

PIONEER GEOLOGISTS OF NOVA SCOTIA

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THERE is a branch of the science of Geology known as "Historical Geology." It attempts to piece together the story of the crust of our Earth. Many men, by isolated labours, in many separated lands, have contributed each his portion to the record. The work goes on, still far from completed. In a sense the record can never be completed to man's cognisance, as Earth changes are taking place still as they always did.

This branch of Geology, because of its time implications, attracts the philosophical mind more than its modern specialization into merely utilitarian vocations, and around it especially has raged the man-conceived conflict between Theology and Science, occasioned always by partial knowledge and consequently erroneous assumptions in both fields of human speculation. Happily there is a growing realization that all things material or spiritual, including even the thoughts of men, are manifestations of a power that transcends our intellect.

Our province has provided both the men and the geological phenomena that have assisted in forming modern conceptions of the building of the earth as we now see it.

I

Abraham Gesner (1797-1864)

Among the earliest of these men was Abraham Gesner, surgeon, of Parrsborough, whose work, *Remarks on the Geology and Mineralogy of Nova Scotia*, was published by Gossip and Coade in Halifax in 1836. As an apology for some of the imperfections of the work, Gesner pleads that it has not been prepared with leisure and retirement, but on the contrary

Amidst the arduous duties of a laborious profession, and under the annoyance of perpetual interruption, most of its pages have been written; or during the silent hours of midnight, when the labour but not the fatigue of the day had departed.

The "agents" for Dr. Gesner's book include names famous in Nova Scotian history, and still prominent in provincial affairs and culture, such as Starr, Howe, Belcher, de Wolfe, Creighton, Dickie, Logan, Pineo, Chipman, Allison, Avard, then as now names associated with Cumberland, Hants, Colchester, Annapolis Counties, and more especially associated with the Bay of

Fundy and the North Shore where Dr. Gesner's geological labours were chiefly spent. Cape Breton Island is included in the map, but not in the territory examined by our surgeon-geologist. It must have seemed a remote locality in Gesner's day, and significantly there is not a single "Mac" among the "agents."

We cannot in our day realize how difficult and physically fatiguing were geological observations in Gesner's time. His remarks on the Cobequid Range are revealing:

Covered with a thick and pathless forest, the mountains defy the labors of the geologist . . . More than once has the caribou been alarmed by our footsteps, and darted away with bounding speed. Not so the lazy and sulky bear—he has either stood his ground, or carelessly stalked among the underbrush upon the approach of a solitary visitor.

Dr. Gesner lived at a time when geological theories were in flux. The conflict between the Neptunians and the Vulcanists, between the German, Abraham Gottlob Werner of Freiburg, and the Scot, James Hutton of Edinburgh was dying down, with the general acceptance of Hutton's view of the building of our earth's crust as set out in his great work of 1795. In Britain, Charles Robert Darwin, also the son of a country doctor, was working out his theories of natural selection and evolution, which when published in 1859 loosed a flood of philosophical controversy—"the fertilizing flood over the whole realm of thought."

Gesner admits "The theory of Werner must be given up," and he sketches the beginnings of modern geological conceptions with a grasp and clarity that compel our admiration. But, like all his contemporaries, he was sorely troubled to maintain the truth of the literal meaning of *Genesis*, and the worldwide extent of the Noachian Deluge. The effects of glaciation, so numerous and striking in Nova Scotia, seemed to Gesner proof of a great deluge which he associates with "a great and sudden change in the temperature of the terraqueous globe," a prescient observation when it is remembered that the hypothesis of Ice Ages was not advanced until 1840, as later mentioned.

Faced with the weight of his own observations, and his logical deductions therefrom, he dwells on the long ages that must have passed in the deposition of the Joggins and Cumberland coal-measures:

the numerous alterations, amounting to many hundreds sometimes, of sandstone, shale, and beds of coal, proving a long period of the process of deposition.

And yet, he asks himself, "Why need the human mind revel in chaos, a thing incomprehensible, an invention of the Persian Magi? Might not the Cumberland coal-field have been "submersed" during the time which elapsed between the creation of the world and the deluge?"

And might it not have been restored at that awful crisis, when Noah and his family were floating in the ark?

We must remember, that it was not until 1840 that Agassiz and Buckland first marshalled the evidence of Ice Ages.

Dr. Gesner's pride in his native province, and his belief in the cultural and economic future of Nova Scotia, were great. There is a distinct analogy in our time to his scepticism of extra-provincial control of our natural resources, and he seems not to have liked the General Mining Association.

Referring to the Cumberland Coalfield he observes:

. . . It is remarkable that those who claim an extraordinary right to the Mines and Minerals of Nova Scotia should neglect a situation offering so many advantages . . . It is however, very probable that the Mining Association, having expended large sums of money at the coal-mines of the eastern parts of the Province, would rather discourage the coal-trade from Cumberland than abandon their former labours. And while competition is prevented, and the inhabitants of Nova Scotia are only permitted to gaze upon the treasures of their country, without being permitted even to dig a bushel of coals from beneath the soil, so long in all probability will the mines of Cumberland remain closed, although steamboats propelled by fuel brought from England shall almost daily pass over their strata.

There spoke the geologist, to whom land and sea are only surface aspects of earth's crust.

Gesner mentions, rather slightly, in two instances, pits dug by "a Mr. Backwell" in search for copper, in the River Herbert district and at Cap D'Or at the tip of the Chignecto Peninsula. Here "Mr. Backwell, an English gentleman, dug a pit on the top of the cape, but for what useful purpose we could never discover." Mr. Backwell was an early emissary of the General Mining Association, sent out to prospect for copper which it seems to have been rumored was plentiful in Nova Scotia. He reported on his return to England that profitably

workable deposits of copper were not present in Nova Scotia, but that there was much coal. As a result of this report, the Association sent out Richard Brown to Sydney Mines, a man to whose outstanding personality later reference will be made. Although diligent search has been made, the initials of "Mr. Backwell" do not seem to have been recorded, but he seems to have been a discerning and faithful servant of his employers.

The tyranny of the theory of the verbal inspiration of the Bible has had a disastrously limiting influence on the vision of men like Gesner, who were torn between the truths they had wrested from Nature's own book and the necessity to force these truths "into conformity with Biblical cosmogonies involving cataclysmic origins by fire and water." As the schoolboy wrote, some part of their faith had to consist "in believing things they knew could not be true." We can apply to the memory of Abraham Gesner his own soliloquizing on the mind of the "Natural Philosopher:"

Although he may toil in silence, and remain unknown, and may not receive the least encouragement among his labours, or reward for his pains, yet when he disappears he leaves something in the hands of his successors that may administer to his wants, and render them wiser and more happy.

One may be permitted to mention that the name "Gesner" is famous in early geology. Conrad Gesner, born 1516 in Zurich, the greatest naturalist of his time, wrote the first treatise on fossils. It is recorded of him that he combined enormous erudition with deep religious faith, and we could employ a similar eulogy in reference to his Nova Scotian namesake.

Thomas Chandler Haliburton (1796-1865).

While the elder Haliburton has not usually been numbered among geologists, yet reference to his encyclopaedic work, *An Historical and Statistical Account of Nova Scotia*, discloses that his geological studies and field observations must have been extensive. To those of us who are actively engaged in commerce and industry, whose mental activities are necessarily concentrated in special grooves, who marvel at the wide extent of the pioneers of Nova Scotia, and credit them—perhaps erroneously—with greater leisure than is possible in our day, it is almost amusing to read Haliburton's chapter: "Of the Objects of Natural History in Nova Scotia."

In an infant colony, where subsistence is the chief object of every man's attention, there are very few to be found who have a taste for natural history, and still fewer who have leisure to pursue their researches to any extent . . . The study belongs to a more advanced stage of society than exists in this country.

The contemporary situation emerges clearly from Haliburton's chapter on "Geology and Mineralogy," the subject matter of which he credits wholly "to Richard Smith and Richard Brown, Esquires":

If we except the coalfields of Sydney and Pictou, no excavation of any depth has been made into the interior of the earth, and its surface is, as yet, so covered with an almost impenetrable forest that a very large portion has never been made the subject of philosophical investigation.

The troubles of an isolated student of the mining science are noted—there could be added the approval of students of later date—when he complains of the "language of Mineralogy" and the variation of nomenclature:

The pupils of one school cannot understand what is intended when they peruse a publication of a person educated under a different system.

A further glimpse into the contemporary scene is given by reference to

the impolitic reservation to the Crown of the most valuable minerals in the grants of land made to the people of this Province:

and to the Duke of York's Lease, a combination, in the case of the lessees,

rendering them not only indifferent about the discovery of minerals, but preventing them from communicating any information they may possess.

He proceeds to observe that as the study of geology and mineralogy are intimately connected,

The knowledge of both is likely to be confined for many years, in this country, to those persons connected with the English mining establishment.

This observation, in the circumstances of flagrant nepotism that originated the "Duke of York's Lease," was doubtless

justified. But the judicial fairness of this most eminent of our pioneers is shown in his collaboration with Richard Brown, and his reference to the trial smelting of clay ironstone by Albion coal in the Pictou area. In congratulating the inhabitants of Nova Scotia on development of such important resources, Haliburton remarks:—

We also sincerely hope and trust that the adventurers who have so liberally spent their Capital in bringing to light the hidden treasures of the Province will be speedily and amply compensated for their great trouble and risk.

D. Honeyman (1817-1889).

Dr. Honeyman, born in Fifeshire and educated at the University of St. Andrews, specialized in oriental languages and natural science. He came to Halifax as Professor of Hebrew in the Free Church College, later becoming minister of the Presbyterian church at Shubenacadie and subsequently at Antigonish, where he began his geological work as a collector of fossils along the Arisaig Coast. He was a friend of Dawson, and under the stimulus of the first (1855) edition of *Acadian Geology* he developed his geological knowledge. He resigned his pastoral duties at Antigonish, upon his appointment by the Nova Scotia Government to make a collection of the minerals of the Province and to superintend the whole of the Nova Scotia exhibit at the London Exhibition of 1862. Later he surveyed much of Antigonish Country for the Canadian Geological Survey, and on leaving the Survey he has made Curator of the Provincial Museum, of which he was to a large extent the creator. This office he held until his death. He was for 18 years Secretary of the Nova Scotian Institute of Natural Science. From the *Transactions* of this Institute for 1889-90 the foregoing particulars have been culled from the Presidential Address of Prof. J. G. MacGregor.*

Dr. Honeyman represented Nova Scotia at the Dublin Exhibition of 1865, the Paris Exhibition of 1867, the Philadelphia Exhibition of 1876 and the London Fisheries Exhibition of 1883. His membership of international learned societies and his professional honours make a long list. In his life and writings and in his visits abroad he seems to have most worthily represented Nova Scotia.

*In this address is also contained eulogistic reference to William Gossip, a member of the firm of "Gossip and Coade," publishers of Gesner's *Geology and Mineralogy of Nova Scotia*, for a time editor and publisher of the *Pictou Observer* and later of *The Times* in Halifax.

In an unpublished MS. (found after his death) he made acute observations of the glacial geology of Cape Breton at a time when the idea of an Ice Age was hotly disputed by geologists of greater reputation. With the Presbyterian Manse at Strathlorne as "headquarters," our reverend Doctor made excursions with the aid of Hugh Fletcher's newly-published geological map, which he unreservedly praises, and concludes that ice-grooving on the verge of the sea

unmistakably shows that an impulse was communicated from *beyond* Nova Scotia and Cape Breton, and that the glaciers of both are only members of a great glacier system which comprehended both Nova Scotia and Cape Breton.

In another unfinished paper of date near to his death in 1889, Dr. Honeyman revisited regions near Mabou, C. B., examined by him in 1851, and, prevented by heavy rain from proceeding further, like the true geologist he was, wrote: "We will return on another day."

Richard Brown.

No other figure stands out so arrestingly in the early coal-mining annals of Cape Breton Island as Richard Brown, whose *Coalfields of Cape Breton* with its hand-drawn pencil sketches of the cliff-exposures on Sydney Harbour, and his map of the Sydney Coalfield, never ceases to astonish those who know the limitations under which he worked.

Brown was not only a mining engineer but one of the very earliest of coal paleobotanists, although that science was not yet developed in his day. Looking at the town of New Waterford, and knowing how practically continuous are the submarine workings of coal from Sydney Mines to Waterford under the fairway of Sydney Harbour, it is difficult indeed to grasp Brown's limitations when he describes the south shore of Sydney Harbour in 1867 as *terra incognita* from a geological standpoint. Without here attempting to explain why, Brown believed, and for a long time Dawson agreed with him, that the Sydney Mines seams were "the very lowest in the coalfield." and that "there is one, perhaps two, large faults under the waters of the Harbour." Actually the Sydney Mines seams are the highest-placed and the last-deposited in the Coalfield.

Richard Brown was a man of long vision, a competent mining engineer, geologist and historian. His account of the "Coalfields of Cape Breton," issued from London in 1871, almost

50 years after he first commenced his pioneer work at Sydney Mines, finishes with the note of a new day. "The island of Cape Breton, we may safely prophesy, will before long become one of the most prosperous portions of the New Dominion."

Sir James William Dawson (1820-1899.)

The eminence of Sir J. W. Dawson in the roll of early geologists of Nova Scotia is so outstanding and his achievements are so well known to citizens of his native Province that it would be out of place in this communication to attempt to cover biographical details that are part of the literature of Nova Scotia.

But it may be permitted to refer to the first edition of *Acadian Geology* of 1855, so small in its dimensions when compared with the later editions, and to the dedication to Sir Charles Lyell in its modest revelation of the contemporary scene as it appealed to the young Dawson:—

To a young naturalist labouring in a comparatively remote and isolated position, no aid can be more valuable than the encouragement and co-operation of those who, from the vantage ground of a high scientific reputation, and in the great literary centre of the Anglo-Saxon world, are prosecuting similar pursuits.

Acadian Geology was, as the author stated, intended to have a popular appeal and, printed in Edinburgh, was sold by J. Dawson and Son of Pictou, N. S., a circumstance which ever since has been a source of local pride to citizens of "The County." The engraved hand-coloured geological map that accompanies the volume, apart from its scientific value, is a beautiful example of the map-makers' laborious art of ninety years ago.

Dawson, in this early work, like Gesner, gives us an insight into the contemporary political scene, especially the resentment of what he calls "the colonists" against the reservation of Nova Scotia minerals to the Crown and their leasing to "an association of British capitalists . . . some of whose agents have zealously and successfully aided in exploring the geology of the Country." Among these Dawson mentions "Messrs. Brown and Smith," exploring the Province on behalf of the General Mining Association and for aid in completing the map of Cape Breton expresses his indebtedness to Richard Brown.

The beginnings of the Canadian Geological Survey under "Mr. Logan" are referred to, and regret expressed that Nova Scotia had not enjoyed the benefit of a public geological survey, which Dawson suggested was a consequence of the natural

disinclination of the provincial legislature to expend public money "in the examination of deposits in which its constituents have no direct interest."

The day of Canadian Federation had yet to dawn. The great work of later geologists under the Canadian Geological Survey, men like Robb, Fletcher, Faribault and—in our day—Bell, was still to come. The vision of Canadian national unity, to Nova Scotians, was but a vision. The solid achievements of our day—in peace and in war—were embryonic in the womb of Time, especially to those who felt that Nova Scotia was "one of the more obscure and insignificant dependencies of the British Crown."

Dawson, in 1855, did not foresee that his son, George M. Dawson (1849-1901), would become Chief Geologist of the Canadian Geological Survey in 1875, and would later become the Director of the Survey, in which post he died in 1901. Also that the paternal name would be permanently written in Dawson City, named in honour of his son. Neither could he foresee that the indefensible nepotism of the "Duke of York's Lease" would develop public ownership of the coal-seams of our Province, "ownership by the Crown in the right of Nova Scotia" eighty-six years before such public ownership became law in Great Britain itself by State purchase of the coal ownership from private landlords.

In his geological writings, as an unsigned article in the *Britannica* puts it, Dawson "maintained a distinctly theological attitude, declining to admit the descent or evolution of man from brute ancestors, and holding that the human species only made its appearance on this earth within quite recent times". He also held views on glacial periods not now accepted. And he was a doughty controversialist.

The *Britannica* article notes that Dawson studied Geology at Edinburgh University "under Robert Jameson." The full meaning of this reference is not grasped unless it is known that Jameson was an ardent "Wernerian" and remained so until his death. Some remnant of influence of Wernerian teaching is traceable in Dawson's earlier writings.

Sir Charles Lyell.

An event of especial importance to the geologists of Nova Scotia was the visit, in 1842, of Sir Charles Lyell, as recorded by this great geologist and acute observer in his *Travels in North America*, published in 1845. The Geological Map compiled

from U.S. State Surveys and other sources does not extend beyond the Lake of the Woods in Canada and the Lower Missouri River in the United States. As authorities for his Nova Scotia mapping Lyell names Dr. Gesner, J. W. Dawson, and Richard Brown. Lyell's description of his gathering with these men has unique interest, and must be quoted:

I had arranged with Captain Bayfield, whom I had not seen for many years, that we should meet at Pictou, and the day after my arrival there, his surveying ship, the "*Gulnare*", sailed into the harbour. I spent a day on board that vessel, and we then visited together the Albion Mines, from whence coal is conveyed by a railway to the estuary of the East River, and there shipped. Mr. Richard Brown, whose able co-operation in my geological enquiries I have before acknowledged, had come from Cape Breton to meet me, and with him and Mr. Dawson I examined the cliffs of the East River, accompanied by the superintendent of the Albion Mines, Mr. Poole, at whose house we were most kindly received.

At Parrsborough, after crossing the "Basin of Mines" Lyell was joined by Dr. Gesner, who "came expressly from New Brunswick to meet me" and together they inspected the famous Joggins shore-section (later made famous by Logan's description). Lyell was greatly interested in the upright fossil trees in this section, the first allusion to which he credits to Richard Brown in "Halyburton's" Nova Scotia. From this section Lyell drew the far-reaching conclusions that his genius enabled him to arrive at, based upon an observation of Richard Brown that the rootlets of *Stigmaria* which are found in such profusion in the underclays of coal-seams were really the root system of the upright *Sigillaria* trees which are to be found in the cliffs at the Joggins and around Sydney Harbour. A footnote to Brown's *Coalfields of Cape Breton* mentions that a fine specimen of a compressed *Sigillaria* stump, the "dome-shaped fossil" which so long puzzled fossil botanists, from the Sydney Coal Measures may be seen in the Museum of Geology, Jermyn Street (London).

Dawson in *Acadian Geology* gives due credit to Brown's priority of discovery:

Mr. Brown's various papers on these fossils gave to the geological world the first really satisfactory information respecting the true nature and growth of *Stigmaria*. Mr. Binney can claim priority in date of publication, but his specimens were much less perfect in detail of structure, and therefore less satisfactory than those described by Mr. Brown.

Richard Brown's discovery and Lyell's examination of the Joggins shore-section, where he noted evidence of "ten forests of fossil trees superimposed one upon the other", led him to a conclusion of commonplace acceptance in our day but of revolutionary nature a hundred years ago;

. . . All the innumerable underclays with stigmaria in North America and Europe . . . are indications of an equal number of soils, whether of dry land or freshwater marshes which supported a growth of timber and were then submerged.

"If this is true", Lyell concluded, "and the conclusion seems inevitable, the phenomenon of the upright trees in Nova Scotia, marvellous as it may be, shrinks into insignificance by comparison."

When Lyell and Gesner visited the Joggins Shore, Lyell asked if there were any meaning to this local name and a local resident "immediately pointed to the salient and retiring angles of the cliff, observing, 'You see that they jog in and out' ". Lyell was also informed that the Blue Noses were so called "from a kind of potato which thrives here". His impression of Nova Scotia is best expressed by his own words:

I never travelled in any country where my scientific pursuits seemed to be better understood, or were more zealously forwarded, than in Nova Scotia, although I went there almost without letters of introduction.

He gives instances of the courtesy of Nova Scotians which are pleasingly numerous.

Lyell was able to correct one misconception in Nova Scotia geology, namely the age position of the "Gypsiferous Formation" (which we now know as the Windsor series of the Lower Carboniferous). For reasons too obscure to explain here, it was thought that this formation lay above and not, as is actually the case, below the coal-bearing measures. Dawson and Brown, and later Logan, accepted Lyell's findings, but Gesner never abandoned his original opinion of the younger age of the Windsor limestones, and thought Lyell had been misled.

The extensive drilling for a petroleum-bearing horizon now proceeding in Cape Breton is based on the underlying position of the marine limestones of the Windsor series below the freshwater coal-bearing rocks, and the old controversy is of interest in this communication only as illustrating the very human side of the conflict of scientific opinions, of which Nova Scotia has had a fair share.

II

Historical Errors.

During the course of the 150 years which have elapsed since our pioneer geologists made their unassisted observations, actual mining operations have disclosed physical facts where formerly only surmise and deduction from incomplete data were possible. It is difficult for us to realize how lonely were the labours of these pioneers, but it is necessary to appreciate this if one is to treat fairly of many early conceptions of mining that the revelations of time have proved to be erroneous.

"Fern Ledges", Saint John, N. B.

One of the most interesting of these historical misconceptions is concerned with the "Fern Ledges" situated near Saint John, N. B. At this locality there are found beautifully preserved plant impressions, classed by Sir J. W. Dawson in 1861 as of Devonian Age. At this early date Dawson was an isolated pioneer worker and had access to few figures of Palaeozoic plants as described by American and European workers. Dawson established and named as new species many fossil specimens now recognised as common typical Carboniferous flora.

Dr. G. F. Matthew, an old friend and colleague of Sir William Dawson, whose writings on New Brunswick geology extended from 1863 to his death in 1923 at the age of 86 years, supported Dawson's assignment of the Fern Ledges to Devonian Age, but in his later years Dr. Matthew regarded them as of Silurian Age. This heterodox opinion caused a great fluttering in international palaeontological circles, because the fossils as collected and described by Dawson and Matthew are, in fact, a typical assemblage of Carboniferous flora. And as this fact became plainer, one of the liveliest controversies, of worldwide extent, resulted, leading to the Canadian Geological Survey securing the services of a remarkably accomplished lady, Miss Marie Stopes, a palaeontologist of world repute and a student of coal substance whose original work pioneered a branch of coal geology now having tremendous economic consequences. Miss Stopes settled the controversy by her Report of 1914 establishing the Carboniferous age of the "Fern Ledges" plants.

It is related, however, by Dr. F. J. Alcock, in his Report on the Geology of Saint John, N. B. (Memoir 216, 1938) that Dr. Matthew remained unconvinced. Only a couple of years prior to his death in 1923, at the age of 86, he traversed nearly the whole of the Bay of Fundy coast from Saint John westward,

gathering information about the disputed beds, and at the end had a paper nearly ready for publication maintaining his views of their Silurian age. Miss Stopes, in her historical preface, considers Dr. Matthew's views "a claim so startling to palaeontologists" as to require thorough and impartial sifting of the evidence.

Actually, as it appears to us at this date, the engagement of Miss Stopes by the Canadian Geological Survey reflects credit on the respect in which that distinguished Department holds the memory of Dawson and his co-workers. Their action is not without its pleasing aspects.

Miss Stopes expresses her thanks to Dr. Matthew for accompanying her on excursions near St. John . . . "pointing out features of interest and recalling delightful reminiscences".

The McCullough Fault.

Another misconception removed by mining explorations is the locally famous "McCullough Fault" in the Pictou Coal-field. This hypothetical fault, a favourite subject of discussion among miners for 75 years, was based on the belief that the Westville coal-seams and the Stellarton seams were laid down as one continuous deposit, when in reality they are deposits of vastly different ages. The presumed "fault" was shown on Sir William Logan's map of 1869, and its assumed position shifted on later map revisions as the coal-workings progressed without meeting any dislocation of the measures. The great authority of Sir Wm. Logan's name—the Father of the Geological Survey—and the extraordinary structural complexity of the Pictou Fields, discouraged general recognition of the non-existence of the McCullough Fault until coal workings demonstrated this fact, although 30 years ago the writer suggested there was no McCullough Fault. The fact is that an understanding of the Pictou County coal-fields could not be arrived at on a basis of structural geology. It has remained for Dr. Walter A. Bell, carrying on the tradition of the Geological Survey, to apply the science of paleobotany to the elucidation of the puzzle and to determine that the Pictou County coal-bearing district contains not one, but three, coalfields, one superimposed above the other, under greatly variant conditions' at epochs separated by long stretches of geological time.

Sydney Harbour "Fault".

Richard Brown's map of the Sydney Coalfield is astonishingly accurate as drawn, and it is difficult for present-day

students of the coalfield to realize that the correlation of the seams across the field, which are today known without possibility of misunderstanding through actual mining operations, should have so puzzled Brown and caused him to state that "beyond all doubt, the Sydney Mines measures are the very lowest in the field." Actually they are the highest. His difficulty seems to have been grounded in his natural ignorance of the fact, later recognised, that the lower seams of the Glace Bay area die out going westwards and do not extend to the Sydney Mines area.

Indeed the smaller extent of the lower seams in the Sydney Coalfield as compared with the upper seams has only become apparent through mining operations only quite recent years.

Brown thought it evident that under the waters of Sydney Harbour "there is one, perhaps two large faults." We know now there is no fault, merely a twisting of the measures.

III

Old Writers.

In reviewing the early evolution of precise knowledge in coal geology of Nova Scotia the writer desires least of all to appear to discount the labours and the vision of the pioneers. On the contrary, his apology is that when he came to Cape Breton, forty years ago, the only works of reference available were those written by these same pioneers, Richard Brown, J. W. Dawson, Henry S. Poole, and Edwin Gilpin, Jr., excepting, of course, the dependable and accurate publications of the Canadian Geological Survey, chiefly the reports of Robb and Fletcher, and very notably their "Note on the Sydney Coalfield" of 1900. The great flowering of Nova Scotia intellect as applied to the natural sciences was between 1830 and 1875, after which date absorption in daily work and the economic struggle which accompanies the marginal and outpost situation of Nova Scotia in the continental economy seems to have discouraged personal amateur studies in our Province. Our cultural base shifted to the great universities of Montreal and Toronto, with their intensive specialization of branches of applied science. Our young people have gone from these metropolitan schools to build up our Canada, and were largely lost to Nova Scotia during the first quarter of the current century and until the economic storm of the 'thirties. There are now signs of renaissance in our provincial culture, and some of the economic difficulties we have

met in Nova Scotia are seen to arise from our own failure to help ourselves both by local learning and by local industry.

We have to an unfortunate extent relied on the pioneer work of our native scientists. Many of them were self-taught amateurs in their beginnings, who passed along their knowledge with its contemporary limitations to us, which knowledge we have too much accepted without using our own critical faculties. We have, as a people, tended to submit our problems to outside expert opinion, and have acquired a frame of mind that sometimes mistakes insurgence for independence and borders on mendicancy. We could well follow the pioneer acuteness of the fathers of Nova Scotia, while using our own faculties to round out and supplement the heritage of knowledge they left us.

Our Nova Scotian pioneers of geology were self-instructed men.

Gesner was a surgeon, Honeyman a clergyman, Dawson a great educationist, and Brown a coal-mining engineer.

All of them—contrary to the saying of the tired cynic who penned *Ecclesiastes*—knew that there was much new and undiscovered in our changing planet, and they themselves, with others who followed them had much profit from their labours.

One had even thought that this generalization was original, applying to Nova Scotian tradition especially, had not one found in Sir Archibald Geikie's *Founders of Geology* the following eloquent passage:

Of the whole gallery of worthies that have passed before us, a comparatively small proportion could be classed as in the strictest sense professional geologists . . . From the beginning of its career, geology has owed its foundation and its advance to no select and privileged class. It has been open to all who cared to undergo the trials which its successful prosecution demands. And what it has been in the past, it remains to-day. No branch of natural knowledge lies more invitingly open to every student who, loving the fresh face of Nature, is willing to train his faculty of observation in the field, and to discipline his mind by the patient correlation of facts and the fearless dissection of theories. To such an enquirer no limit can be set.

He may be enabled to rebuild parts of the Temple of Science, or to add new towers and pinnacles to its superstructure. But even if he should never venture into such ambitious undertakings, he will gain, in the cultivation of geological pursuits, a solace and enjoyment amid the cares of life, which will become to him a source of the purest joy.

One may conclude this communication by the oft-quoted words which end Geikie's book:

Proving all things and holding fast that which we believe to be true, let us look back with gratitude and pride to what has been achieved by our forerunners in the race, and while we labour to emulate their devotion, let us hold high the torch of science, and pass it on bright and burning to those who shall receive it from our hands.