

ART. VII.—THE DEVONIAN OF CAPE BRETON. By E. GILPIN,  
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(Read 14th April, 1890.)

In my last paper on the Geology of this Island, I described the minerals of the Carboniferous Division, and have now to touch upon the horizon next in descending order. The exact delimitation of this horizon palceontologically speaking may yet be among the unsettled problems, and the knowledge so far learned of its relations in Cape Breton may perhaps be summed up by saying that it carries back a step the conditions so widely prevailing here at the opening of the Carboniferous. No distinctive harvest of the flora permits the correllation of its divisions. It may however be asserted that the position is of more importance than the name, and that here it fills a gap, more or less completely, between the Silurian and Carboniferous. As exposed here it is a formation not of special interest from a geological or mine-ralogical point of view, and at present the most interesting field for study offered by it are the numerous dykes and their metamorphic powers.

Geographically speaking it begins at Loch Lomond, near the county line, and runs toward MacNab's Cove, having a selvage of Carboniferous between it and the Pre-Cambrian felsites of East Bay. From MacNab's Cove it runs to St. Peter's, shewing itself at the head of the various coves and indentations, the islands and points of land being covered by the Carboniferous. From St. Peter's it fills the shore eastward as far as Lower L'Ardoise, where it meets the Pre-Cambrian, and skirting these measures runs north-easterly to the Grand River which it follows to the place of commencement. Several outliers of it are met on the east bank of the river, resting on the felsites which occupy almost all the shore as far east as

Mira Bay. All Isle Madame (Arichat Island) is occupied by it, except a narrow fringe of carboniferous extending from Grandique westwardly along the north shore, and a few patches of felsites, etc., near Arichat town and Petit de Gras Harbor. It is met again on the Guysboro' shore, and extends nearly to the mouth of the Strait of Canso where it crosses into Cape Breton again. Here it stretches along the shore from Port Hastings to Low Point, and extends inland about six miles, among the spurs of the band of crystalline limestones, gneisses, etc., which is best known by its exposure at Whycocomah. From this it will be seen that the extent of these measures in Cape Breton is limited, and that they do not form mining or agricultural districts. They are most particularly presented to the traveller passing through Lennox Passage, where he sees the low, monotonous, spruce-covered hills of Arichat Island, broken by few clearings and animated only by the huts and stages of the fishermen.

In the district lying east of St. Peter's, the presence of great masses of igneous rocks, has permitted of bolder outlines, and the Devonian is presented in rolling hills, with narrow irregular valleys. Prior to the surveys made by Mr. Fletcher, of the Geological Survey, these measures were generally referred, without much comment, to the lower Carboniferous. In reporting on the field work of 1877, he says of the two basins of metamorphic rock running parallel to the great felsite series, that the first, stretching from Mira River to Upper Marie Joseph, is characterized by primordial fossils. The second, probably Devonian, is characterized by more recent shells and plants. It contains masses of granitoid and trappean rock, and the associated strata bear a close lithological resemblance to the Cordaite shales and Dadoxylon sandstones of St. John, New Brunswick.

These strata, in the St. Peter's district, present numerous outcrops, but are so contorted that no continuous section can be given; nor can any reliable estimate be formed of their thickness.

The various sections are composed chiefly of coherent grits, sandstones, areno-argillaceous shales, sometimes quartzo-felspathic, greenish, blueish, reddish, purple, gray or whitish. Car-

bonized plants, cordaites, ferns, calamites, and sphenophyllum are met. Argillites of varying degrees of hardness are found, with green, black, and red colors, and are frequently nacreous. The conglomerates are red and greenish, and compact; the pebbles being quartzite, with sandstone and felsite, and they are frequently banded with sandstone.

Limestones are met at many points and they differ from those of the carboniferous, in being in all cases highly altered, in places approaching marble in texture. The limestone seen at many points between St. Peter's and Macnab's cove is bluish and grey, compact, crystalline, concretionary or slaty. Galena is sometimes observed in it, and layers of chloritic matter. At Robertson's cove the limestone contains conularia, streptorynchus, and stems of plants and other organic forms. It contains veins and nests of crystalline spar, hematite, etc. Another limestone near MacNab's cove is described as blackish, bluish, grey, yellow weathering, dressed with hematite, veined with calcspar, with cone in cone concretions, and holding dark purple fluorspar.

In the northern part of the district these measures are rather more compact and altered than near the shore. At numerous points they have their joints filled with calcspar. These measures are cut by numerous masses and ridges of trap and diorite. The St. Peter's Canal is excavated in a mass of greenish, grey and yellow mixtures of hornblende and felspar, etc. Dykes of coarse greenish diorite are met, slightly altering in their immediate vicinity the sandstones and grits they intersect. Black, bluish and greenish trap passing into felsite or diorite occurs at Alex Island. Its cavities contain hematite, calcspar, chlorite and zeolites.

These strata cut off by the sea emerge again, and as already noted, occupy nearly all the island of Arichat.

Mr. Fletcher, during the seasons of 1878 and 1879, continued the work of tracing the geological formations of Richmond and Inverness Counties. He, however, raises a question if part of the beds on this Island may not be older, and refers to the opinion of Sir William Dawson, who is inclined, on specimens of a species of *Rhynchonella* found by him at Rocky Bay, near Arichat, to

refer some of the strata to the Silurian, on the analogy of other parts of Nova Scotia. To clear up these questions, which are more easily asked than answered, a much more detailed survey and study would be required.

Good examples of the unconformability between the Carboniferous and Devonian are met here, where the former, little altered, come into contact with and hold pebbles of the metamorphic rocks. Between Rocky Bay and Lennox Passage there seems to be a vertical thickness of 10,000 feet of strata.

In general character the rocks of this district resemble those of the same formation, as exposed about Loch Lomond and Grand River. Mr. Fletcher appears, upon more mature reflection, to question if the limestones of St. Peter's may not be at the base of the Carboniferous, and that their alteration by the igneous rocks of the locality mark the Carboniferous date of the metamorphic action. I do not myself recognize much resemblance between any of the St. Peter's diorites, etc., and undoubted Carboniferous dykes which I have seen elsewhere. However this may be viewed, the limestone, whether placed at the top of one formation or at the bottom of the succeeding one, may be looked upon as marking a period of change, with differences in level, and the consequent change in nature of sediments.

Over large parts of Arichat Island are beds of quartzite and sandstone, with reddish and purplish conglomerates, giving a rocky, rough surface, barren, and intersected by swamps. Petit de Gras Island is largely made up of conglomerates. At Rocky Bay coherent grit and fine conglomerate, with their irregular veins of quartz, are succeeded by purple, greenish, and gray grits, Indian red, gray, flaggy, arenaceous, cleft and jointed rocks, sometimes friable, and pearly with quartz in films, blotches and veins containing much chlorite. The different varieties seem to be confusedly mixed, the sandstone passing on one hand into fine granular quartzite, and on the other into compact sandstone, often almost replaced in the bedding and across it by veins of quartz and calcspar. The abundance of calcspar in all the rocks on the island is noteworthy, but I am not aware that it carries any notable amounts of metallic sulphides, etc. Fossil plants are

frequently found. The general trend of the measures appears to run lengthwise through the island and to connect naturally with the St. Peter's and the Guysboro' districts. The exposures of diorite, etc., are not as prominent a feature here as in the former district, but examples can be noticed where the dykes cut the beds and pass laterally between them, with comparatively local amounts of metamorphism.

Passing to the third area of Devonian rocks, we find them exposed beneath the limestone of Plaster Cove. They consist of greenish quartz, felspathic sandstones, associated with dark greenish, veined, very coherent shale and sandstone, conglomerate, and black shales. On the Victoria Road, a mile and a half from Hastings, are whitish coherent grit, and conglomerate, with many veins of quartz. Some of the exposures of grit and shale are soft and crumbly, while others are hard and flinty. Dykes of diorites are met, but as a rule their effect on the strata is very local, and the metamorphism has been regional. Frequent junctions with the precambrian syenites and felsites are observed. In general, these strata resemble those of Arichat and St. Peters, and the fossils they present are similar.

The minerals of the Devonian of Cape Breton are limited in number. I am not aware of any quarries having been opened in them for building purposes, although the surface blocks are locally used for foundations, bridges, etc. Limestone is met at several places. That of St. Peter's inlet has been quarried and burned to a small extent, and was utilized during the construction of the canal. The bed of limestone between Pirate's Cove and Mulgrave was quarried on quite an extensive scale some years ago, and exported chiefly to Prince Edward Island. Behind the chapel at Arichat there is a quarry in a dark grey compact limestone, veined with calcspar. The limestone at Pirate's Cove is said to be somewhat hydraulic, and contains fluorspar.

The occurrence of fluorspar in these measures leads to a hope that this mineral, which is of considerable value, may be found in amounts of economic importance. In 1887, 3,000 tons were mined in the United States and valued at the mines at \$20,000. About two-thirds was used in iron, brass and steel works; the

remainder in glass works, and for the production of fluoric acid and other chemicals. In the States fluoric acid to the extent of 6,000 tons, valued at \$3.00 per ton, is produced as a by-product from the manufacture of cryolite into various sodium salts, alum, aluminium, etc.

Galena occurs in limestone near the head of Arichat harbor, and has been prospected several times. The ore carries small amounts of gold and, I am informed, up to ten ounces of silver.

Barytes occur in small quantities near McMillan's Point, on the Strait of Canso.

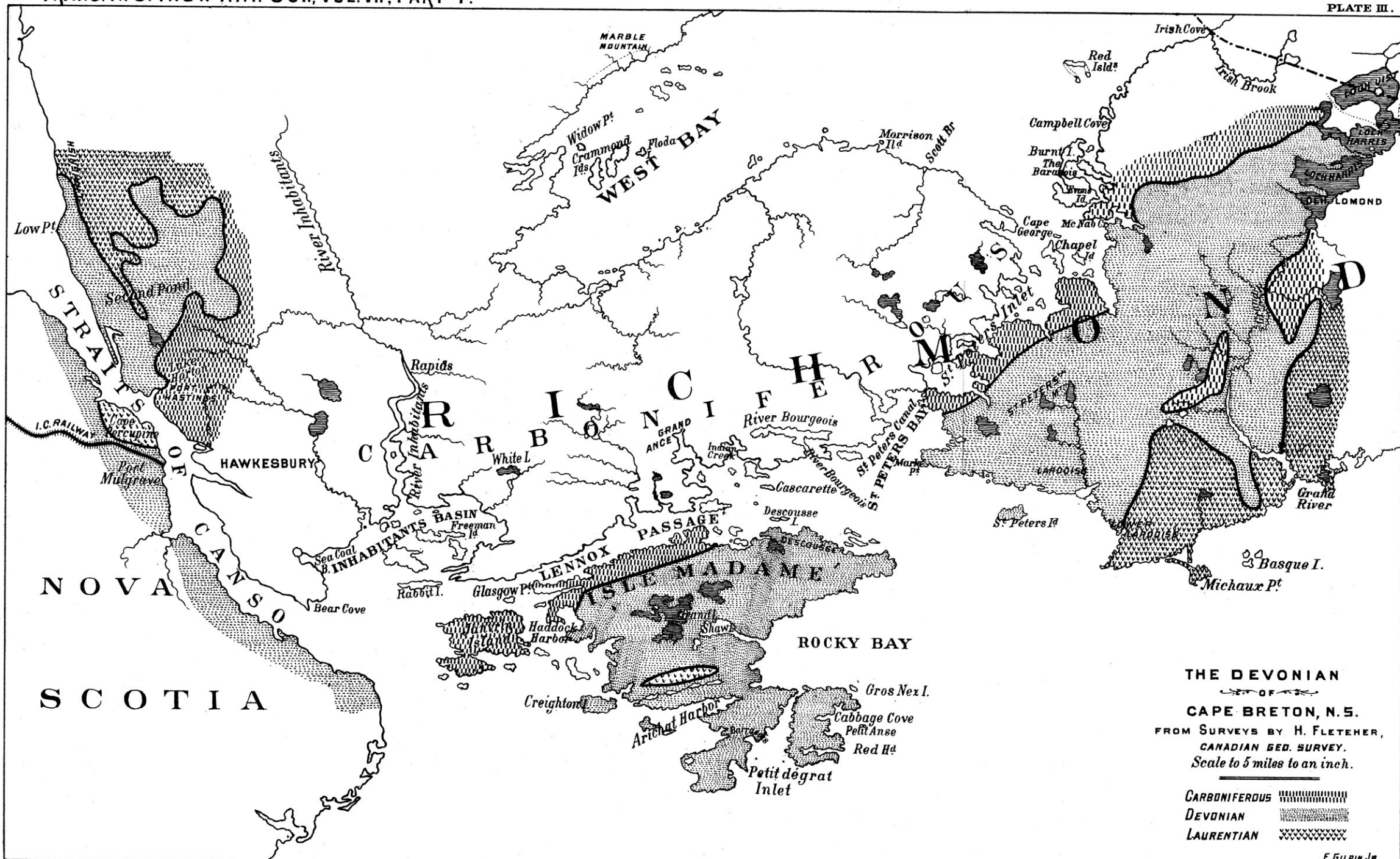
So far, the Devonian rocks of Cape Breton have shown the greatest mineral value in iron ore, and inferentially it may be expected that future valuable discoveries will be made. In strata of this age in Annapolis County are known the valuable bedded hematites, sometimes altered into magnetites, of Clementsport and the Nictaux district. So far, similar deposits have not been met in the counterpart of these rocks in Cape Breton. In Guysboro' County, however, important deposits have been opened, and their mode of occurrence has a direct bearing upon the probable ore-yielding localities on the opposite side of the Strait of Canso. At Erinville is a large and important deposit of specular ore. Some years ago a test was made of the extent of this deposit. A shaft was sunk in the ore fifty feet, and a tunnel driven, exposing a body of ore sixty-five feet wide; another bed in the vicinity was twelve feet wide. The ore is fairly compact, running from 55 to 62 per cent. of metallic iron, and very low in phosphorus, and not holding above the amount of sulphur usually found in ore of this character. The walls of the veins are composed of greenish, dioritic, felspathic, trappean, brecciated rock. About a mile further west, promising indications of ore have been found in altered slates, and shales with quartz. In the vicinity are large masses of dark gray trap, in contact with conglomerate. On the seashore, near the east side of the mouth of Milford Haven, are large beds of altered clay slates, veined with calcespar and quartz, and penetrated by dioritic rocks. Veins of ore up to two feet in thickness, of the compact specular variety, have been opened here and worked to a small extent.

The ore, which was of excellent quality, was not carefully mined, and the admixture of stone which was sent away caused the Londonderry works to stop buying it.

At the Indian Reserve, near Robinson's Cove in Richmond County, similar deposits of specular iron ore are met, cutting the shales and sandstones. Some explorations have shown the presence of deposits of workable size. As in Guysboro' County they are in the immediate vicinity of igneous rocks. The ore is of good quality, and not excessively sulphurous. The fact of the connection between the igneous rocks and the iron ore veins is of value to the prospector, as by bearing it in mind, he is able to contract the area in which he may be searching. It is true that deposits of this character, owing their existence to irregular masses of intrusive rocks, have not the uniformity of bedded deposits, but they are not necessarily more irregular than the normal vein deposits of specular ore.

Some attention has been given during the past year to the iron ores of St. Peter's mountain, some miles south of MacNab's Cove, but I am not acquainted with the ore or its surroundings. The ores of this district are favorably situated for shipment, and of fair quality, and it appears, so far as our present stock of information goes, any future mining activity of the localities we have been considering will be found in their extraction and transportation.

Mr. Fletcher's reports, as issued by the Geological Survey of Canada, give fuller details about the Devonian of Cape Breton, and I am indebted to him for much of the information I included in this paper.



THE DEVONIAN  
OF  
CAPE BRETON, N. S.  
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E. GILPIN, JR.

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