

similarity between the telegraph switch and the animal brain. From the battery only two wires, one from either pole, lead the force to the *switch*; yet from this switch any number of wires may radiate, each one endowed with equal magnetic force, or the whole may be concentrated in one. From our stomach two cords also lead up the spine to the base of the brain, (which may be compared to the telegraph switch,) and from the brain the whole nervous system of the human body proceeds.

The inference to be deduced from this wonderful coincidence is, that the body is merely a machine, whose brain is controlled by the magnetism of the body; the *mind* being the *telegraph operator*.

An animal is thus as much a magnet as a plant, and its life is magnetism.

In concluding our argument that magnetism is the life of the world, if we have proved that minerals, plants and animals all live and grow by magnetism, then it only remains to show that the earth is a magnet; but this is a well established and acknowledged fact, and thus it is only making more certain what is sure, by proving plants and animals magnets; for the invariable law of magnetism is, that every atom of a magnet, no matter how connected, is also a complete magnet as well as a part of the whole.

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ART. X.—NOVA SCOTIAN GEOLOGY.—NOTES TO RETROSPECT OF 1878.—BY REV. D. HONEYMAN, D. C. L., *Hon. Memb. Geol. Assoc., London, &c., Fellow of the University of Halifax, Curator of the Provincial Museum, Professor of Geology Dalhousie College and University.*

(Read April 14th, 1879.)

AFTER I read my essay "On the Fossiliferous Rocks of Arisaig," before the Halifax Literary and Scientific Society, in April, 1859, a notice appeared in the *Presbyterian Witness* newspaper, in which the editor stated "that I had settled questions that had puzzled Lyell and Dawson," regarding the age of the Arisaig rocks.

The author of *Acadian Geology*, who is a reader of the *Witness*, and always on the *qui vive* in matters relating to the Geology of Nova Scotia, shortly after sent me a letter from Montreal, in which he expressed his gratification at my directing attention to the interesting rocks of Arisaig, observing that the rocks were "probably" of Lower Helderberg age. In a letter replying, I said that they were "certainly" of Upper Ludlow age, and that my reasons for regarding them to be of that age would be seen from the abstract of my paper, then in the press, when published.

I was not then the owner of a copy of *Acadian Geology*. I had only seen and read a copy of it in Pictou immediately after its publication. I distinctly remembered, however, that they were considered to be of Hamilton and Chemung age, U. S., Devonian.

In now regarding them as "probably Lower Helderberg, U. S.," the author had adopted the only alternative. I suspected that the opinion expressed was suggested by the observation in the *Presbyterian Witness*. This may be what the author calls "simultaneously and independently" in *Acadian Geology*, second edition.

I did not refer to the correspondence in my "Retrospect." I only referred to printed documents, not considering that the author was committed to the opinion, somewhat cautiously expressed, until it appeared in printed form. I have searched in vain to find any evidence of this kind until 1860. It is not to be found in the catalogue of "*Acadian Geology*."

On this ground I preferred the claim to having taken "the first steps onward."

#### CORRECTIONS.

I find that, trusting my memory, I was led into error in some of the reasons that I assigned as objections to the division of the Arisaig fossiliferous rocks into Upper and Lower by the author of "*Acadian Geology*." When I wrote the objection, I forgot that he made the division in his paper in the *Canadian Naturalist* in 1860.

At the time the division was made it seemed altogether pro-

per, while at the time of the publication of "Acadian Geology," 1868, it had become objectionable by reason of the further development of the series and Salter's determinations of the several members. My proper reasons were then given, when I had occasion to make a "Middle Arisaig series." *Vide* paper "on the I. C. R. in the Cobequids," pp. 390, 392, *Transactions of the Institute*, 1873-4.

I shall quote these: "After the lapse of ten years, and a great amount of labour and research, I consider that the alphabetical division is the only unobjectionable one that has been proposed, and that the only modification of the British division required is the omission of the 'Lower Ludlow,' which was not suggested by Mr. Salter. Previous to Mr. Salter's examination and correlation, I had correlated D with the Upper Ludlow of Wales. Dr. Dawson, at the same time, correlated C and D with the Lower Helderberg, U. S.; and B' with the Clinton, U. S. D and C are further distinguished by Dr. Dawson 'Upper Arisaig,' and B' 'Lower Arisaig.' Extensive observation has proved that Mr. Salter was correct in giving the Arisaig series a greater range in time than that given by Dr. Dawson. I have referred to another division of the Arisaig series into Upper and Lower, the Lower Helderberg equivalent being the *Upper*, and the Clinton the *Lower Arisaig*. There are two applications of the word Arisaig. There is the *Arisaig township* and the *locality Arisaig*. In the former sense it is much too restricted, as it ignores a great part of the Arisaig series, besides a typical series of Crystalline rock, which I have elsewhere designated as 'Lower Arisaig,'—*Transactions*, 1872,—and Carboniferous rocks. In the latter sense it includes too much, as the 'Lower Arisaig' of the division *alone* lies in Arisaig, while the 'Upper Arisaig' is in the Moidart.

"On these grounds I consider these divisions as untenable."

#### ACADIAN GEOLOGY.

##### *Maps.*

In my remarks upon the Maps of the two editions of Acadian Geology, I did not make sufficient allowance for necessary imperfections, so that my remarks seem to be somewhat *hypercritical*; still, it cannot be denied that on some very important

points the map of the second edition is the reverse of an improvement on that of the first.

#### A NEW MAP.

Much has been done by the Geological Survey and others in exact surveying and mapping in Nova Scotia and Cape Breton since 1868. The publication of a progress map on a larger scale than the maps of Acadian Geology, indicating the work thus accomplished, is certainly a great *desideratum*.

#### MAPS CONSTRUCTED SINCE 1868.

Maps of Nova Scotia and Cape Breton, accompanying Reports of Geological Survey of Canada.

Robb & Fletcher's.

Prof. Hind's Maps, published by the N. S. Department of Mines.

The Author's Maps in the Museum portfolio, constructed to illustrate papers on Nova Scotian Geology read before the Institute, which were exhibited at the American Centennial Exhibition.

To these have been added a Map of a part of Annapolis County and a Map of a part of King's County, which were also made to illustrate papers read.

#### GEOLOGICAL SOCIETY.

I have referred to the abstract of my paper "on the Laurentian Rocks of Arisaig," which appeared in the Journal of the Geological Society. This, like many abstracts of papers not made by the authors, seemed to me not to do justice to my paper; still, I regard the abstract as valuable, as it is the first description of this interesting series of rocks in a scientific journal. I regard the nature of the discussion as also interesting and useful.

I would observe that the publication is also to be valued, as it led to the production of a very valuable note by Prof. T. Rupert Jones, on *Entomostraca* from Arisaig, "D. Upper series," which I had given to him in 1862.

#### CENTENNIAL EXHIBITION PHIL., 1876.

When I saw the admirable stratigraphical collection of rocks

of the Canadian Geological Survey arranged in the Canadian Mineral Department, I was somewhat surprised to find a suite of specimens from George's River, Cape Breton, (the Cape Breton representative of my "Lower Arisaig series,"—vide *Trans.*) arranged with others from C. B. in the Laurentian division, I was led to believe that the Geological Survey still followed in the wake of "Acadian Geology." I was therefore not at all surprised to find Mr. Selwyn, the distinguished Chief of the Survey, describing to the International Judges of Class 100 the *Laurentian axis* delineated on a sketch map of Nova Scotia, and including in it George's River, Arisaig, and the Cobequid Mountains, as well as the Laurentian series of rocks of New Brunswick.

#### PRE-SILURIAN ROCKS OF CAPE BRETON.

August, 1876, I received the *Canadian Journal* containing Prof. Chapman's admirable "Outlines of the Geology of Canada." In the Cape Breton section I took particular notice of the Geology of Campbellton, Victoria County. Here the Pre-carboniferous rocks are described as Pre-silurian. These had been examined by the author, accompanied by Mr. Fletcher of the Geological Survey. In the vicinity of these are the Pre-silurian rocks of St. Ann, from which Mr. Hendry, Dep. Comnr. of Crown Lands, took the specimen of Ophicalcite which was exhibited in the Nova Scotian Department of the Exposition de Paris, 1867. This was the specimen referred to in which Sir C. Wyville Thompson found *eoazonal* structure. There were also the rocks which Mr. Hartley, of the Geological Survey, considered to be of Laurentian age. Mr. Robb considered the Campbellton rocks to be of Quebec age.

Every Geologist that examined the Cape Breton Pre-carboniferous Crystalline rocks had thus come to form an opinion different from that expressed by the author of "Acadian Geology," who seemed still determined to maintain their Devonian or Upper Silurian age.

#### CORRESPONDENCE.

Not long after the receipt of the *Canadian Journal*, I re-

ceived a letter from the author of "Acadian Geology," requesting a copy of the *Transactions* of 1875-6, containing my papers, "A month among the Geological Formations of New Brunswick," and "Geology of Antigonish County."

On receipt of the *Transactions*, another letter was sent, in which he made some objections to my use of the terms Lower, Middle, and Upper Arisaig, stating that Geologists would never concede to one locality all the formations that I had assigned to it, at the same time proposing that I would call my "Lower Arisaig series" the "Cobequid Mountain series," and then he would accept of it.\* I had adopted the nomenclature after *disposing* of the "Acadian Geology" division, and as a convenient, and, to me at least, satisfactory method of indicating my operations in Pre-carboniferous Geology, especially at Arisaig, I could not see any valid reason for substituting any other local nomenclature in its stead, especially that preferred. If I were to consider it expedient to adopt any other, I would adopt "*George's River, C. B.*," which I associated with Arisaig in my paper of 1872, following the example of the Geological Survey in its maps and reports of Cape Breton. For the Middle Arisaig I would adopt Wentworth, I. C. R., Cobequid, A, (B being employed to represent the *Wentworth fossiliferous series*.) It was here that I first found occasion to adopt the term "Middle Arisaig." My "Upper Arisaig series" I would then call the "Arisaig and Moydart series," the last being the "Lower and Upper Arisaig" of Acadian Geology.

Considering that the Pre-silurian age of the "Lower Arisaig series" has now been established, and that it may be an open question for some time to come, whether the series be of Laurentian, Huronian, or Lower Cambrian age, I have no objections whatever to discontinue the use of the term "Lower Arisaig series," and to imitate the example of American Geologists in adopting the term "Archæan," under which Prof. J. Dana has already placed the typical Arisaig series. "Manual of Geology,"

\* It appears, according to his own account, in his address as President of the Natural History Society of Montreal, the author of Acadian Geology in his last *Edition-Third*, has acted on his suggestion, and made a "Cobequid Series" and described it. He seems to have described my "Middle Series" but certainly not my "Lower Series" nor the *George's River, C. B. Series*.—Address Canadian Naturalist, New Series, Vol. 9, No. 3.

*last edition.* I would reserve "Middle" and "Upper Arisaig" for further use.

#### ARCHÆAN.

##### George's River, C. B.

The Arisaig Crystalline rocks were *per se* correlated with the Laurentian by comparison with the fine series of Laurentian rock specimens in the Canadian Department of the Exposition de Paris, 1867. Shortly after I thus correlated them I showed specimens to Sir W. E. Logan, who considered them to be of Quebec age. When I found the corresponding series at George's River, C. Breton, I came to the conclusion that both were of Quebec age, which was then regarded as corresponding with the Calcareous (Lower Silurian), and designated the typical series "Lower Arisaig." The discovery of an intermediate series in the Cobequids, which I designated "Middle Arisaig," led me to lower the horizon of the "Lower Arisaig." The subsequent examination of the Saint John, New Brunswick, Laurentian, led to the conclusion that the two were perfectly identical,—*vide* note on paper, "A month among the Geological Formations of New Brunswick," 1875-6.

Mr. Fletcher's very interesting discoveries of Primordial forms in strata overlying the Crystalline rocks of George's River, C. B., Lower Arisaig, tended to confirm the correlation with St. John Laurentian. Additional evidence is also furnished by his discovery of Upper Lingula flag forms at Marion Bridge, Mira River, C. B. To these I have to add the Rev. D. Sutherland's discovery of Primordial sandstone, with *Lingulella* sp., on Mira ridge, C. B.

#### NOTE.

I have just received from Mr. Selwyn, Director of the Dominion Geological and Natural History Survey, a *brochure* giving a very interesting account of his examinations of the Quebec formations of Canadian rocks. He proposes to adopt the following divisions of systems to include the groups enumerated.

I.—Laurentian. To be confined to all those clearly lower unconformable granitoid gneisses, in which we never find interstra-

tified bands of calcareous, argillaceous, arenaceous and conglomerates.

II.—Huronian. To include, 1st, the typical or original Huronian; 2nd, the Hastings, Templeton, Buckingham and Grenville group; 3rd, the supposed Upper Laurentian or Norian; 4th, the altered Quebec; 5th, the Cape Breton, Nova Scotia, and New Brunswick pre-primordial sub-crystalline and gneissoid group.

It thus appears that when I regarded the "Lower Arisaig series" as Laurentian, and then Quebec, and last of all, as identical with the New Brunswick, and therefore, Laurentian, I had not diverted very much from first to last.

The *Canadian Naturalist* of July, 1879, contains a paper read before the Natural History Society of Montreal, by McFarlane, Esq., in answer to Mr. Selwyn's pamphlet. In this he claims precedence in ascribing a *Cambrian* age to the Quebec Metamorphic rocks. It seems that this view of their age was expressed by him in a report to the Director of the Survey as early as 1862. If I had been fortunate enough to meet with this report when comparison of the Arisaig and George's River, C. B., with the Quebec rocks was instituted, I would have been prevented from making so great a change as from the Laurentian to the Calciferous, (Lower Silurian.)

#### ANNAPOLIS COUNTY.

##### Nictaux.

##### *Fossiliferous Rocks.*

Silurian, Gesner, 1849.

Devonian and Lower Helderberg, Dawson, 1868.

Middle Silurian, Honeyman, 1878.

When I examined the Nictaux formations, I had no recollection of the existence of the coral there, which had been considered a *Zaphrentis*, and referred to by the author of "Acadian Geology" in a note to my paper "on new Fossiliferous Silurian localities in Eastern N. S.," *Canadian Naturalist*, 1860, and also in "Acadian Geology," ed. 1868. I had only a faint recollection of anything that I had read about the Nictaux fossils, and I did.



not wish to refresh my recollection, as I wished to examine them in the light of my own experience. This led me to identify the rocks with others with which I was well acquainted without any reference to the coral in question. The lithology and stratigraphical relations and familiar forms of fossils found in certain strata, enabled me to correlate the strata with the Middle Silurian formations of Eastern Nova Scotia, and led me to seek for other familiar forms, and to find them; *Petraia* was notably one of the number.

It is noteworthy that the *Devonian Zaphrentis* of Dawson is the *Petraia Forrestere* of Salter, occurring in strata referred by him to Mayhill Sandstone, (Intermediate Silurian of Ramsay and Salter). This is eminently characteristic of all the *Mayhill Sandstone* localities in Eastern Nova Scotia, which are eight in number. In one of these localities in the Marshy Hope, in the County of Antigonish, the *Petraia* strata seem to stand alone. In Barney's River, French River, and Sutherland's River, they are associated with Clinton and underlie it, other members of the Upper Arisaig series being absent.

At Lochaber the same strata are associated with C and D Upper Arisaig, and underlie them.

At Irish Mountain and McLellan's Mountain they are associated with B' and D Upper Arisaig and underlie them. At Arisaig the *Petraia* strata (A) are associated with and underlie B, and the B' Clinton of Hall and Dawson, C Aymestry Limestone, and D Upper Ludlow, or Lower Helderberg. In Irish Mountain and McLellan's Mountain the *Petraia* strata are Central Mountain strata in common with the extensive Diorites of *Devonian age*.

It is also *peculiarly* noteworthy that the author of "Acadian Geology," on the faith of "one indistinct specimen of *Zaphrentis*," concluded that the *Petraia* strata of Lochaber was of Devonian age, and *re-asserted* the same opinion about 1874.

PRE-CARBONIFEROUS ROCKS OF THE PICTOU COAL FIELDS, OF  
DEVONIAN AGE.

In the Report of Progress of the Canadian Survey from 1866-9

page 7, Sir W. E. Logan says, in reference to certain pre-carboniferous rocks underlying the Pictou Coal Fields: "No evidence was observed by me on McLellan's Mountain, to show to what epoch these older rocks belong, but masses somewhat similar are noticed by Mr. Hartley on the west side of the East River, in a position where they have been mentioned in his *Acadian Geology*, by Dr. J. W. Dawson, who considered them to be of Devonian age, and on his authority they will be so distinguished."

In my criticism of this conclusion in *Transactions* 1870-1, 1st paper, I said: "I presume that this language is intended to apply to the area indicated on the S. E. corner of the map which accompanies Sir. W. Logan's Report, which is distinguished by the Devonian colouring. Now this area has its N. E. corner at the Falls of Sutherland's River, and its S. E. corner at the bridge at McPherson's Mills, so that in addition to the northern part of McLellan's Mountain, (range,) the area in question includes also a part of Sutherland's River."

In my second paper of the same session, *Transactions* page 141, I wrote: "The supposed Devonian rocks on the west side of East River, which are considered by Sir W. Logan to be "somewhat similar" to those of McLellan's Mountain, as indicated on Sir W. Logan's map, by a Devonian coloured area on the north west. Here the Pre-carboniferous rocks of Waters' Hill are regarded by Dr. Dawson as "probably of Devonian age,"—*vide* page 319 of "*Acadian Geology*" 1st Ed. It will be observed that this cautious expression hardly warrants the positive conclusion which Sir W. Logan derives from it."

When the question of the age of the Pre-carboniferous rocks of McLellan's Mountain had to be referred to the authority of "*Acadian Geology*," it would have been as well to make a direct reference. In 1855 the rocks in question were referred to the *altogether problematical* "Devonian and Upper Silurian, mostly metamorphosed,"—"Acadian Geology," 1855, map,—and no one had succeeded in finding evidence up to the time that Sir W. Logan examined them and found no evidence by which he could determine their age. i. e., 1868.

It was in the summer of 1869 when Mr. Hartley was working

alone in the Pictou Coal Field that I succeeded in identifying A, B' and D of my Upper Arisaig series, (i. e, A Mayhill Sandstone, B' Clinton, and D Upper Ludlow or Lower Helderberg), in Irish Mountain, McLellan's Mountain, and Sutherland's River, and in discovering characteristic fossils in them all. It was on this occasion that I identified the Mayhill Sandstone of Fraser's Mountain, (McLellan's Mountain range), and found *Petraia* afterwards in the same way that I identified *Nictaux* corresponding strata and found *Petraia* in them.

I also identified the same formation at Sutherland's River by the occurrence of *Petraia*, the rocks being unlike and the relations doubtful and found characteristic, *Athyris* and *Orthis* of A in like abundance, and of the same genera and species (undetermined) as at Lochaber, Arisaig, and Marshy Hope.

About the time that Sir W. Logan was writing his report, I read a paper before the Institute which I concluded thus:—"It may seem strange that during my description of the area underlying the Pictou Coal Field, I have made no mention of the Devonian formation which is *so often spoken of* in connection with the strata underlying the coal field. The reason why is this,—*there is no Devonian to be found there.*"—*Transactions*, 1870-1, page 75. I felt called upon the following session, 1871-2, to maintain the conclusion arrived at, after the appearance of Sir W. Logan's Report on the Pictou Coal Field, which I did by adducing the evidence which I had discovered in Irish Mountain, McLellan's Mountain, and Sutherland's River, in opposition to Sir W. Logan's views, evidence which has not yet been called in question, but which the author of "Acadian Geology," in accordance with his views on Lochaber and *Nictaux*, would have regarded as confirming the opinion expressed by Sir William Logan, founded on his authority.

An application of the preceding to views entertained regarding *Nictaux* is obvious, but as the Devonian age of the Lochaber *Petraia* strata was inferred by the author of "Acadian Geology" from a specimen of *Petraia* which was *Zaphrentis*, "a cast not sufficiently perfect for specific determination, but not unlike imperfect specimens from the Devonian of *Nictaux*."—*Canadian*

*Naturalist*, Aug., 1866, page 199. I do not consider the application as of much importance.\*

## CORRECTION.

I used the expression "antiquated" in characterizing the views of Sir W. E. Logan. This was an improper application of the word to Sir W.'s views as expressed in 1870. I then had reference to the views entertained in 1855, and did not consider that it was my own observations in 1869 that disposed of the Devonian at McLellan's Mountain.

## GRANITES.

*Archaean.*

In the typical "Lower Arisaig series" granites have not yet been found. Quartz veins with mica are found penetrating the Petrosiliceous rocks of the series. In Cape Breton coarse granites are of very frequent occurrence among rocks of the series. In the Cobequid Mountains they also occur. In this respect the rocks of this series correspond with the Laurentian formation of Saint John, New Brunswick. I consider these granites to be the *oldest* in Nova Scotia, i. e., according to present appearances.

## HALIFAX, SHELBURNE, ETC.

*Granites.*

"The Granite of Nova Scotia and its associated gneisses and Mica slates are among the oldest rocks found in the Province."—*"Acadian Geology,"* 1868, page 622.

## NICTAUX.

"As the Granite is itself of Devonian Age." *"Acadian Geology,"* page 500.

Sir Wm. E. Logan, the late Director, regarded, and Mr. Selwyn, the present Director of the Geological Survey of Canada, regards the Granites as all of the same age—*Devonian*.

Professor H. Y. Hind considers the Cape Breton and Nova Scotian Granites to be Laurentian Gneisses.

I have shown in my paper "on Geology of Annapolis County—Nictaux," that the Granites underlie (almost unaltered) Middle

\*NOTE.—I have just examined the Geology of the Moose River Iron deposits. They amply confirm my opinion regarding Nictaux deposits.

Silurian—possibly Lower Silurian strata, and therefore that that they are of “pre-Middle Silurian” age. I have also demonstrated that a Gneissoid connection of this Granite and *phenomena* are precisely similar to what are observed at Halifax, and that there is not sufficient grounds for assigning one age to one and another age to another.

All our Granites seem to be of *Archæan Age*. In the case of the Halifax Granites, as well as those of Nictaux, there seems to have been a *re-metamorphism* effected during Upper Cambrian and part Lower Silurian time.

In a paper which I am preparing “on the Geology of Halifax” I will give my reasons for the conclusion stated.

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ART. XI.—FISH CULTURE.—BY JOHN T. MELLISH, M. A., *Principal of Albro Street School, Halifax, N. S.*

(Read May 12, 1879.)

THE subject of fish culture, or the propagation of various kinds of fish by artificial means, has within the past few years received considerable attention on both sides of the Atlantic. As a branch of economic industry, the culture or breeding of trout, shad, oysters, salmon and other kinds of fish used by man as food, cannot be too carefully attended to by the State, and especially so, when such artificial breeding seems to be the only remedy for re-stocking depleted rivers and streams. My object in preparing this paper is to place on record in connected form a short history of fish culture in our own country. In doing this, I shall touch very briefly on the subject as referring to other countries. The culture of the salmon, and, to some extent, the white fish, is all that has been attempted as yet in Canada. As the Institute was favored a short time since with a most excellent paper on the Salmon by a distinguished member of this body, Dr. J. B. Gilpin, it is not at all necessary that on the present occasion I should refer, except incidentally, to the various stages of growth and development through which the fish passes, from the time it leaves the ova till it becomes the full grown salmon, beautiful to the eye, delicious to the taste. The peculiar instinct of the