

TRANSACTIONS  
OF THE  
*Nova Scotian Institute of Natural Science.*

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ART. I. RECORD OF OBSERVATIONS ON NOVA SCOTIAN GEOLOGY,  
SINCE 1855. BY REV. D. HONEYMAN, D. C. L.,  
F. G. S., &c., *Director of the Provincial Museum.*

(Read Nov. 14, 1870.)

I NOW purpose to record the most important observations made by me since the year 1855. This is the date of the publication of the first edition of Dawson's *Acadian Geology*. To this classic work and the friendship and suggestions of its distinguished author, I am indebted for an introduction to the practical study of Nova Scotian Geology. I commenced by directing attention to the Geology of Arisaig, a locality and a township in the county of Antigonish. Antigonish was the place of my residence. I made the rocks of Arisaig a special study for several years. I have examined them with the greatest minuteness. The position and appearance of its rocks are familiar as the objects in my parlour; their fauna are my intimate acquaintances.

In my first communication "On the Geology of Arisaig," read before the Nova Scotia Literary and Scientific Society (the short-lived predecessor of this Institution), I shewed from the character of a large collection of fossils made in what was then considered to be the upper rocks of the Arisaig series, and what are now designated the *Upper Arisaig* (vide *Acadian Geology* last edition) that the rocks are not Devonian as was then supposed, but the equivalents of the Upper Ludlow of England, and therefore Upper Silurian. While my paper was in the press Dr. Dawson informed me by letter, that he considered the rocks in question as probably the equivalents of the Lower Helderberg of the United States, and therefore Upper Silurian. Prof. Hall subsequently, and afterward

Mr. Salter, on examining my collections in the Exhibition of 1862, confirmed this opinion, so that this is now an article in the Nova Scotian Geological Creed.

Prof. Hall and Dr. Dawson then distinguished a lower member of the same series. One of the characteristic fossils of this member is *Graptolithus Clintonensis*; it is therefore considered to be the equivalent of the Clinton of the United States or Middle Silurian. This is designated by Dr. Dawson (vide *Acadian Geology* last ed.) the *Lower Arisaig*. I found in Arisaig rocks, intermediate between these two members, strata having a distinct fauna, *i. e.*, different from those of the equivalents of the Upper Ludlow or Lower Helderberg and the Clinton.

Mr. Salter on examining my collections pronounced them to be Aymestry limestone fossils. This band may therefore be considered as the probable equivalent of the Niagara Limestone. At Doctor's Brook of Arisaig, and in the township of Arisaig, are shales which appear lithologically distinct from the Clinton or Lower Arisaig of Dawson, and were supposed to be non-fossiliferous. In them I found fossils which however did not appear to be characteristic of distinctive. They were considered to be lower than the Clinton or Arisaig, as undoubtedly the strata were lower in position, and that was all that could be said about them. In the meantime I discovered a band of fossiliferous rocks to the east of Lochaber Lake in the county of Antigonishe. In the upper part of the band or those on the margin of the Lake, I found characteristic fossils of upper Arisaig, *e. g.* *Chonetes Nova Scotica*, Hall. I found many others of the same age, but not *in situ*, *e. g.* *Dalmania Logani*, *Crania Acadiensis*. Farther back I found strata with casts of *Petraia Forresteri* and of *Trumpet shaped Cornulites*, (Salter thus characterised them,) which evidently occupied stratigraphically a lower position than the upper Arisaig, although the fossils were by some supposed to be Devonian. Mr. Salter considered the fossils to be equivalents of the May Hill sandstone. Subsequently I found Aymestry Limestone fossils in the same locality, showing that the Middle Arisaig also existed here. I also, about the same time, discovered another fossiliferous locality in Merigomish, County of Pictou, where branches of French River intersect the New Glasgow

Road. I found strata with *Graptolithus Clintonenses* and other Graptolites, Trilobites, Strophomena, Orthis, &c. In the drift near Sutherland's River I found abundance of upper Arisaig fossils, shewing the existence of upper Arisaig strata in this quarter. While making these discoveries I had also been developing the Silurian of Springville, East River, Pictou. Having occasion to visit this place annually I had become somewhat familiar with its prominent features. It was, however, at the time of the Prince of Wales' visit to Nova Scotia that I made decided progress in the investigation of the details of the locality. I then made a special visit to Springville with a view to a particular investigation.

My worthy mare Jess, my associate in my distant Geological rambles, apparently resolving that I should keep to work, took a ramble herself, and left me for a month to pursue my geological investigations alone. I then discovered an interesting fauna in the upper part of the series generically and specifically identical with the Upper Arisaig. These were found immediately underlying the carboniferous at McLean's and MacIntosh's. I found as at Arisaig, *Ascoceras*, *Orthoceras*, *Theca*, *Bellerophon*, different species, *Murchisonia*, *Avicula Honeymani*, abundant, *Modiolopsis*, *Clidophorus*, *Spirifer subsulcatus*, *Chonetes Nova Scotica*, *Crania Aca-diensis*, *Rhynchonella*, various, *Homalonotus Dawsoni*, *Dalmania Logani*, *Prætas Stokesi*, *Calymene*, *Leperditia*, *Beyrichia*, *Favosites*. One prominent stratum shewed exactly the same association of organisms as at Arisaig, viz: *Homalonotus Dawsoni*, in abundance, with abundance of *Spirifer subsulcatus*, *Avicula*, *Honeymani*, and *Cornulites*. The only obvious distinction is, that the East River stratum shews a higher degree of metamorphism than the stratum at Arisaig. At the North of the late Rev. Angus McGillivray's I found the Arisaig Niagara equivalent fossils. This ridge extends up the river about a mile. The same farther south produced a large *Orthoceras*, *Strophomena profunda*, *Spirifer Crispus*, *Atrypa reticularis*, *Rhynchonella didyma*, *Rhynchonella varia*, *Calymene* and *Homalonotus*, of species as in the same horizon at Arisaig. I also found a lower band in a mountain in the rear with singular *Discina*, *Lingula* and *Homalonotus*, different from these of the higher members. This appeared to be of Lower Arisaig age, *Dawson*.

I found in Lime Brook a cast of *Petraia* such as at Lochaber, not *in situ*, shewing the existence of lower Lochaber strata in this locality. At the same time I found in the shales and limestones of lower carboniferous age below Grant's Factory, East Branch East River, teeth of *Cochliodus* and *Bellerophon decussatus*, according to Salter. This was the first discovery of *Bellerophon*, in the lower carboniferous limestones of Nova Scotia.

While making the observations that I have recorded, I discovered teeth of *Diplodus acinaces*, *Dawson*, at least cotemporaneous with the discovery by Mr. Poole at the coal mine near New Glasgow, at the side of the road to Antigonishe. I described them in the first vol. of the *Journal of Education* as reptilian. I found a large tooth of *Rhizodus* at the Joggins, and discovered and measured the carboniferous section on the shore north of Mabou Harbor.

I may mention still farther that I found Lochaber *Petraia* in boulders in the bed of French River, below the Presbyterian Church, shewing the existence of Lochaber *Petraia* strata in this region, and also *Petraia* and *Lingala in situ* in strata on the main road in the Marshy Hope on the Pictou and Antigonishe county line, and at MacDougall's to the east of it, *i. e.* nearly *due south* of Arisaig. About the same time I discovered part of the singular *Lingala* bed near Barney's River.

These observations recorded are the more prominent results of *amateur* work, through which was accumulated the greater part of these collections which interested Murchison, Philips, Bigsby, Salter, Barrande, DeVerneuil, &c., and received Prize Medals in the Exhibitions of London, 1862, Dublin, 1865, and Paris, 1867. In August, 1861, I was engaged by the Nova Scotia Commission for the London Exhibition of 1862, to make a representation of the Geology and mineral resources of Nova Scotia. In prosecuting this work I visited Cape Breton and added to the Geological Map the Gypsums of West Bay in the vicinity of the Rev. Murdoch Stewart's, a beautiful carboniferous section with abundance of regularly formed clay ironstone septaria, which attracted some attention at the London Exhibition. This is situated in a brook a few miles toward St. Peter's Canal. I sailed over the Bay and

found the so-called Marble Mountain, which has lately been brought into prominent notice by the enterprise of Mr. Brown. I visited Grand River, and found lower carboniferous limestones and a bed of wad or bog manganese, which had been supposed to be coal. I crossed over to Red Islands and collected a number of fossils. The most remarkable of them is a recurved *Conularia*. At Big Baddeck I found a mountain to consist of granite where I had expected to find syenite or greenstone, which led me subsequently to maintain that the Middle River or Wagamatcook auriferous strata were of the same age as the Nova Scotian strata, or Lower Silurian, and not Devonian as some Geologists maintained. I found marble at the head of Whycocomagh Lake, and the little carpolite shortly after described by Dr. Dawson in the Transactions of the Geological Society as *Trigonocarpum Hookeri*. I found this in a piece of sandstone on the shores of Port Hood. I returned to Nova Scotia and was directed by the Commission to give some attention to the Geology of the Gold Fields. I accordingly made an examination of the undeveloped Waverley barrel quartz. I examined the section of rocks on the Windsor and Truro lines of Railway, but not having time to make a detailed examination, my observations were necessarily crude. I communicated a paper on the subject to the Geological Society. In this paper I maintained the same view in regard to the Lower Silurian age of the gold fields as Dr. Dawson had done in his *Acadian Geology*. I may mention that in the discussion that took place in the Society on the reading of that paper, there was a difference of opinion expressed in regard to the age of the Gold Fields. Sir W. Logan impugned my views, maintaining that the rocks were *Devonian*. Sir Rodrick Murchison on the contrary, supported the views that I maintained. I found subsequently that my observations were too hastily made to be altogether accurate. The description of the field itself seems accurate enough, and the succession of the rocks between Lakelands and Windsor, but the order of rocks from Lakelands to Waverley, and the supposed connection of the rocks and the line with the Waverley Gold Field, was altogether imaginary.

After my return from the Exhibition, in the Autumn of 1863,

I proceeded to examine the rocks of Arisaig with the aid of the new light furnished by Mr. Salter's report, and the suggestions of other eminent British and Continental Geologists and Palæontologists. I pitched my tent among the rocks and remained among them for nearly three months. I investigated thoroughly the nature and relations of the different parts of the series, studied thoroughly its palæontology, added materially to my collections of its fauna, and endeavoured to ascertain the range of the several families, genera, and species, in time.

I communicated the results to the Geological Society in a paper with map and sections, to be found in the *Journal* of 1864. It is with some satisfaction that I have now to add that after the lapse of seven years and after having made at least one other thorough examination of the district, I still regard this paper as a reliable handbook with which to examine Arisaig. I may have something to add to the observations then recorded, but very little to correct. At that time I discovered a bed of Graptolites at Doctor's Brook, in the black shales underlying the Clinton strata of Arisaig. These Graptolites include various diprionidean forms which appear more to resemble the Hudson River Graptolites than the Clinton. I extended these shales to McDonald's cove to the westward, where I found Cone-in-cone concretions and *Lingula* in nodules like my Barney's River *Lingula* bed, and thence to Arisaig cove to the south of the pier and the north-east of the strata, with Graptolites *Clintonensis*. I did not then find in the band an extensive fauna, and was led to infer that the conditions under which the shales were deposited were not favorable to animal existence.

This is an inference that I have since been led to modify. At this time I discovered the noble Cephalopoda of Middle Arisaig, or the Niagara limestone equivalent, and I also discovered at Doctor's Brook the equivalent of the Lochaber *Petraia* strata. By this discovery I was enabled to ascertain the exact position of those strata in the system, to make a larger collection of fossils than it was possible to make at Lochaber or Marshy Hope, and to ascertain the mode and order of their occurrence. In my paper I styled this **A Arisaig—Doctor's Brook, McDonald's cove and to the S. of the Frenchman's barn (rock)**. I also found connected with this,

another band (metamorphic) which I then supposed to be a part of the same but altered. I am now, however, disposed to separate them. I will return to this point again.

In the summer of 1864, I was engaged by the Government to make a preliminary Geological survey. I then ascertained the extent and distribution of the Silurian fossiliferous strata at Lochaber and the strata which appear to be succeeding these, which I am disposed to consider as Middle Silurian. I also extended the Lingula bed or the equivalent of the Doctor's Brook shales at Barney's River, extending it to the Middle branch. I also found the Lochaber Petraia rocks underlying the shales containing this bed and forming the side of the mountain range which extends to the east and west of the outcrop discovered, onward as I believe on the one side and the other to Marshy Hope and French River, main branch. Here the fossils appear to be as various and numerous as on the Arisaig shore. At the western entrance to the Marshy Hope with conglomerate in enormous mass intervening between it and the extension of the Lochaber equivalent just referred to, I found an outcrop of similar strata, which appear to be a continuation of those already referred to as occurring in Marshy Hope near the County line. I also directed attention to the east branch of East River, Pictou, and determined the Geological position of the bed of Iron ore there.

In 1866 I communicated to the Institute a paper on the Geology of Antigonish, which contains an account of what I had done in that County up to the time when it was written, and the opinions entertained in connection with the facts ascertained, *vide* paper in vol. I, part 4. I also made an examination of the Geology of the Londonderry Mines, and of the Gay's River Gold Field, *vide* Transactions of Institute, vol. I, part 1. In the Spring of 1868, I was engaged by Sir W. Logan in connection with the Canadian survey. The work prescribed to me was the collection of a suite of specimens from the Arisaig rocks, and the tracing of these rocks onward to the Cobequid Mountains.

In the performance of this work I was fortunate to make some interesting discoveries, one of which has excited some attention and discussion.

First of all I found in the section of Doctor's Brook shale in the

Arisaig cove, all the organisms that I found originally at Doctor's Brook in great number and in a better state of preservation, with corals of species different from any heretofore found in the Nova Scotian rocks, abundance of crinoids and trizobites of genera Phacops, and Calymene, in fine preservation, and Graptolites. This discovery shewed that the strata which I had before described as poor in fossils was on the contrary rather rich, and that the circumstances under which these shales originated were favorable to the existence of animal life.

In the succeeding strata or the Lower Arisaig of Dawson or Clinton equivalent, I found two specimens of Conularia. I had found the same organism in the same horizon at French River. These are the only instances in which this pteropod has been found in a position lower than the lower carboniferous in Nova Scotia. I would here observe that Dana in his list of foreign Silurian fossils not yet met with in America, specifies the *Grammysia cingulata*. By referring to my catalogue of the fossils found in the Arisaig Clinton, it will be there observed. Salter recognized it in my collection of the London Exhibition of 1862. I also succeeded in extending the Lower Arisaig farther to the east of Doctor's Brook, *i. e.* to the mouth of McNeil's brook, any farther extension of these in this direction must pass into the Strait of Northumberland.

In the beautiful section of the Arisaig rocks on the shore, a little to the east of McAra's Brook, there appears a set of red strata dipping in a different direction from the variegated strata or Lower Helderberg. As far as I can ascertain this red band of argillites is non-fossiliferous. I found these strata dipping regularly in McAra's Brook and beyond it, and therefore of considerable thickness. They are also found in McAdams' Brook to the east of McAras' Brook. They are certainly not Lower Helderberg and may therefore be Devonian. I would name them the McAra's Brook strata. Upon these the Lower Carboniferous conglomerates lie unconformably—the line of junction being behind a mass of amygdaloid. In my paper on Arisaig, I designated the Doctor's Brook Graptolite, and Lingula Shales B, and Dawson's Lower Arisaig B with an *accent*. There is a marked difference between the two sets of strata in structure. At the mouth of Arisaig



Brook is their place of meeting, and I thought to make this also the point of geological separation, but fortunately I found a nodule with a distinct Graptolithus Clintonensis on the shaley side of the line; so if this is to be regarded as a distinctive Fossil, Doctor's Brook shale is also a lower part of Lower Arisaig, and is also Clinton. The Petraia slates at Doctor's Brook are lithologically and palæontologically distinct from the shales. They were considered by Salter to be the equivalents of the May Hill sandstone of Great Britain. There is every probability that they are the equivalents of the Medina sandstone of the United States. Underlying these is a metamorphic band—until lately I have regarded this as a portion of what I have designated the Medina sandstone equivalent. I now regard it as the equivalent of the Oneida conglomerate, U. S. This includes the red Jaspideous rock of the Arisaig Pier and the Frenchman's Barn (rock) a considerable mass of rocks at Doctor's Brook, and similar rocks to the west of McNeil's Brook on the shore. Connected with these in the last mentioned locality, I discovered a soft variegated rock which strikingly contrasts with the hard unyielding character of its associate. It is easily polished, and may be useful for ornamental purposes. At first I regarded it as Steatite, and then Rensselaerite. It is now considered to be a silicate of alumina—agalmatolite. I subsequently found it also in the same connection at Arisaig Pier, and it was afterwards found near Frenchman's Barn. In this locality there are veins of it, yellowish and translucent. Here it has since been quarried to some extent by a company formed for the purpose. It is reported to be serviceable for pottery. These rocks are considered to have been altered by the great dyke of greenstone, greenstone porphyry and amygdaloid, which is in contact with it throughout the entire length of the band.

It may tend to confirm my view of its equivalency if I quote the views of Dr. Dawson in reference to the character of the rocks in question: "It is a very instructive study to compare the soft conglomerates and their interstratified trap at McAra's Brook, *with the continuation of the same body eastward of Arisaig Pier* where they appear forced into hard quartzose rocks, in some of which the original texture is entirely obliterated." (*Acadian Geology*, 1st ed. page 268.)

The only difference is that formerly the rocks were regarded as altered Lower Carboniferous conglomerate, now they are regarded as altered Oneida conglomerate.

This fine series of Middle Silurian, Upper Silurian and Devonian strata exposed on the shore dip, in a general southerly direction; exposed in and near Arisaig Brook, Doctor's Brook, and McNeil's Brook are similar strata; at least one of the middle members of the series is found dipping in a general northerly direction. The two thus form a synclinal. On the east branch of Doctor's Brook, and a small southern tributary is an insulated patch of Lower Carboniferous strata consisting of a considerable band of limestone, underlaid by conglomerate greenstone and porphyry. I have characterised it as insulated. I have tried to connect it with a patch of Lower Carboniferous conglomerate at Malignant Cove, but all connection appears to have been cut off by intrusive greenstone. Both are alike insulated by greenstone and separated from rocks of corresponding age. We have now reached the *ultima thule* of all geological investigation in this district prior to 1868. I now pass from the band of fossiliferous rocks which is so instructive and interesting to the Palæontological Geologist into another set of rocks, from which organic remains appear to be wholly obliterated. Before entering upon these, however, I would recapitulate to a small extent by describing the boundaries of the fossiliferous Silurian rocks of the district. On the north they are bounded by Northumberland Strait. Their eastern extremity is McNeil's Brook on the beach of the same Strait. On the west they are bounded by McAra's Brook, its Devonian slates and overlying sandstones, interstratified trap and limestones. The east branch of Doctor's Brook until it turns south, and its main branch until it turns to the same direction. Opposite Arisaig Pier are parts of its southern boundary. The remainder on the south side is obscure. Any continuation of these in a westerly direction lie under the carboniferous formation of Pictou County. As I have generally adopted the *ascending order* in my geological descriptions, I would now in this order record my investigation of the metamorphic band that lies to the south of the band already described. My starting point lies to the south of Doctor's Brook,

about two miles from the coast on McDougall's mountain south of Bayfield's Beacon, 1000 feet above the sea level, according to Bayfield's measurement. I found the lowest rock here to be a *conglomerate*, very much hardened and shewing cleavage. When I first observed this rock, I imagined that I had found a lower carboniferous conglomerate in a very elevated and unusual position. I consider this as the equivalent of the Oneida Conglomerate. To the north of this and overlying it, are greenish quartzite strata, which on the surface is chalk white, and yields to the knife. Passing on the west, along the strike of the rocks, we come to McDonald's Hill, having an equal elevation of 1000 feet. In the rear of this is the same quartzite, south of the Frenchman's Barn. Still proceeding westward, we come to the main branch of Doctor's Brook—here the same quartzite is exposed rising from the Brook into lofty ridges. Farther west the mountain range continues south of Arisaig Pier, having the same quartzite with grit apparently corresponding with the conglomerate of McDougall's mountain. South of this, or under it, I found exposed in a field a considerable outcrop of syenite. I found all obscure in the rear or to the south of this. There is a table land with good farms, with the wilderness to the south. Passing westward in the rear of the mountains, I found this range apparently extending onward like a titanic rampart toward Merigomishe. I observed an outcrop of the same strata on a small bank south of McAdam's Brook referred to in describing the fossiliferous band of Arisaig. Observing a brook in the mountains N. W. of this, I attempted to find a path. I found a long, dreary and tortuous way in the shape of the bed of the main branch of Mill Brook. Where this Brook intersects the mountains, I found noble sections of the quartzite already pointed out, and other strata. I should have liked to have traversed the brook throughout, but I was diverted from my path by a bear which appeared to be disposed to dispute the right of way. As I did not feel disposed to dispute the matter, I betook myself to the steep side of the mountain, and at last regained the brook in safety, and emerged from it between lofty sides of the mountains with fine sections of argillites; passed through the north side of the mountain range with its outcropping argillites at the forks of the

brook *i. e.* where the east branch unites with the main branch, near a lower carboniferous brine spring. Returning to the starting point at McDougall's mountain and proceeding eastward, we pass over the east branch of Doctor's Brook, and climb Mackintosh's mountain—we find diorite as the lowest rock with overlying argillites; these in the direction of their dip or northerly extend for some distance onward to the shore, forming mountains. To the S. E. of Mackintosh's and McDougall's rises McNeil's mountain, having according to Bayfield an elevation of 1010 feet above the sea level, being by ten feet the highest mountain of the range. This mountain consists of red syenite which rises abruptly on the south side, with a marsh and wilderness without any appearance of rock in the rear. The crown of the mountain is entirely syenite as well as its sides, in the cultivated land that rises up against it, and on the road leading to it we have as before, a succession of argillite extending northward to a certain point. We shall leave it there with the expectation of meeting it again.

I commence at the said point at McDougall's mountain again. I pass from the Oneida conglomerate in a northerly direction across the strata and towards the shore. I think I can separate the series into different members, but the operation is somewhat uncertain owing to the absence of fossils. My progress is arrested. The sides of the rock are precipitous, the ravine is of great depth; it extends east and west. From Doctor's Brook east to Doctor's Brook west it forms a valley for Arisaig Brook and east branch Mill Brook. It is filled with sapling bushes, marshes, &c. It is the highway for our old acquaintance bruin. The wool and bones of sheep show that he improves his opportunities.

On the south side of the ravine are lofty rocks—diorite—succeeded by a broad band of red slate, the exact counterpart of the supposed Devonian slate of Lochaber. This broad band extends to the insulated carboniferous patch already referred to at East Branch, Doctor's Brook, and its small tributary on the north which extends to the vicinity of the fossiliferous band; it extends westerly and terminates on the south side of the east branch of Mill Brook almost due south of the mouth of McAra's Brook. Here the lower carboniferous sandstones also rest on it unconformably as on the

shore strata. It extends eastward under Doctor's Brook. It bifurcates and then trifurcates being divided by greenstones, its branches pass onward, eastward, the northern branch terminates in the *fort-like* rock at McNeil's Barn, near Malignant Cove. The middle branch passes on and is lost among brush, &c. The southern branch passes by not far from the *point* to which I brought the shale from McNeil's mountain, and proceeds onward and appears to terminate on the south side of Malignant Cove Sugar Loaf. Any continuation easterly must lie under the carboniferous areas which extend onward to St. George's Bay.

## ART. II. REVIEW OF NOVA SCOTIAN DIURNAL LEPIDOPTERA.

BY J. M. JONES, ESQ., F. L. S.

(Read, Nov. 14, 1870.)

NEARLY seven years ago, Mr. Thomas Belt read before this Institute a paper entitled "A list of Butterflies observed in the neighborhood of Halifax," in which he included no less than thirty species, the result of his observation and collection during the years 1862-3. Since that time I have been able to add a few new forms to the list, and also facts regarding the habits of the several species, and trust the same may be found of service in advancing our present knowledge of that interesting and beautiful class of insects.

### SWALLOW-TAIL, (*Papilio turnus*, Lin.)

This butterfly which is far more common during some seasons than others, generally makes its appearance about the first week in June. Mr. Belt says the 1st of June, but I have failed to note its presence before the 7th of the month. A pleasant sight it is to the eye of the entomologist to observe about the middle of that genial month a lilac (*Syringa vulgaris*,) covered with its purple masses of luxuriant bloom, on which may be seen many of these pretty insects revelling in their honied sweets. Flitting alternately from flower to flower, their delicate wings of lemon striped with black, contrasting with the more sober colour of the flower, presents