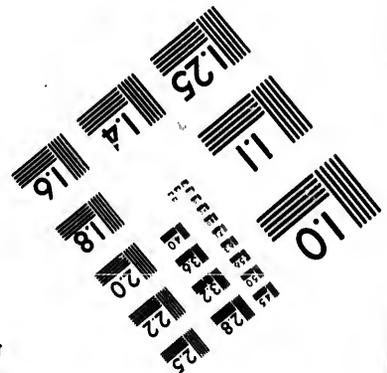
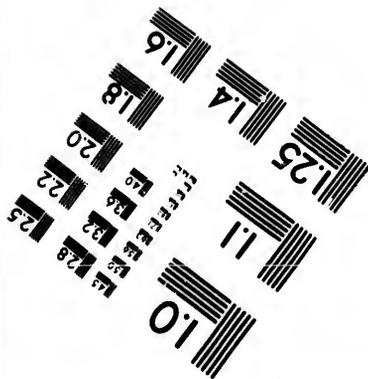
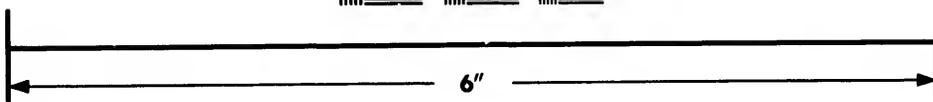
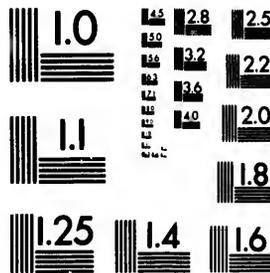


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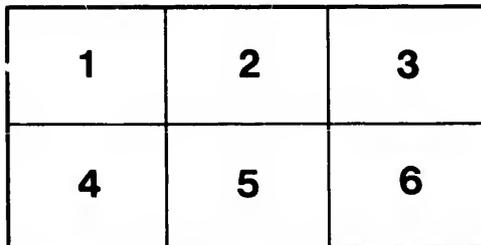
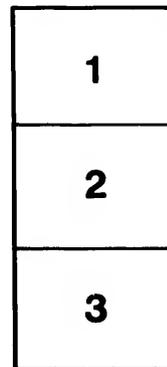
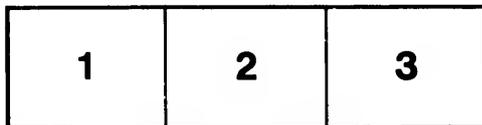
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(From the Canadian Naturalist and Geologist for August, 1860.)

NOTES ON THE COAL FIELD OF PICTOU.

BY H. POOLE, Esq.

Superintendent of the Fraser Mine.

(Communicated to the Natural History Society by Principal Dawson.)

[The facts contained in the following communication, may be regarded as supplementary to those noticed in my Acadian Geology, and in a paper by Mr. Poole and myself, published in the proceedings of the Geological Society. The coal measures of the Albion mines, dipping to the N. E., at an angle of about 18° contain the great main seam, 36 feet in thickness, and 157 feet below this the deep seam, a bed of inferior but still great thickness. To the north-west these coal measures are apparently cut off by a great bed of conglomerate dipping north, beyond which occur other coal measures, also with northerly dip. For reasons stated in the publications above mentioned, I regard the great conglomerate of New Glasgow above referred to, not as a recurrence of the Lower Carboniferous conglomerate, but as a bed of the date of the coal formation, a contemporaneous shingle beach, which shut off the Albion Mines coal area, and occasioned its exceptional character. In connection with these facts and views, Mr. Poole's observations bear on the following points; (1). The character of the coal measures below the deep seam, previously little known. (2). The sudden bending of the outcrops of the coal seams to the southward, west of the Albion Mines, so that they assume northerly dips for some distance, though they appear to return to a N. E. dip further to the westward. (3). The occurrence of a narrow and abrupt synclinal immediately to the N. E. of the Albion Mines, succeeded by an anticlinal, near the axis of which in this locality is the outcrop of the great conglomerate. (4). The results of explorations made in the measures north of the conglomerate, confirming apparently the difference of these in character, from the great coal measures south of the conglomerate. (5.) The frequent occurrence, as at the Joggins, of scales of fishes, bivalve shells, *Cypris* and *Spirorbis* in connection with the beds of "Oil Shale," and coal. I have added a notice of these fossils to Mr. Poole's paper. J. w. D.]

The operations of the Fraser Oil Coal Company were carried on during the past year in a seam of coal and bituminous shale

situated upon the Coal Brook, and underlying the seams of bituminous coal worked by the General Mining Association.

The respective out crops of the deep seam and the Fraser oil coal being 528 yards apart on the surface, and the general dip N. 42° E., at an angle of 18 degrees, or 1 to 3, the oil coal will underlie the deep seam 528 feet in perpendicular section.

It is situated about 60 feet below the tabulated section given in Haliburton's History of Nova Scotia, which distance is chiefly occupied by strong bands of sandstone, whose actual thickness is not yet proved, thin soft shales with bands of ironstone, *Stigmaria* with *Sigillaria* and a few detached fern leaves (*Neuropteris*), in such soft shale that I have not been able to preserve any good specimens. Immediately above the oil coal are fourteen inches of bituminous coal, but only the lower four inches are of good quality, the upper part being of a soft friable nature, producing a great deal of ash.

The oil coal has a smooth regular parting at top, next to the coal, as well as at the bottom, next to the oil shale, but varies in its thickness from a few inches up to twenty. Throughout its entire thickness it has a curled and twisted structure, many of its fractures look like the casts of shells, and the sharp edges are polished and stickensided. No fossils that I am aware of, have hitherto been found in the "curly" oil coal, but scales of calcareous spar are often met with in the joints. The oil shale next below is nearly two feet thick, of a homogeneous character with a shaly cleavage of various thicknesses. In this band a few scattered ganoid scales have been found, and two or three varieties of lepidodendron beautifully preserved, also leaves of *Cordaites* of various lengths and breadths, which have undergone so little change, that pieces from four to six inches long, and in breadth about a quarter of an inch, could be removed when the shales were first split, and were so elastic that they could be bent considerably without breaking. In the argillaceous shales below are bands containing innumerable *Cypris* and *Spirorbis* shells. The crop of a small seam of coal which must underlie the oil coal about thirty feet is seen in the brook. There are surface indications of the coal measures continuing for a considerable distance towards the south-west, and this has been proved to be the case by Robert Culton, who is opening up a seam of coal upon his farm upwards of one mile and a quarter distant, to the rise of our mine, which will be alluded to hereafter.

There are numerous small faults running across the measures in the Fraser Mine, which are uniformly downthrows to the west : and I may here mention that I observed some years ago in the deep seam several faults of from four to ten feet each, which could not be found in the main coal workings above (the distance between the two seams is $157\frac{1}{2}$ feet), which shows that the disturbances must have taken place previous to the formation of the main coal seam ; a fact which should not be lost sight of in investigating this extensive coal-field.

The oil coal has been traced from the Fraser Mine eastward as far as the main road, but from thence down to the East river there is a great thickness of drift which appears to have cut off the crop. It has not been traced on the east side of the East river, and, although a bed of oil coal has been found and worked by A. Patrick on the McLellan Brook, I am inclined to think it is not a continuation of the same seam, but—from the fossil—sof one much lower down in the coal formation.

To the west the oil coal has been traced for half a mile, with a line of strike parallel to the deep and main seams, or a course about $N. 50^{\circ} W.$ to the top of the hill, where there is evidently some disturbance, the sandstone appearing on edge and dipping in different directions. It was next found in the McCulloch Brook at a considerable distance up the brook, or to the south of the general line of strike, where it was found to dip 13 degrees $N. 67^{\circ} W.$ The oil coal is here of a much richer quality than at the Fraser mine, and from the free way in which it burns, throwing off stars or sparks of light, it has been named Stellar coal to distinguish it, and an adit is now being driven in it back towards the Fraser mine. It also varies in thickness from two to twenty inches, and as the coal roof is regular, I should infer from the twisted appearance of the oil coal that it has been in a pasty state and subjected to great and unequal pressure.

1600 tons of two qualities were shipped to Boston, in 1859, from the Fraser mine, the top seam of curled coal yielded in the D retorts 63 gallons per ton, and the second quality of shale, 45 gallons per ton of crude oil. A small sample of the stellar coal gave 77 gallons per ton of crude oil. I am told that the rotating retorts produce 30 per cent more oil from the same material than the D retorts. Some picked samples from Duncan McKay's adit tried in Boston gave 199 gallons per ton. Torbane Hill mineral yields 125 gallons ; the Albertine coal of New Bruns-

wick gives 100 gallons, and the Lesmahago Cannel of Scotland gives 40 gallons per ton of crude oil.

Professor How of Windsor has sent me the following analyses of these coals.*

Fraser Mine	No. 1.	Stellar Coal	McCulloch Brook.
Moisture	0.39	Moisture	0.23
Volatile Matter	33.43	Volatile Matter	66.33
Fixed Carbon	10.78	Fixed Carbon	25.23
Ash	55.40	Ash	8.21
	100.00		100.00

The ultimate analysis of the Stellar Coal yielded:—

Carbon.....	80.96
Hydrogen.....	10.15

Two small trial holes have been made by Mr. R. Culton in the bank of the McCulloch Brook at 124½ chains distance from the south division line of the Fraser mine. The coal measures dip N. 40° E. 22°, but as there is the appearance of a fault which has thrown up the measures, they will no doubt be found lying flatter when sunk upon to the deep.

There is here a confusion of seams, consisting of bright bituminous coal, and cannel-like curled oil coal with bituminous shales; in the latter is an abundance of fossils. I obtained *Lepidodendron*, *Cordaites*, and other markings which I have regarded as similar to the *Cardiocarpon acutum* of Mantell; also a stalk, with a head like ryegrass.† One band or more of the shales contains innumerable *Spirorbis* and *Cyprides*, and accompanying them are ganoid fish scales, teeth and spines. Thick plates or scales are also found on the same slab with the *Cardiocarpon*. Similar plates are found at J. McKay's mine south of New Glasgow as well as in the bituminous shales near Smelt Brook, and at the basin; both of the latter places being to the north of the conglomerate ridge. There are appearances of crops of coal and shales in several places on the McCulloch Brook between Robert Culton's farm and the Fraser mine, but they have not yet been examined.

Proceeding down the McCulloch Brook to the adit worked in the stellar coal, and at about 200 yards distance south, underlying the stellar coal, is the crop of a coal seam about five feet thick, dipping 21° N. 25° W. of inferior quality, with a band of

* Professor How has since published these and other analyses in a paper in the Ed. New Phil. Journal, and Silliman's Journal.

† Antholites?

calc spar running through it (the same thing was observed in a trial pit sunk to the rise of the oil coal on Duncan McKay's farm) with *Sigillaria*, *Stigmaria* and *Cordaites* in the soft crumbling coal, so that specimens could not be preserved; a thin seam of coal with shales lies about 30 feet below the stellar coal dipping 16° N. 55° W.

The stellar coal seam has a black friable clay above the coal with ironstone balls in the shale above. *Lepidodendron* and *Stigmaria* have been found in the coaly bands, and *Cordaites* in small fragments and one *Cardiocarpon?* (similar to those at R. Culton's seam), have been found in the clay ironstone; also a few ganoid scales and nodules full of soft ochreous matter, of no decided form. The measures here are much disturbed: in the adit on the east side of the McCulloch brook the dip is 13° N. 67° W.; while on the west side of the brook the stellar coal dips 12° N. 45° E. We have not been able to trace the strike of the stellar coal farther west, owing to the covering of drift, which ranges from 40 to 50 feet in thickness between the two brooks. At 220 feet from the entrance to the adit we have cut a fault running north-west and south-east, which is a downthrow to the east, and is the first of that kind that has been met with in the Albion coal field. Its size has not yet been accurately determined, nor whether it is the main fault, or only a branch that has thrown all the coal measures round, and made their outcrops so much farther south than the general strike at the Albion Mines indicated*.

Descending the McCulloch Brook, but in ascending order for the measures, some trial pits and boreholes have been sunk, but only thick beds of fire-clay and black shales discovered; at 15 chains distance from the stellar coal is the crop of a coal seam, thickness not satisfactorily proved, with a band of shale full of *Cypris*, dipping N. 20° W. At the next bend of the brook three chains distant is the outcrop of beds of sandstone dip N. 22° E. 15° ; and three chains further on is a coal seam five feet or more in thickness, with bands of shale intermixed dip N. 26° E. $7\frac{1}{2}^{\circ}$; thence the distance is five chains to the old Middle River Telegraph road, where there is another crop of a coal seam, which I believe to be the

* While I am writing we have struck another fault bearing N. 8° W., S. 8° E., dipping S. 82° W. 45° , being an upthrow to the east, and of which the first fault is a branch. It is eight feet up as far as we have gone, and we are not yet through it.

continuation of the deep seam of the Albion Mines ; dip 12° due north. Here also the measures are disturbed by small faults, and the pit is sunk on the crop, so that we cannot judge very correctly of the actual thickness, or quality of the seam. Nineteen feet 5 inches of coal have been sunk through, of which Mr. Fraser is working the lower 7 feet 3 inches ; I have made the following analyses.

Deep Seam	Sp. Gr.	Vol.		Fixed		Ash	Color of Ash.
		Mat	Coko	Carbon	Cokes		
No. 5 Band 1	2.9	1.355	22.50	77.50	67.00	10.50	Grey white.
2		1.383	22.25	77.75	60.50	17.25	do Dun.
3		1.342	21.50	78.50	70.25	8.25	do Dun white.
No. 6 Band	2.0	1.440	20.00	80.00	57.00	23.00	do Grey white.
No. 7 Band	2.6	1.335	20.00	80.00	68.00	12.00	do Dun white.

Worked 7.3

Lepidodendron got in No. 6. Band.

Eight chains further north is the crop of another coal seam which shows in the brook for a breadth of two chains, and therefore corresponds with the main seam. *Stigmaria* was got in the underclay at a small trial pit. The shales and sandstones dip south on the old Glebe and Duff's farm to the north of the Association's reservation ; and at the Burial ground I found by the bank of the East river the measures dipping $S.20^{\circ} E.63^{\circ}$; showing ripple marked sandstone, *Calamites* and *Stigmaria* : the shales contained *Cypris*. At the Gondola wharf the shales dip $S. 45^{\circ} E. 50^{\circ}$; and by the side of the old quarry road (Fraser Ogg) we sank a pit 15 feet and got one foot of the curly oil coal, dip $S. 20^{\circ} W. 50$, but it thinned out in going down and was close on the conglomerate.

At the Basin there are several thin seams of bituminous shale. An inch of coal shows about fifteen feet above the shale at the dam, containing fish remains, but it did not appear in the trial pit. The position and thickness of the bed containing the fish remains and *Cypris* corresponds with the upper seam of bituminous shales on the opposite side of the East river. They yield upwards of 60 gallons of crude oil of superior quality to the ton ; but are too thin to be worked profitably.

We are now boring to prove the measures at Mathieson's farm opposite to the Loading ground, and have sunk a pit down 14 feet on drift gravel and clay, then 5 feet of soft blue sandy clay with no regular cleavage, full of fossils. I obtained *Lepidodendron*, *Lepidostrobos*, *Calamites*, *Pecopteris*, *Neuropteris*, and fragments of other plants, but the clay was soft and crumbled immediately on exposure to the atmosphere so that I could not preserve good specimens : then followed three inches of black friable clay ; then

1.3 of good coal yielding water, dip 5° N. 25° E.; succeeded by strong grey sandstone, through which we are now boring. At Forbes's Point a borehole was put down 75 feet but nothing obtained but red and white sandstone in thick beds.

At low water an inch of coal and fire-clay is seen to crop out upon Skinner's point but nothing else has been observed along the shore of the Middle River.

Returning up the East river to Smelt Brook, several seams of bituminous shale and sandstone appear in the bank, also one small seam of an inch of coal, with sandstone bands of different thicknesses and qualities; the No. 1 and 3 seams of shale are particularly full of fish remains and coprolites near the roof, and the large plates appear like *Glyptolepis* figured in Miller's Testimony of the Rocks, page 229: I also found one or two grooved plates which correspond with the *Osteolepis*. The roof of No. 1 seam is one mass of *Cypris* shells; No. 2 contains principally small ganoid scales; No. 3 seam has small fish jaws and small *Lepidodendron* and *Poacites* on the roof.

The sandstone bands contain *Calamites*, and large roots of *Stigmara* with their accompanying rootlets. Here the inch seam of coal appears below the bands of bituminous shale succeeded by the *Unio* shells, unless fault has caused the outcrop of these bands to be repeated.

Ascending the East river and to the south of Smelt Brook, is a thick band of coarse sandstone full of hard flattened red concretionary balls and ripple marked; then comes a four inch band, of honey-combed, concretionary limestone, in which I have detected a piece of shell in the fresh fracture, and which looks like the metamorphic rock near Churchville. I could not find any fossils in the pit sunk at Sinclair's cove.

The adits driven in upon the coal to the south of New Glasgow, by the side of the road to Antigonish, are upon the anticlinal axis; both mines have the same fish remains in the roof, and limestone pavement, and cannot be worked far to the northwest before they will be cut off by the conglomerate. The fish teeth are abundant in the roof. In one slab four by six inches, I counted fifteen large *Diplodus* teeth. Higher up the brook and road, I am told, the crop of the coal shows a dip to the N. W., but I have not yet seen it.

The shales and coal up the McLellan Brook, dip from E. by the bridge at George Fraser's farm, to S. 15° E. at Turnbull's farm,

then the measures are reversed, and at A. Patrick's adit, they dip N. 45° E. 30°; where the oil shales have been worked for about 100 feet, and having struck a fault have been cut off by the other shales dipping S. 20° E. 25°. Mr. Patrick has proved a seam of bituminous coal about three feet thick, dipping to the N. E. underlying his oil shales near the foot of the mill dam, in addition to the small seam which shows in the bank of the mill pond. I am told that the high conical hill just verging to the south, contains iron ore, and that it is succeeded by limestone.

[Among the fossils sent by Mr. Poole, the most interesting are the following :

Of placoid fishes there are, 1. *Diplodus penetrans*, N. S. This is smaller than the species *D. acinaces*, found commonly in the upper part of the Albion Main Seam, and described by me in a supplementary chapter to my Acadian Geology, now in press. The height of the tooth is $2\frac{1}{2}$ lines, and almost equal to the breadth. The lateral denticles half as broad as high, flattened and serrated, especially at the outer margin and near the base; cross section of the denticles rhomboid. They diverge at an angle of 35° to 40°. The central denticle is minute and conical. 2. *Ctenoptychius*, a small species indicated by a tooth with eight denticles. The specimen is an imperfect impression.

Of ganoid fishes there are numerous scales of small species belonging to *Palaeoniscus* or allied genera, broad flat scales punctured and lined after the manner of *Osteoplax* of McCoy, and others marked with fine wavy lines, as in *Holoptychius* or *Rhizodus*. There is also a curved conical tooth belonging to one of these latter fishes, and differing from others that I have seen in having the concave side marked with fine spiral ridges nearly to the point. There are also certain flat sabre-like spines of small size, but much resembling in form those of the Devonian *Machæracanthi*.

The above are chiefly in the coals and shales overlying or near the great conglomerate. In the lower measures at McLellan's Brook, are bivalve shells of that modiola or unio-like form, characteristic of the fresh and brackish water portion of the coal measures, and which I have elsewhere designated by the generic name *Naiadites*. They are all thin, inequilateral, toothless, and marked by concentric lines of growth. A new species in the present collection, *N. obtusa*, is characterized by the broad and

truncate outline of the anterior extremity, giving it a somewhat quadrilateral form.

The *Spirorbis* found abundantly in several of the beds noticed is the ordinary *Sp. (Microconchus) carbonarius* common to the American and European coal fields.]

On new Localities of Fossiliferous Silurian Rocks in Eastern Nova Scotia. By REV. D. HONEYMAN.

(Read before the Natural History Society.)

This subject has already been very fully discussed in Dr. Dawson's Acadian Geology and in his recent paper read to this Society, with Professor Hall's elaborate and valuable Memoir on the Fossils of Arisaig.

A few notes by another observer who is now labouring in the same interesting field may not be unnecessary and unacceptable. A catalogue of the most interesting Silurian Sections in Nova Scotia is already given in the paper referred to. To this I would now add two altogether new and equally interesting localities, which I shall endeavour to describe, adding some observations upon a supposed extension of the Arisaig Section.

The first of these localities is to the S. W. of Merigomish in the county of Pictou and on the north of the Metamorphic hills that extend between Barney's River and East River, *vide* Dawson's Geological map of Nova Scotia. The first and lowest part of the section, as yet observed, occurs at a place where the Antigonishe and New Glasgow new road crosses a small brook about $3\frac{1}{2}$ miles west of Barney's River and to the east of French River and about 5 or 6 miles from the Gulf of St. Lawrence. Here there is a quantity of shale which is apparently very little altered, having fossils in good preservation. At the side of another small brook to the westward, we have similar shale with correspondeng fossils. This appears to be equivalent to the Arisaig group of Clinton age, as we have here the *Graptolithus Clintonensis*, *Strophomena corrugata* and a species of *Orthis* which is characteristic of the Graptolite shale of Arisaig; we also found a trilobite which is however different from any that has been met with at Arisaig. We have also fossils like those of the upper Silurian group of Arisaig, abounding in the drift from French River, till near

Sutherland's River, where there is a small brook which is crossed by the road already referred to, and which has on the one side drift with Silurian fossils and on the other or northern side the lower carboniferous Conglomerate.

Among these fossils we find *Homalonotus Dawsoni*, *Dalmania Logani*, *Beyrichia pustulosa*, *Chonetes N. Scotica*. *Chonetes tenuistriata*, *Crania Acadiensis* and other organisms characteristic of the Arisaig series.

There is thus every reason to suppose that we have here discovered a section exactly parallel to that of Arisaig. On account of its inland position we cannot have the aid of old Neptune in disintombing its ancient inhabitants, so that its fauna cannot be collected and studied with equal advantage. It is nevertheless to be regarded as interesting on account of its similarity; and as collections of its organisms even under existing circumstances are by no means insignificant, either in number or variety, it is possible that a detailed examination of this new locality may aid in unravelling some of the Arisaig mysteries.

The second new section to which we would refer is situate at the head of Lochaber Lake in the county of Sidney, and on the east of the Ohio River. It appears to extend about 2 miles from N. to S. on the west side of the lake. The strata consist of grey slate which has been very much hardened and thrown into a vertical position. The fossiliferous strata appear only on one side of the lake, except where it bends in a westerly direction, and the highest of the Lochaber hills approaches the lake, and then a patch of the grey slate appears on the opposite side. A small lake to the west of the great lake, and from which a stream flows into the Ohio River, bounds a considerable part of the western side of the section. Where the strata are exposed on the highest or S. W. side and in the beds of two or three small brooks, fossils are found *in situ*. Their number is considerable but their variety does not yet appear to be great.

In consequence of the highly altered state of the strata, casts only are found, but these are often very beautiful. In this state we have abundance of *Pentamerus*, *Orthis*, *Cornulites* and corals. These all appear to be characteristic of this section. A conical or turbinated species of coral is peculiarly so and is of very frequent occurrence and often very perfectly preserved.* It is truly beauti-

* A *Zaphrenitis*, see note.

ful, and appears to the common observer as the most striking of the Nova Scotia silurian fossils in my collection.

I have also found here, but not in situ, a cast of a large *Orthoceras*. Its length is 8 inches—it tapers very little—the siphuncle is central—cross section is elliptical having a transverse diameter of $1\frac{1}{2}$ inches and a conjugate diameter of 1 inch. The fossils of this section are generally found like our elegant coral and *Orthoceras* in the cairns piled up by the farmers in the overlying fields. In the cairns of the northern part of the section the fossils appear chiefly to correspond with those of the upper group of Arisaig. Here we have the *Dalmania Loganii* the *Calymene Blumenbachii* the *Bellerophon trilobatus*, and a tuberculated crinoid, so that it is possible we have here an equivalent of the upper Arisaig groups as well as a lower group probably the equivalent of the Wenlock limestone of Murchison.

I hope yet to have opportunities of examining these sections more in detail, and of submitting full collections of their fossils to the proper authorities, in order that their true age and the character of their organisms may be determined.

I would refer also to a subsection, which although not so interesting to the collector may be of equal interest to the geologist, as it is possibly to be regarded as a descending continuation of the Arisaig section. It occurs at Doctor's Brook about $2\frac{1}{2}$ miles east of Arisaig Pier. This will make the whole Arisaig section extend about 5 or 6 miles S.E. and N.W.

The Silurian strata are here very much altered and distorted, arising, as Dr. Dawson has already observed, from volcanic action of the carboniferous era. Of this there are obvious remains existing at various points along the sea shore from the conglomerate on the east to the conglomerate on the west of the Arisaig Silurian strata, or from Malignant Brook till beyond McCara's Brook, a distance of at least ten miles. In Malignant Brook and a little brook to the eastward, we find subcrystalline trap in immediate contact with the lower carboniferous conglomerate, and the latter has consequently become very much hardened; to the west of this the section is obscure and depressed till we reach a small brook having elevated ground on its western side, and there is no appearance of rock of any kind until we meet the subcrystalline trap and altered Silurian strata of Doctor's Brook. From this point to Arisaig Pier we find the same kind of trap in contact with the Silurian strata, and converting these into a red jaspida-

ceous rock or otherwise hardening and altering them in proportion to their proximity to the point of contact. The results are the conspicuous red and oblong rock locally known as the "Frenchman's Barn," the breakwater of Arisaig pier, the hardening and tilting of the slate and shale near the Frenchman's Barn and the prevailing disorder of the Arisaig Section.

When we again meet with volcanic rock, it assumes the form of beds of amygdaloid associated with the lower carboniferous conglomerate at McCara's Brook.* This rock has suffered much from denudation as is evident from the horizontal section on the beach; a large mass has been dislodged by the frosts of last winter and it is evident that after a number of years it will entirely disappear and the present picturesque appearance of this part of the section be materially affected or destroyed.

The distorted shale at Doctor's Brook contains fossils, but these are by no means abundant or of a superior grade. After a strict search I have found a bed of *Lingula* of two or three varieties, associated with a group of a small species of *Orthis*. In another place, I got the casts of a delicately striated shell resembling a compressed *Chonetes*, an impression of the aster of a small crinoid joint, and at some distance to the south I met with one or two *Lingula cuneata*? one specimen of which measures from the umbo to the base 9 lines, and a shell of a different kind, resembling in shape *Clidophorus concentricus*, but having the surface marking *reticulated*. I will take an early opportunity of transmitting the cast of this and duplicates of the others for determination. These fossils were found in situ, and they lie at right angles to the slaty fracture.

The masses of trap, the Frenchman's barn and the rugged crags at the mouth of Doctor's Brook, shew that in this region the volcanic action has been very violent and the fossiliferous strata have been so distorted that there is for a considerable distance southward no appearance of stratification remaining. The lofty banks of shale present this aspect until we reach a point in the brook where a Plutonic rock again appears, there is then an interval and the shale then appears to dip at a certain angle and in a uniform direction. This igneous rock appears to indicate the

* For a detailed notice of this place see *Journal of Geological Society* Vol. 1. p. 239.

reason why the preceding strata have been so much shattered and distorted,—to shew that they have been subjected to the violent action of igneous forces before, beneath, and behind.

(Note by Dr. Dawson.)

The observations recorded in the above paper by Rev. Mr. Honeyman are of much interest. They establish the continuation of the Arisaig line of outcrop to the East River, as suggested by me in my paper lately published in this Journal. They make known for the first time the occurrence of fossils at Lochaber Lake, in rocks supposed from their mineral character to be of the age of those of Arisaig and N. Canaan. The fossils found by Mr. Honeyman confirm this view, and probably also indicate the occurrence there of another and perhaps newer group, similar to that of Nictaux. The position of this place accords with the idea of a succession of anticlinal and synclinal folds proposed in my paper. Mr. Honeyman has also apparently extended the Arisaig series downward by the discovery of fossils in the slates of Doctor's Brook, in which I have often searched in vain for such remains. I shall look with much interest for specimens from this place.

Among the fossils kindly sent to me with the paper, are some throwing new light on species previously imperfectly known, and others that are new to Nova Scotian Geology. The following especially deserve notice.



Fig. 1.

1. *Homalonus Dawsoni*,—(Hall.) The caudal shield and portions of the articulations of the body, were the only parts known when the species was described by Prof. Hall. Mr. Honeyman now sends nearly perfect specimens of the head. It has the posterior border nearly straight, the glabella moderately prominent and slightly wider behind than before. It descends abruptly in front, and the frontal margin, which is absent in the specimen figured, appears to have risen in front of the glabella and eyes, with equal abruptness. The eyes are large and prominent, and advance into a line with the front of the glabella. Some of Mr. Honeyman's specimens shew that the species attained to a considerable size, at least three times that indicated by the head now figured. (Fig. 1 above.)

2. *Phacops Stokesii*,—(Edwards.) A cast of a head referable to this species, for notice of which and the closely allied *P. Orestes*, (Billings.) see Mr Billings's paper in *Canad. Nat.* vol. 5 pp. 65 and 66.

Of two other trilobites, fragments of which have been sent by Mr. Honeyman, one is according to Mr. Billings, a *Proetus*, the other a *Dalmania*, allied to *D. socialis*.

3. *Orthoceras exornatum*, N. s. This very prettily marked species is circular in its cross section, moderately tapering and straight, with siphuncle slightly eccentric, and septa half a line to a line apart, in a specimen two to four lines in diameter. The surface is slightly annulated and ornamented with about twenty-four flat longitudinal flutings in the manner of a Doric column. The whole surface is also delicately striated transversely. In some respects it closely resembles *O. canaliculatum*, (Sow.) of the English Wenlock.

4. *Theca Forbesii*,—(Sharpe.) A little Pteropod in Mr. Honeyman's collection, appears perfectly identical with this species which is found in the Ludlow of England, and which resembles the *T. triangularis*, (Hall) of New York.

5. *Pleurotomaria*,—A flattish species with four turns, and interesting as being apparently the same with one common in the supposed equivalent of the Upper Arisaig group at Nictaux.

6. *Platyostoma*,—A species allied to *P. Niagarensis* of Hall.

7. *Bellerophon*,—Diameter, $\frac{1}{2}$ inch, carina prominent and broad, outer and umbilical slope of whorls steep and straightish, so as to give a somewhat rhomboidal cross section, surface with strong sharply waved transverse striæ, crossed by finer longitudinal striæ, cast of interior nearly smooth, with traces of transverse striæ. This shell much resembles Hall's *B. stigmosa* from the Clinton.

8. *Bellerophon*.—Two imperfect casts representing forms similar to *B. expansus* and *dilatatus*.

9. *Zaphrenitis*,—A cast not sufficiently perfect for specific determination, but not unlike imperfect specimens from the Devonian of Nictaux. This specimen is from Lochaber Lake.]

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