intrusive. The rock has much the appearance of a North Mountain (triassic) trap. I have seen no rock like it elsewhere. *Queries*.—When did this eruption occur? It is evidently an occurrence posterior to the metamorphism of the associate strata. Was the eruption in *pre-middle* or *post-carboniferous* time? Did it happen before the formation of the *Arthrostauros Godfreyi* quartzites and the *Asaphus ditmarsiae* iron deposit? Did it occur after the metamorphism of the latter by the *dioritic eruptions*, and prior to the formation of the conglomerates and Chester limestones or other deposits of lower carboniferous age, or after, when the auriferous rock and associate lower carboniferous conglomerates quartz and limestones were brought into their present position?

3rd. Grey argillites with quartz veins large and small.

4th. Black argillites, very pyritous with quartz veins, numerous and occasionally of great thickness.

A black substance like impure graphite occurs in the shaly argillites.

5th. A granitoid hornblendic rock with grey shaly argillite on either side.

Returning to Yarmouth we took a road that led us to the Poor House. Here I examined an imposing outcrop of white quartz which had been operated upon by gold hunters. On either side of the quartz, which is thirty feet thick, are black shaly argillites. It is evidently a continuation of one of the great veins which I have already referred to as occurring in the black argillites of Jebogue Point.

BEAR RIVER.

The Hon. L. E. Baker took me to Bear River on the following

day. I expected to find this a region of peculiar interest. Here we have the county line of Yarmouth and Digby and the junction of the formations which I am now investigating, according to "Map of Acadian Geology," Ed. 1868.

Passing Cranberry Point I observed an inviting outcrop on the road at "John Cann's Farm," the strike was found to be N. 50 E., S. 50 W. We then proceeded to "High Head" in search of a rock section. Reaching the shore at J. Trask's I found a section extending from High Head to Trask's, a distance of about half a mile. It consists of grey quartzites in ledges with alternating shales. The strike at Trask's is S. 69 W., N. 69 E, dip 45° S., 21 E. As far as I could see beyond this section to the north no other outcrop appears.

On the shore at Bear River there is a magnificent exposure of strata. The rocks are quartzites and schists. The strike is S. 69 W., N. 69 E. North side of the wharves and shipyard an outcrop of micaceous quartzite was reached, and a specimen of the rock secured just before it was covered by the tide.

I supposed, at the time, that this might be the lowest rock of the series, as no outcrops of rocks were visible beyond.

LAKE GEORGE.

In Yarmouth Mrs. S. M. Ryerson showed me a quantity of beautiful sand, which was supposed to be *amethystine*. On examination I found the sand to consist of myriads of small garnets, a great proportion of which were perfect crystals—rhombic duodecahedrons. It was said to have come from Lake George. Being anxious to see the deposit and ascertain its origin I requested Mr. Baker to return by Lake George. Taking into account the facts that all the strata observed on and towards the shore had a N. E. and S. W. strike, and that the rocks outcropping on and near the line of railway are extensions of the rocks on the shore, I concluded that the micaceous schists found near Four Mile Lake on the line of railway holding quartz and staurotide, which seemed to belong to a band of considerable width, must be the bed rock of the lake and the source of its garnet sand.

Coming to Lake George I could not find any rocks outcropping. I had therefore to have recourse to stones scattered around and collected into heaps. Among these I found abundance of mica schist stones replete with garnets, generally small like those of the sand that I had seen. Sometimes, however, stones were found having common garnets of large size. One specimen of rock that I picked up is a most beautiful cabinet specimen. In it the garnets are pretty large; one side is light colored and shows the numerous garnets in relief to great advantage; the other side is dark micaceous schist with numerous rubbed garnets.

We called upon Mr. Winter, who is said to be the best informed, relating the place of occurrence of the sand in question. He had a number of barrels filled with the sand, which I examined with interest. According to his account the places on the shore where the sand occurs are increasing in number; none of them are of easy access so that we did not see them.

There can be no doubt that garnetiferous mica schists are the chief rocks of the lake, and that the sand is their debris. The lake is large and is frequently agitated by great storms, so that the *debris* accumulates rapidly. The specific gravity of the garnets is greater than that of the mica or quartz, and therefore the garnets are separated readily from the *debris* and sorted by the action of the water.

Artificial stone has been made with the garnet sand. It is said to be beautiful.

Masses of brownish crypto crystalline quartzite are found scattered about the lake. There are quartz veins in these which are hardly distinguished from the rock. Hornblendic rocks of a peculiar character are also represented by masses. Some of these are very hornblendic, hard and tough; others are hornblendic-micaceous-schists, having the crystals of hornblende singularly arranged in stellar and plumose forms.

On our return to Yarmouth we passed over outcrops of rocks of the railway and harbour.

HARBOUR.

I examined the rocks of the harbour, accompanied b

Cowan of Digby Neck. On the way to the light-house I observed outcrops of strata whose strike is in the direction of Cape Point.

Mr. Cowan informed me that these are exposed in a fine section at the point.

Not having an opportunity of examining the said section when with Mr. Cowan, I made a subsequent attempt with Mr. Johns, of the Yarmouth Bank, but did not succeed owing to rainy weather.

The rocks exposed on the road are hornblendic, being identical with the rock masses met with at Lake George. The light-house band which lies on the south of these is a singular schist. It is hornblendic and micaceous on the north side of the harbour; towards the light-house it becomes light green in colour and homogeneous in appearance. The strike of these is N. 35 E., S. 35 W. These rocks are evidently a continuation of rocks seen outcropping toward the line of railway. At the head of the harbour beside the railway station I examined a slaty rock which is soft and fine grained. This is an outcrop of the harbour strata. Specimens of slaty rock, having hornblende beautifully plumose, were brought to me when I was on the point of leaving. Masses pointed out to me as the rocks that produced the specimens, were seen to abound in similar hornblendic figures. These are evidently derived from the Yarmouth underlying strata.

BEAVER RIVER TO CAPE COVE.

Uniting Church's maps of Yarmouth and Digby Counties, I found that there were several miles intervening between Beaver River and Cape Cove which I had not examined; this was by no means satisfactory. Mr. Johns readily offered to aid me in this work. Considering it advisable to resume my former investigations where I had discontinued them, we made direct for Z. Deveu's at Cape Cove. Following the strike of the black argillites, with quartz veins exposed at Deveu's, towards the shore, we found a great section extending southward toward a distant point. Before reaching the point the colour changed from black to grey. I was at once convinced that I had misunderstood the character of Deveu's strata in regarding them as

corresponding with Cape St. Mary's black strata, and as forming an anticline with the latter.

I have before shewed that the strike of the Cape St. Mary black argillites is S. 70 W., N. 70 E., and the dip vertical. The strike of Deveu's argillites, as observed on the shore, is S. 50 W., N. 50 E., and their dip 45° S., 40 W. The latter are very pyritous, cubical crystals occupying the lines of bedding and making beautifully brilliant lines in the sunshine. This is not a characteristic of the black argillites of Cape St. Mary. I have noticed the occurrence of milky quartz in the latter. The pyritous argillites are replete with quartz veins. The black pyritous argillites of Jebogue Point with quartz veins are more nearly analogous. The division between the two great series of rocks is the *diorite* already noticed as intervening between the Cape Cove strata and Deveu's strata. We have thus a division corresponding with the Bloomington Road division at Nictaux, and at Gordon's on the King's County side of Annapolis and King's County line. *Transactions* 1877-8.

While we note this point of resemblance I would also note the following points of difference: At Bloomington Road, Nictaux, the diorite is seen to occupy nearly the entire space between the two formations, there being only a very narrow interval of obscurity between the *diorite* which immediately underlies the fossiliferous strata of the ferriferous on the north and the gneissoid strata at Wheelock's, of the auriferous formation, on the south. At Gordon's, near the New Canaan Road on the King's County side of the county line, the *diorite* has corresponding fossiliferous strata on the north, and only a short distance of obscurity between the diorite and the singularly plicated *gneissoid strata*, of the other formation on the south. In the locality under examination the *diorite* is in immediate contact with the lowest strata of the ferriferous formation in Cape Cove, while there is an obscure interval of one mile between the *diorite* and Deveu's black argillites of the auriferous formation.

CARBONIFEROUS.

There is yet another point of interest to which I would direct

attention. When I was examining the interval between the cove rocks and the black pyritous argillites, I observed a singular section which occupies a large part of the obscure interval; on the north side of this, next the flats of Cape Cove, the soil is underlaid by a coarse ferruginous gravel. It then becomes more compact, cemented by iron oxide it becomes conglomerate, grit and breccia, arranged in *beach form*. It is then seen overlying unconformably the black pyritous argillites at a considerable height, and with a northerly dip. The greater part of these is derived from the black argillite which supplies rock material and iron cement. A small stream of water flows down the face of the highest part of the section—*chalybeate water*. I recognised the strata of the section as a counterpart of the carboniferous, auriferous, conglomerates and breccias of Gay's River, Colchester County. This section fills up about a third of the interval. How far this formation extends inland cannot be ascertained except by *sinking* or *boring*.

We have thus three formations meeting or nearly so in this locality, which is distant 5 miles from Beaver River and county line. I have thus added to the geological formations of Digby County a carboniferous formation, and 5 miles of auriferous formation.

SALMON RIVER.

Returning we observed an outcrop of grey slates on the road side, about opposite the point on the shore referred to when examining the sections of black slates. Near Salmon River we directed our course to the shore for the purpose of examining the southern extension of the preceding section. Here I was gratified by finding great ledges of rocks, solid grey quartzites having pyrite in large crystals, the exact counterpart of the Bedford Basin quartzites, Halifax County. Towards the point referred to, the quartzites become less solid and are succeeded by grey argillites. These in turn are succeeded by Deveu's black argillites. Considering the grey quartzites with the argillites of the railway section, to be an extension of the shore section grey quartzites and argillites, south of the point south of Cape Cove, it seems to require the grey argillites extending northward beyond the

said point Deveu's black pyritous argillites, the rocks hid in the interval between Deveu's and Cape Cove, and Cape Cove and Cape St. Mary's rocks to a distance of $\frac{3}{4}$ of a mile north of Cape Cove, to fill up the obscure gap on the line of railway. I also examined strata outcropping to the south of the grey quartzites. These are quartzites with interbedded argillites. At the last of these outcrops great masses of basalts were examined. At a distance these appeared as solid. They are only masses transported from Digby Neck, Long Island or Briar Island.

CRANBERRY HEAD.

When I previously visited Cranberry Head gold mines, I was just beginning to make acquaintance with the rocks of the region, and was somewhat perplexed with their singular characteristics. I now wished to examine the gold bearing strata in the light of experience since acquired. Mr. Ryerson readily consented to re-conduct me to the locality.

With a view to connect my observations with those made on the rocks on the north, we went beyond the mines until we reached the end of the outcrops of the Mines' section on the shore, about a mile distant. The first rocks are grey quartzites with interbedded soft argillites. The position, alternation, exposure and general appearance led me to expect *fossils* in them. I soon found a mass of quartzite detached from the strata of the ledges, having on it forms whose resemblance to *stromatopora* is unmistakable. Considering it as interesting I determined to secure it. The size of the stone, the want of assistance and proper tools—Mr. Ryerson had left me to meet at the mines—were difficulties in the way. However, by patience, perseverance and a good hammer, I succeeded in making a portable specimen. The picture in "Geology of Canada, 1866, page 49," might pass for a figure of it, if partly obscured on the top. It is banded; two of the bands amastomose, a large part of the top is obscured as if rubbed or pressed by the overlying rock, outlines of the sub-parallel bands being preserved. The specimen figured by Sir William Logan was compared with *stromatopora rugosa*. It is now known as the *Eozoon canadense*. Our speci-

men strikingly resembles a museum specimen of *stromatopora* *sp.*, from the Niagara limestones of *Baie de Chaleurs*, New Brunswick. The specimen is not a cast. The organism, if it was one, has been replaced by quartzose material so as to preserve the form. The specimen may only represent a certain rock structure; if so it illustrates the possibility of a striking imitation of organic structure being only rock structure. I give the specimen the name *Stromatoporoid, sp.*

Several of the grey quartzite strata which are overlaid by the shaly argillites have had their faces partially exposed. These look so like fossiliferous rocks that I was led to search in them for fossils. I succeeded in finding in one of the quartzite strata peculiar forms which were certainly made by organisms. In shape they are *discoid* and *elliptical*. One specimen which I succeeded in securing is oval with an interior depression. The only thing that can compare with them are roots of *Buthotrephis*—Hall's Palaeontology of New York, vol. 2, plates 7, fig's 2, 6, 10, fig's 9, 10. It is certainly interesting to find such forms in proximity to gold producing *strata*. Proceeding I found next an enormous exposure of crystalline rocks—*diorites*. These are of a character different from the *diorites* of Cape Cove. Like the porphyrite of Sunday Point the *diorite* here is very *micaceous*. Crossing this enormous outcrop of diorites I came to another great exposure of grey quartzites, and reached the Cream-Pot with the auriferous quartz of the gold mine.

CREAM-POT.

Is so called as the sea is said, in violent storms, to fill the recess with froth. This pot is geologically interesting. The strata within succeeding the quartzite last described as reaching to the point, has some resemblance to soap-stone; they are light grey, soft and unctuous argillites. In these the auriferous quartz vein is found. This is beautifully exposed on the side of the Cream-Pot, and can be studied to great advantage. This vein is very peculiar, it swells out and narrows in turns, being in the one case often of considerable thickness, on the other very narrow. The great softness of the rock which includes it

renders mining easy and comparatively inexpensive. I have on my former visit noticed the stratum underlying with its *arsenopyrite* crystals. Large quantities of quartz were ready for the mill.

From this we went to

JEGOGGIN POINT.

Between this and the mines no rock exposures were observed. At Jegoggin is found an interesting exposure. The rocks are chiefly micaceous schists. In these are quartz veins, large and small. One of the former is 10 feet thick. Interbedded are lenticular masses of hornblendic rock with crystals arranged in stellar form. Some of these schists are full of small garnets. This series of garnetiferous and hornblendic schists is evidently a section of the schists of Lake George and the line of railway. The strike of the strata is N. 50 E., S. 50 W. We did not take time to collect the sand among the rocks. It must be garnet sand.

I have thus, in a somewhat irregular manner, examined every important outcrop of rocks from Jebogue Point on the south to Meteghan Point on the north. I would now arrange the several outcrops in the form of a general section, thus:

1. Jebogue Point.
2. Sunday Point.
3. Town of Yarmouth.
4. Lighthouse Point.
5. West Point.
6. Jegoggin Point.
7. Cranberry Head.
8. Red Head.
9. Beaver River (County Line).
10. Salmon River to Cape Cove.
11. Meteghan.

Boundary Line of the two metamorphic series, auriferous and fossiliferous, in the Counties of Yarmouth, Digby and Annapolis,

I begin at Cape Cove, making the extensive *diorite* with quartzite the starting point. Passing on to the line of railway

we have a point in the line $2\frac{1}{4}$ miles north of the grey quartzite and argillite cutting. Following our *hypothetical line* to Bear River N. 40 E., we have the approximate boundary south of the village and Rice's mill. From Bear River to Moose River it lies between the granites and fossiliferous quartzites. It then follows the granite line from Moose River to Beale's Lake, and the Digby and Annapolis shore road, 6 miles from Annapolis. It follows the same line to Annapolis River, Paradise River and Lawrencetown. It passes south to the diorites which are on the south of the westward continuation of the Nictaux fossiliferous strata. Touching Nictaux it comes between the diorites, fossiliferous strata and the granites on the Lawrencetown and Albany road. At the back (S.) of Cleveland Mountain it lies between the granite and the overlying magnetite and fossiliferous strata. On the Albany road it lies between the gneissoid and the magnetite strata on the Nictaux and Albany road. It passes on to the division between the diorite and gneissoid rocks on the Bloomington Road. It then comes between the fossiliferous and quartzite and gneissoid rocks at Wheelock's, south of the New Canaan road, and then between the diorites and contorted gneissoid strata at Gordon's, south of the same road and east of the Annapolis and King's County line.

CORRELATION.

In *Acadian Geology*, Ed. 1855, pages 346-7, the following occurs regarding the age of the "Metamorphic district of the Atlantic Coast": "Hitherto each successive formation has been proved to be older than that which preceded it, by the evidence of direct contact, in such a way that the older could be seen to underlie the newer." Here we lose this chain of evidence. I have found no section in which the Devonian or Upper Silurian rocks, described in the last chapter, could be seen to rest on those now described. Yet I believe the group of rocks now under consideration to be the older of the two for the following reasons. On the St. Mary's River, fragments of slate and quartz rock from this formation are found in the lower carboniferous conglomerate, proving that these rocks were metamorphosed before

the commencement of the Carboniferous period. They must therefore belong at least to the Devonian group. They differ, however, so materially from rocks of that age that they cannot be assigned to it with any probability. We must therefore go back at least to the Silurian period for the time of their deposition; and possibly they may belong to that still older or Azoic series which has been recognized in Canada. Farther, that while there is evidence that much of the igneous rock of the Devonian hills was erupted during the carboniferous period, there is no evidence whatever that any igneous action occurred within the granite group as late as the commencement of that period, consequently the igneous as well as the stratified rocks of the present group are older than the last described (Devonian or Upper Silurian rocks).

In a paper which I read before the Geological Society, "On the Gold Fields of Nova Scotia," Journal 1862, I was led to infer the Lower Silurian age of the stratified rocks of the Gold Fields, from the consideration that they differed so much from Devonian, Upper and Middle Silurian rocks, that they could not be regarded as any of these, and as they could not be newer, therefore they were probably Lower Silurian metamorphic.

In the discussion that followed the reading of this paper, Sir William Logan maintained the opinion that the rocks in question were Devonian metamorphic. Sir R. I. Murchison at the same time, on the ground that gold had been discovered in quantity in our gold fields, considered that the opinion which I maintained was the correct one.

Subsequently Dr. Selwyn came to the conclusion that the said rocks are of Cambrian age, on certain considerations, particularly as he had discovered the Cambrian fossil *Eophyton* in the rocks of the Lunenburg Ovens. I had come to entertain the same view, i. e., to consider the formation of the rocks to be of Cambrian age, and to refer their metamorphism to Lower Silurian time, and to adopt the term Cambro-Silurian (Lower) as expressive of the age of the rocks metamorphosed, thus referring the age of the gold deposits to the Lower Silurian period. The term *Cambrian*, as here used, is, as understood by H. M. Geolo-

gical Survey of Great Britain, being applied to the formation next below the *Lower Silurian*. I make this explanation as the term Cambrian is now sometimes used differently.

The Devonian and Upper Silurian of Nictaux, according to "Acadian Geology," was transformed into Middle and Upper Silurian; and the Devonian granites were observed, at the back of Cleveland Mountain, at a point in the above described boundary line, *in contact* with Middle Silurian strata, without any metamorphism of the latter as the result of the contact. This indicates that the granite existed before the formation of the Middle Silurian strata. At some considerable distance south of the boundary line, at the Bloomington Road, granite is seen including fragments of the associated garnetiferous rocks, showing that the latter were formed and consolidated before the granite was *prepared* to enclose the gneissoid fragments. It was inferred that this condition was induced in the *pre Middle* and Lower Silurian, or *pre Silurian* period, (Cambrian) the gneissoid rocks being referred to *early Lower Silurian* or Cambrian time.—*Transactions* 1877-8.

At Moose River the new mines, considered by "Acadian Geology" to be of the same age as the iron deposits of Nictaux, produced the giant trilobite *Asaphus ditmarsiae* of a Lower and Middle Silurian race. The Bear River strata corresponding on the south side of the syncline have produced evidence of like age with the iron deposits. The underlying quartzites with fossils which intervene between the preceding and Greenland granites indicate a thickness too great to be included in any Middle Silurian series. I have run the boundary line between these and the granites.

The highly metamorphic quartzite specimen with a vein of quartz having the singular organism *Arthrostauros godfreyi* and a cast of *Moelurea*, described in *Trans.* 1878-80, indicates that three great bands of quartzite on the north side of the *magnetyte* strata may be fossiliferous. The specimen *might* be derived from any of the three, although I assigned it to Bogart's quartzite, which occupies a position relative to the *Asaphus magnetyte*, like that which Rice's mill quartzite and continuation

bears to Middle Silurian series on the south side of the syncline. These quartzites may all be regarded as of Lower Silurian age, probably Calciferous, as *Maclurea* seems to indicate. This would leave the Potsdam period for *metamorphism*, and the Cambrian and Archæan for *formation*. In this way I regard the Auriferous series as Archæo-Cambro-Silurian (Lower).

ARTICLE II.—NOVA SCOTIAN FUNGI.—By J. SOMERS, M. D.

(Read Dec. 10, 1880.)

THE following additions to the list of Fungi published in vol. V., part 2nd, Transactions of the Institute, 1879-80, have been collected during the past season; the greater number are from the vicinity of Halifax, the remainder are specimens principally Polyporei, kindly sent to me by A. H. McKay, Esq., of Pictou; of the latter there are several which I have not yet identified as growing here. Allowing for errors in diagnosis not inseparable from the study of a class of vegetables of which we lack a good American descriptive text book, we are compelled to depend almost solely upon Cook, no mean authority 'tis true, and comprehensive also. Yet one finds many species that depart from the characters of those described by Cook under their common genera. It will not therefore be surprising that we may find it necessary to make corrections in a future revision of the list.

Order Agaricini.

Sub-Gen. Amanita.

1. Agaricus (Amanita) spissus, *Fr.*, clammy Amanita, under Larch, Willow Park, Sept., 1880.

Sub-Gen. Tricholoma, *Fr.*

2. A. (Tricholoma) sejunctus, *Sow.*, N. W. A. woods, Aug. and Sept., 1880.

Sub-Gen. Clitocybe, *Fr.*

3. A. (Clitocybe) candicans, *Fr.*, Park woods, Nov. 1880.
4. A. (Clitocybe) opacus, *With* " "
5. A. (Clitocybe) fumosus, *P* " "