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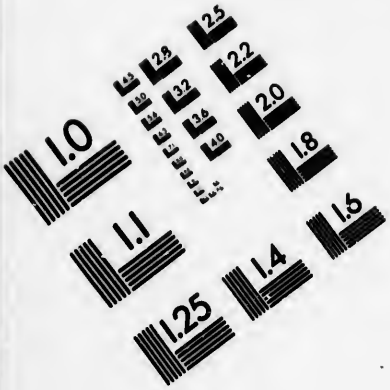

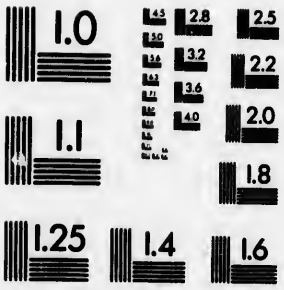

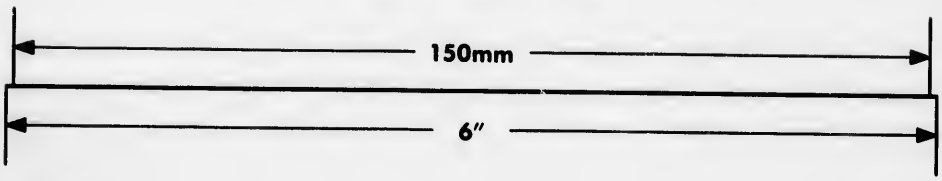

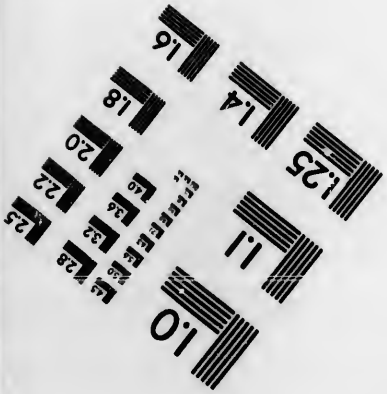

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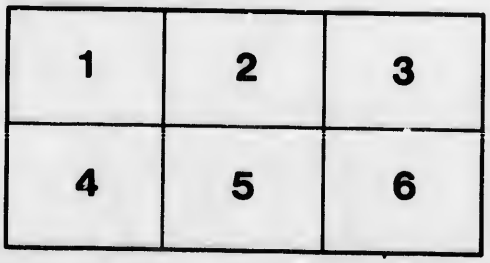

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR.

REPORT

ON

GEOLOGICAL SURVEYS AND EXPLORATIONS

IN THE COUNTIES OF

GUYSBOROUGH, ANTIGONISH, PICTOU, COLCHESTER, AND HALIFAX,

NOVA SCOTIA,

FROM 1882 TO 1886.

BY

HUGH FLETCHER, B.A.,

AND

E. R. FARIBAULT, C.E.

PUBLISHED BY AUTHORITY OF PARLIAMENT.

MONTREAL:
DAWSON BROTHERS.
1887.

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To ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S.
Director of the Geological and Natural History Survey.

SIR,—I have the honor to submit herewith the reports of Mr. E. R. Faribault, C.E., and myself, on work done during the summers of 1882 to 1886, in the counties of Guysborough, Antigonish, Pictou, Colchester and Halifax, Nova Scotia, as described in the summary reports for 1880-81-82, page 21; 1882-83-84, page 14; 1885, pages 22 A and 62 A, and Report of the Department of the Interior, 1886, Part III., pp. 31 and 32.

Mr. Faribault has devoted himself to an investigation of the gold-bearing rocks of the Atlantic coast, and was assisted in the field by Messrs. M. H. McLeod and Archibald Cameron, while I have been aided, both in the field and office work, by Mr. J. A. Robert, B.Ap. Sc. and Mr. John McMillan.

As in previous years, the greater part of our time has been spent on topographical surveys; and a map on a scale of one mile to an inch, has been constructed almost wholly from these surveys, and laid down on a projection prepared by Mr. Scott Barlow, who also reduced from the Admiralty charts the coast line between the Strait of Canso and Pictou Harbour, thus connecting the present map with that of the Pictou coal-field, drawn by him on the same scale for Sir William Logan and published in the Report for 1866-69.

I have again to thank many gentlemen for information, assistance, and hospitality, but more especially the following:—Sheriff Hill, E. G. Millidge, C.E., H. C. Smith and W. B. Robb, of Antigonish; Charles Lundy, Superintendent of the Direct Cable Company, Tor Bay; E. D. Arnaud, of Annapolis; Rev. John Chisholm, P.P. of Heatherton; Rev. Peter Forgeron, P.P. of Harbour Bouché; Archibald McPhee, of Upper South River; Alex. Manson, of North Side Lochaber; Wm. Giroir, of Giroir's, Tracadie; E. J. Cunningham, Postmaster of Guysborough; Jeffrey McColl, M.P.P. and Abram McDonald, of New Glasgow; Capt. Angus McDonald, of Cape George; Dougald Angus McDonald, of Malignant Cove; Joseph McDonald, of McAra's Brook; Henry Dunbar, Evan Ross and Alex. McDonald, of Sunnybrae; Wm. McDonald, of Barney's River Station; David Walker, John Cameron, Wm. Henderson, of Big Island, Merigomish; David Huggan, of Avondale; Jas. R. Mackenzie, of Roy Island; Chas. J. Macdonald, P. O. Inspector; Edwin Gilpin, Inspector of Mines; Dr. Honeyman, Curator of the Provincial Museum, and James H. Austen, of Halifax; Henry S. Poole, Manager of the Acadia Coal Mines, Stellarton; John Rutherford, M. E. of Albion Mines; Ambrose F. Church, of Bedford; T. M. Williams, of Mine Hill, N.J.; F. N. Gisborne, Superintendent of Government Telegraphs, and Collingwood Schreiber, Chief Engineer of Government Railways, of Ottawa.

I have the honor to be, Sir,
Your obedient servant,

OTTAWA, *March 14th*, 1887. HUGH FLETCHER.

REPORT

ON

GEOLOGICAL SURVEYS AND EXPLORATIONS

IN THE COUNTIES OF

GUYSBOROUGH, ANTIGONISH AND PICTOU,

NOVA SCOTIA.

By HUGH FLETCHER, B.A.

INTRODUCTION.

Area surveyed.

The following report relates to the geology of those portions of the counties of Guysborough, Antigonish and Pictou, which lie north of the gold-bearing series of the Atlantic coast and east of Sutherland's River and of the Pictou coal-field—a region which presents in its geography, geology and scenery, many interesting features. The highest land extends along the Gulf shore from Cape George and Morristown to the East River of Pictou; but few of the summits exceed 1,000 feet in height, and deep, broad valleys are cut by the Salmon, Guysborough, Pomquet, Antigonish, St. Mary's, Barney's, French and Sutherland's Rivers.

General features.

The northern part, including nearly all Antigonish and a large portion of Pictou county, is well settled. Guysborough county is in general much less productive and contains large uninhabited tracts of woodland and barren.

GEOLOGY.

No gap in the geological formations from Pre-Cambrian to Permian.

There seems no reason to believe that any one of the formations between the Triassic and the Pre-Cambrian is absent from Nova Scotia, Those found in Cape Breton are also found on the mainland with others of Lower Cambrian age—the gold-bearing series—Silurian, Cambro-Silurian and Permian, most of which are also traceable through Cumberland county* into New Brunswick.

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* Geol. Survey Report for 1885, page 54 E.

Distribution of the Pre-Carboniferous formations.

The large Pre-Carboniferous metamorphic area, eighteen miles wide at the Strait of Canso, narrows near Lochaber, about thirty-five miles to the south-westward* to less than five miles: then widens again to about eighteen miles between the Carboniferous basins of Merigomish and East River of St. Mary's, sending an unbroken spur along the sea shore from McAra's Brook to Livingstone Cove, near Cape George.

Composed largely of Devonian and Cambro-Silurian rocks.

This area, described by Sir J. W. Dawson,† instead of being Silurian as supposed by him, includes, from the Strait of Canso to Lochaber, only the plant-bearing Devonian strata described in previous reports,‡ and to the north and west, chiefly Cambro-Silurian and older formations.

Gesner's map.

On Gesner's geological map of Nova Scotia, published in the Proceedings of the Geological Society of London for 1843, p. 280, the rocks about Chedabucto Bay are called metamorphic and Silurian, but the Carboniferous area of River Inhabitants is colored in the same way, while all Madame Island is referred to the gypsiferous series, the southern metamorphic portion having probably not been examined. Mr. Brown's views on these rocks are given in the Proceedings of the same Society, Vol. iv., p. 424.

Areas of Silurian rocks.

Small areas of Silurian rocks, holding characteristic fossils, are found resting unconformably on the older formations: (1) at Cape George; (2) at Arisaig; (3) at Vamey's Brook; (4) in the valley of Marshy Hope; (5) at Lochaber; (6) in a basin extending southward from Avondale up Barney's River and across French River toward Sutherland's River; (7) in a small basin at Moose River; (8) in irregular, broken outcrops extending from Kerrowgare down the East River of Pictou, where fossils have been collected and described by Sir J. W. Dawson, Dr. Honeyman, and others; (9) in a small area north of Sutherland Lake.

A rich and interesting field of research is presented by the Cambro-Silurian rocks, from which few fossils have yet been collected, more attention having been given to unravelling the structure of this hitherto little known series.

Areas of Carboniferous rocks.

Carboniferous rocks occupy three well marked belts often folded obliquely to the longer axis. These are: (1) The St. George's Bay basin, perhaps containing no beds higher than the Carboniferous limestone, extending from North Canso to Ohio, thence northward to Cape George, but broken at Antigonish Harbour by bosses of older rocks, the largest of which runs from the Sugar-loaf Mountain to Morristown; (2) the Merigomish basin, extending from McAra's Brook westward

* All the courses given in this report are astronomical, the variation being about 24° 15′ west at the Strait of Canso. They are reckoned in degrees from the north, 0°, by east, 90°, south, 180° and west, 270° to 360°.

† Acadian Geology, pp. 558 and 568.

‡ Geol. Survey Report for 1877-78, p. 16 F. and Report for 1879-80, p. 32 F.

to the Pictou coalfield and overlain by the Permian of Big Island; (3) the St. Mary's basin, the fossil plants of which would indicate either a Millstone Grit or Lower Carboniferous age;* but the altered aspect of the rocks would rather refer it to the latter; it extends from the neighborhood of Salmon River Lakes to the head of West River, St. Mary's, and is mentioned by Sir J. W. Dawson in his Supplement to Acadian Geology, page 49, and in Lower Carboniferous Plants, page 10.

These strata may be classified as in the following tabular view :— Classification.

G. 4. Permian,	New Glasgow conglomerate and rocks of Big Island, Merigomish and Pictou Harbour.	
G. Carboniferous,	G. 2. Millstone Grit.	
	G. 1. Carboniferous limestone.	
	G. 1 m. " conglomerate.	
F. Devonian,	Upper red slate and sandstone group.	
	Middle gray slate " "	
	Lower conglomerate " "	
E. Silurian,	E. 6. Lower Helderberg, Div. D. of Dr. Honeyman, at Arisaig.	
	E. 3. Niagara, " C. " "	
	E. 2.	Upper Clinton " B'. " "
		Lower Clinton " B. " "
	E. 1. Medina, " A. " "	
D. Cambro-Silurian,	Upper sandstone and conglomerate of Bear's Brook.	
	Middle shale and sandstone of Baxter's Brook.	
	Lower flinty slate and sandstone of James River & Eigg Mtn.	
A. B. Pre-Cambrian?	Felsites of the shore at Doctor's Brook and Georgeville; syenitic rocks of Ohio; and schists of Sutherland's River and Garden of Eden.	

Volcanic rocks are associated with these groups as high as G. 1 m, while a large proportion of the material of the Cambro-Silurian and Pre-Cambrian is apparently of volcanic origin. Volcanic rocks.

A. B. PRE-CAMBRIAN?

In this division will be classed provisionally, on the authority of Dr. Honeyman, the felsitic rocks of Georgeville, Doctor's Brook, and Arisaig on the Gulf shore, which are, at least, older than Medina; the syenite, felsite and allied rocks between the head of the West River of Antigonish and Garden River, upon which rest, unconformably, patches of Cambro-Silurian strata; and the gneisses, schists, and syenites at the base of the Cambro-Silurian, west of Garden River, at the head of Sutherland's and Moose Rivers and elsewhere. That part, or all of these rocks may be Cambrian, or even Cambro-Silurian, cannot be gainsaid; but they are the lowest found in the region, resemble no rocks known as Cambrian in other parts of Nova Scotia, are strikingly Doubt concerning the position of these rocks.

* "The faunæ of the seas of the Lower Carboniferous coal formation and Permian periods, both in Europe and America, present so great similarities that they may, in a broad view of the subject, be regarded as identical."—Acadian Geology, p. 263.

like those beneath the Upper Cambrian in Cape Breton, and those called Pre-Cambrian by Dr. Ells, in the Cobequid Mountains.* But it must also be borne in mind that similar gneisses and schists at Canterbury, N.B., have been included by Professor Bailey† in the base of his Cambro-Silurian series; and that large masses of red syenite, cut Cambro-Silurian rocks at James River and other places.

Georgeville Crystalline Rocks.—In the great variety of rocks which occur in the narrow belt along the shore between Livingstone and Malignant Coves, there are probably more than the three Pre-Carboniferous series at present recognized. The two lowest of the latter are cut by syenite and granite, and all are unconformably capped by Carboniferous conglomerate. The extreme care necessary to trace the boundaries of these formations is thus shown; and still further examination will be required to clear up all difficulties. The lowest are regarded by Dr. Honeyman‡ as Laurentian, because of their resemblance to those of George River.

Intrusive rocks

The pink, purplish and greenish flinty felsites and quartz-felsites, veined and spotted with quartz and epidote, at the mouth of Malignant Brook, are probably contemporaneous with, or newer than the Cambro-Silurian conglomerate with which they are associated; whereas the coarse crystalline diorites and syenites on the rough shore to the eastward are older, but break through the slates, banded felsites and crystalline limestones. The latter are not extensively developed, so that little can be said of them. The felsites, like those of Arisaig, hold epidote and quartz in blotches and veins; they are generally greenish-gray or gray, with pink blotches; have chlorite and calcspar in the joints, which are so numerous that the rock breaks into small pieces under a blow of the hammer; and are not unlike the obscurely granular felsite of Capelin Cove.

Malignant Brook.

Crystalline limestone of Georgeville.

The limestone is gray, bluish-gray, whitish and greenish, of varying purity, with indistinct bedding, serpentinous, and showing Eozoon-like wrinkles, compact to broady crystalline, holding small ferruginous patches, in one place forming a cliff twenty feet high, and apparently of great thickness. A quartz vein, eight feet thick, separates a mass of diorite from the limestone on the eastern side.

Quartz vein.

Greendale.

Immediately east of the road from Malignant Cove to Greendale, a small brook presents exposures of dark-bluish gray and greenish rocks, obscurely crystalline, finely banded, resembling mica-schists, but containing also patches of fine hornblendic rock, into which they appear

* Geol. Survey Report for 1885, p. 54 E.

† Geol. Survey Report for 1882-83-84, p. 13 G.

‡ Journal Geol. Soc. 1870; Trans. N.S. Inst. Vol. II., p. 196, Vol. III., p. 35, Vol. IV., pp. 56 and 454.

to pass, and which resemble concretionary masses. Above these are steel-gray and dark, flinty, quartzo-micaceous, banded strata, cut along the bedding by a dyke of fine c[illegible]lline diorite, three feet wide.

On the road near Greendale are outcrops of dark greenish dioritic flinty slates or schists, with scales of specular iron ore, large blotches of milky quartz, fine golden mica and minute fibres of black hornblende, either cut by, or passing into coarse syenite for a few feet, and interstratified with chloritic and epidotic, very massive schists, strikingly resembling the rocks described by Dr. Selwyn at Yarmouth,* which are probably also Pre-Cambrian. In a brook, near the sea shore, are greenish, epidotic, imperfect schists or slates, and massive syenite and diorite, which at the shore contain quartz-veins eighteen inches thick, and are not unlike greatly altered Cambro-Silurian slate and flinty, compact sandstone, mixed with igneous deposits. The soft, serpentinous, calcareous, whitish rocks of the shore north-east of the mouth of this brook, are peculiar. Near the brook a rock, probably volcanic, becomes more trap-like to the eastward and pinches out the last of the limestone, which is here a bluish-gray banded variety. Succeeding it are rocks like those of Capelin Cove, mentioned above. The boundaries of the schistose and coarse dioritic rocks are shown as nearly as possible on the map.

Iron ore.

Resemblance to the rocks at Yarmouth.

Quartz veins.

On the shore road, about one mile west of Georgeville chapel, is an outcrop of crystalline limestone, the only one seen inland.

Crystalline limestone.

Felsitic Rocks of Doctor's Brook and Arisaig.—Of these, as of the foregoing, it should be remarked that although they closely resemble the Louisburg and Coxheath Pre-Cambrian, they may be of any age older than Medina, and have been regarded both as metamorphosed sedimentary, and as volcanic rocks. Full details regarding them have been given by Dr. Honeyman and Sir J. W. Dawson.† They strike in a narrow broken belt along the shore between Arisaig pier and McNeil's Brook, and are cut by amygdaloid of Lower Carboniferous age. On the rocky point of Arisaig pier and on a neighboring knoll they consist of red and yellowish, flinty, compact quartz-felsite and quartzite, but further east pass into fine grained syenite. The interstratified band of dysyntribite, which is traceable for about a mile, is a soft rock, of green, whitish yellow and other colors, about fifty feet thick, apparently underlying the rocks of the pier, and associated with red or brown, shaly, fragmental Louisburg shales, of considerable variety of color, containing spheroidal concretions, two feet and less in diameter, composed also of fragmental rock.

Of doubtful age and volcanic origin.

Arisaig pier.

Dysyntribite.

* Geol. Survey Report for 1870-71, page 271.

† Trans. N. S. Inst. Nat. Sc., Vol. III., p. 233; Vol. IV., pp. 53, 60 and 457; Vol. V., p. 271; Acadian Geology, p. 567, and Supplement, p. 90; Journal Geol. Soc., Vol. VI., p. 347, and Vol. XX., pp. 339 and 341.

Frenchman's Barn. Brown and pink quartz-felsite form the high cliff called Frenchman's Barn, to the eastward of which is an indian-red and yellowish-green shaly variety, made up of grains about as large as peas, every grain having a radiating globular structure. After an interval of about half a mile, occupied by Silurian fossiliferous strata, the shore east of Beech Hill Cove again affords good exposures of greenish, yellowish, and reddish quartz-veined, flinty, compact or obscurely granular and fragmentary felsite and quartz-felsite, with obscure, bent and irregular planes of bedding or jointing, associated with dark amygdaloids, apparently striking with the felsites and containing shaly layers and bands of rocks like those of Louisburg and Cape Rhumore.* These occupy the coast to Doctor's Brook, to the eastward of which are blackish, greenish and brownish shaly amygdaloids, reddish and purplish flinty felsite and similar rocks.

Beech Hill Cove.

Doctor's Brook.

In Doctor's Brook, below the bridge on the shore road, the "picturesque exposures of singularly mixed and indescribable rocks" of this famous trout-brook belong to this series near its contact with Medina fossiliferous strata. Not the slightest alteration is apparent in these latter, which are full of their characteristic fossils one foot from the contact. On the left bank, above the mill-dam, the felsites might at first sight be mistaken for reddish altered Cambro-Silurian grit; but seem in every case on closer examination to be finely fragmental Coxheath felsites, a conclusion supported also by a microscopic section made by Mr. T. C. Weston.

Microscopic section of volcanic rock.

Rory McDonald's Brook. At the mouth of Rory McDonald's Brook, reddish-gray flinty felsites are again in contact with evenly-bedded Medina shales; while on the reefs are the reddish and greenish, shaly and thick-bedded, soft, trap-like rocks of Cape Rhumore, which so often resemble sandstone and conglomerate, but are evidently of volcanic origin.

Two varieties. *Crystalline Rocks of the Keppoch, East River of St. Mary's and Upper Barney's River.*—The crystalline rocks of the hill country east of Garden River consist chiefly of syenitic, dioritic and felsitic strata, rightly placed below the fossiliferous Medina by Dr. Honeyman, who considers them also Archæan;† while those west of that river are for the most part laminated or schistose. It is doubtful whether these rocks are not in great part newer, as their contact with Cambro-Silurian strata would sometimes seem to prove; but the quantity of volcanic material in the latter is so great that these may be only the contact of dykes, whereas isolated patches of comparatively unaltered sedimentary rocks belonging to a later period are found within the felsitic

* Geol. Survey Report for 1875-76, p. 379; for 1876-77, pp. 419 and 425; and for 1877-78, p. 8 F.
† Trans. N. S. Inst. Nat. Sc., Vol. V., p. 206.

areas. On the hill west of Lochaber, fossiliferous Silurian rocks are underlain by a ridge of trappean, fragmental and porphyritic felsites, like those of East Bay and Louisburg, showing lines of obscure bedding, frequently dioritic or passing into red syenite, and associated with greenish or gray, fine-grained or compact, splintery, pyritous, micaceous diorite, hardly distinguishable from fine sandstone, with threads and druses of quartz. These rocks are seen both on the streams flowing into Lochaber and into MacGillivray's mill-brook, in which latter they comprise greenish and purplish, compact, fine-grained and fragmental, Coxheath felsite, with traces of calcspar, hæmatite, epidote and serpentine. North of McNab Brook, compact gray or greenish-gray porphyritic felsite or diorite, blotched with quartz, is mixed with flesh-red compact quartz-felsite, greenish-gray granular felsite, whitish-purple porphyry, with the oblique slaty cleavage of the Coxheath aluminous shales, and the prevailing red syenite of Upper Ohio. The contact of the Silurian rocks is here so abrupt, that without a fault, the felsites could not be regarded as inferior among, or newer than the former, only three feet being concealed between the felsites and a series of little altered greenish and gray fossiliferous argillites or dark slate and flaggy fine sandstone, veined and blotched with quartz. A ridge of high land indicates the extension of the felsites northward to a point behind John McNaughton's, where traces of copper pyrites are found in connection with blotches of quartz.

Lochaber.

McGillivray and McNab Brooks.

Contact with Silurian rocks.

Copper ore.

Similar rocks are cut through by the brooklets which enter the West River of Antigonish, on the west side, above Beaver Meadows. On the first of these brooks, opposite St. Joseph's chapel, they underlie a gray, coherent, Carboniferous limestone, which has been quarried; they consist of very light-colored and greenish-gray, splintery, compact, obscurely porphyritic and granular felsite and quartz-felsite, containing spots of hornblende, chlorite, epidote, hæmatite and other minerals; and of beautifully mottled felsite, much of which is granular. On an adjoining brook, are gray, compact, flinty felsite and quartz-felsite, sometimes light in color, resembling the variety at Coxheath fit for fire-clay, but containing specks of pyrites. Along the hill, near the Ohio cross roads, felsites underlie carboniferous limestone, the boundary of which has been closely traced. They are of the usual colors, hold veins of white quartz, loose blocks of which one foot in diameter lie around, and they pass into syenite or into beautifully mottled, fragmental, coarse felsite-breccia and epidotic porphyry, containing traces of copper.

West River of Antigonish.

Contact with Carboniferous.

Quartz veins.

Copper ore.

The dark greenish-black color of the rocks in the large brook south of the cross roads, indicates their hornblendic character. They are succeeded upstream by a lighter greenish granular mixture of felspar and hornblende, which extends to the Keppoch road.

Keppoch.

Hæmatite. The adjoining brook displays dark greenish, obscurely granular diorite and red and green syenite, containing minute veins and crystals of quartz, with specks and films of hæmatite. The syenite sometimes contains mica, but in the next brook to southward, passes into red, nearly compact quartz-felsite, shown in fine cliffs.

Upper Ohio. Near the head of the Ohio settlement, the prevailing Pre-Carboniferous rock is red syenite.

On Callahan Brook, Carboniferous limestone immediately overlies gray, purple and reddish syenite and felsite, traps, tuffs and amygdaloids, the relation of which to the succeeding bluish and greenish flinty slates is obscure. These slates are apparently Devonian, but possibly Cambro-Silurian, probably altered by the traps, which, however, are not clearly of the same age as the syenite and felsite. These traps, however, may be of the same age as the syenite that cuts the Cambro-Silurian strata of James River. The next brook exposes only reddish-gray, coarse and compact syenite like that of Stewart's and of the upper dam on the West River, containing a minute quantity of hæmatite; while in the river, immediately above the foot bridge, are gray felsite and purple trap. Below the bridge at Stewart's, the unconformity of the syenite and of the Carboniferous strata is well shown, the former here containing minute scattered traces of specular iron, explored in several pits.

Volcanic rocks of Callahan Brook.

Iron ore.

Garvie Lake. On the track between John Carroll's and Garvie Lake, light-gray, compact, flinty quartz-felsite, with glittering grains of vitreous, colorless quartz, passes into flinty porphyry and red syenite.

Dioritic rocks are also found in great abundance in this neighborhood, with blocks of purplish trap; and above the settlement on the West River, bluish-gray, compact felsite accompanies the red and gray syenite of the road from Ohio to the Black Brook of St. Mary's, but is interrupted by outcrops of green slate. At the head of Big Meadows Brook, porphyritic felsite of reddish-gray and other colors, showing its fragmental structure on weathered surfaces, is in place, near reddish-gray, not greatly altered sandstone, probably upper Devonian.

St. Mary's.

Beaver River. In the branch of Beaver River, below McIsaac's, at the county line, are exposures of reddish and of gray, compact, flinty felsite and quartz-felsite.

Below the fork of the branch from the little lake to the eastward, gray, greenish and red flinty felsite and greenish porphyritic diorite appear as far as the crossing of the road to McLean's. The relation of these rocks to the Cambro-Silurian siliceous slates of the vicinity is obscure. Near the fork of the brook flowing from McEachern's Lake, are outcrops of bright red syenite and gray fragmentary Louisburg felsite. That one of the outcrops of felsite is newer than the

slates, seems to be certain, but that the red syenite is also newer, requires further proof. Gray and blackish, fragmental, Louisburg breccia and bright-red, compact, flinty felsite, passing into syenite, are also seen at the cascades, with fine, pyritous diorite. On the hauling-road from this branch to Angus McDonald's, greenish Cambro-Silurian slate is found near the clearings; while felsite and diorite occur for three-quarters of a mile from the river. In the upper part of the river, no rocks are met with, and the felsites, diorites and quartz-felsites, which form the southern boundary of the green slates in Coillteach Brook, more closely resemble newer intrusive rocks than Pre-Cambrian, and those at the mine in the branch from McEachern's Lake, appear also to be mixed intrusive and sedimentary. At the shaft, greenish-gray and whitish, very flinty, porcellanous rock, full of cubes of pyrites and threads of quartz, has been mined; but the veinstone shows only chlorite. The syenite in the immediate vicinity would appear to alter the slates: it extends up to the lake, and is exposed in rocky gorges, and at cascades, then passes into quartz-felsite. Between the lake and the Black Brook road, are blocks of hornblendic slate. From the lake westward to Andrew McKay's, the soil is bad, and is strewn with blocks of coarse, white or flesh-colored granite, composed of transparent milky or colorless quartz, pinkish felspar and light or silver-gray mica, the mica being in small proportion or altogether absent.

Sedimentary rocks of the "mine" in Beaver River.

On the middle branch of Barney's River are felsites, diorites and similar rocks, not belonging to this division, but cutting Cambro-Silurian slates.

Barney's River volcanic rocks.

Above the road to Forbes Lake, crystalline rocks are very abundant, consisting of granular diorite and gray or reddish syenite. At the outlet of the other smaller lake is a ledge of greenish fine diorite, compact felsite and reddish syenite containing little hornblende. In the little brook east of John J. Robinson's, greenish felsite and diorite are succeeded downstream by Cambro-Silurian quartzites. In the neighborhood of the Rossville school-house, dioritic rocks are in place, and diorite, syenite and felsite in the brooks between this settlement and the west branch. Where they come in contact with Cambro-Silurian slates, the latter do not seem to be more porcellanous than usual. In the west branch of Barney's River, apparently mixed with the Cambro-Silurian conglomerate, described elsewhere, are outcrops of reddish and greenish, compact, porphyritic felsite, quartz-felsite, fine diorite, red syenite and allied rocks, perhaps intrusive, perhaps belonging to this division. Higher up, in cliffs and at cascades, are seen red syenite, or a gray coarse mixture of felspar and hornblende with very little quartz; and still higher, the prevailing rock is syenite, with, occasionally, felsites. The rocks are well exposed in the roads, fields and brooks, while on the

Forbes Lake.

main river, above Robert McKay's, outcrops first of red syenite, then of dark gray, pyritous, porphyritic fine felsite and diorite, with bright-red syenite, extend to the Marsh settlement and thence past Brora Lake.

That some of the porphyritic rocks of this river are older than the Cambro-Silurian conglomerate seen lower down, is almost certain; for the well-rounded pebbles of the conglomerate often consist of fragments of felsites.

Brora Lake. On the shores of Brora Lake, gray and reddish syenite, and bluish, massive felsite and felsitic slate, are associated with red slates, perhaps Cambro-Silurian. On the road from the Garden of Eden to Barney's River, felsites are seen in many places, succeeded by the schists of the next division, and syenite and felsite occur also between the Garden of Eden and Beaver Lake. In Campbell Brook, quartzites and conglomerates, perhaps Cambro-Silurian, seem to be in patches among compact and granular, massive felsites, with blotches of milky quartz, associated with felsitic slates of various colors, succeeded upstream by brownish conglomerate, composed of the foregoing rocks, and succeeded again by gray, flinty, massive and laminated felsite.

Campbell Brook.

In both branches of the brook, many varieties of fragmental Coxheath felsite, aluminous slate, red porphyry, syenite and hornblende rock, are found, as well as in the Garden River, but here again they are perhaps, in part at least, intrusive. All the rocks on the road between the Garden of Eden and Rocky Mountain, consist of syenite and felsite of varieties similar to those which are also found on the road to Green Settlement, and on that toward William Brady's. On the road past Thomas McBean's, back to the post road, the felsites are succeeded by bluish-gray slates and other rocks, perhaps Cambro-Silurian.

St. Mary's roads.

Reddish syenite, often coarse, occupies most of the road between the Keppoch and Black Brook, and thence to the main road at East River.

Black Brook of East River, St. Mary's.

Above the settlement, Black Brook exposes bluish-gray, massive felsite and quartz-felsite, succeeded in the west branch by red and gray flinty slates, probably Cambro-Silurian, but giving place higher up to felsite, syenite and diorite of different colors.

Black Brook lakes.

On the upper lake in the settlement are outcrops of red, nearly compact syenite, without much hornblende, of felsite and of dark-gray, coarse diorite, veined with epidote. Above the second lake, syenite forms the walls of a rocky gorge with a fine pool, while below the lake is a celebrated dome-shaped fall, thirty-five or forty feet high. Immediately above the road, at this lower lake, are large outcrops of coarse, reddish and pink quartz-felsite, passing into syenite and mixed with diorite; and similar rocks extend to McKay Brook, where they are overlain by dark slates and quartzites of doubtful age.

Jordan Brook. In Jordan Brook, below Cameron's marsh, mottled red, gray and

green, obscurely granular and compact felsite, passing into red syenite, is associated with gray, softer felsite, and a band of breccia, like that carrying the copper at Coxheath.* In the other branch is a bright-red and mottled felsite.

Crystalline and Schistose Rocks of Moose River, Blue Mountain and Sutherland's River.—These rocks, supposed by Dr. Honeyman† and Dr. Ells to be Pre-Cambrian,‡ and now admitted by Sir J. W. Dawson § to be as low as the base of the Cambro-Silurian, extend in a belt, several miles in width, from the Garden of Eden up Moose River to Blue Mountain and McLellan's Mountain, where they are overlain by Cambro-Silurian and Silurian strata. Their most easterly outcrop seems to be in Campbell Brook, in connection with coarse conglomerate, flinty grit and quartzite, probably upper Cambro-Silurian, and reddish-green syenite or felsite; red, white-spotted, fragmentary felsite; variegated red, whitish and purple felsite, like that of the Green Settlement school house; fragmental, soapy and soft aluminous slates, weathering to look like grit, of great variety of color, and containing specular iron. Extent.

Felsites and fragmental slates are also found on the west side of Eden Lake, and in Moose River above the lake. How they are related to the Cambro-Silurian rocks at the copper mine is uncertain; but fragmental slates are here also present. Eden Lake. Moose River.

Pearly talc and mica-schists, containing spots of quartz, occur in Moose River below Barney's River road, with greenish, porphyritic, fine diorite; they are sometimes chloritic and closely associated with light-gray, flinty, siliceous, Cambro-Silurian slates, like those of Eigg Mountain. Lower down are pearly, scaly slates, containing serpentinous matter, and giving a beautiful play of colors. These consist, essentially, of quartz and felspar, and are interstratified apparently with fragmental rocks, perhaps fit for fire-clay.

In the large mill-brook from the north, are dark-greenish or gray pyritous, fine diorite or felsite; porphyritic and fragmental, epidotic, quartz-felsite, with films of hæmatite in the joints; soft Coxheath slate, often fragmental and full of scales of specular iron; below these are compact and granular felsite, and higher up the stream, schists, granular slates and crypto-crystalline, fragmental felsites. In the east branch of French River, for some distance above Manning Mountain road, are good outcrops of compact and granular, flinty felsite and quartz-felsite, passing into reddish and gray syenite. Higher up, the river runs in Traces of iron ore. East branch of French River.

* Geol. Survey Report for 1879-80, p. 123 F.
† Trans. N. S. Inst. Nat. Sc., Vol. V., p. 206.
‡ Geol. Survey Report for 1885, p. 54 E.
§ Supplement to Acadian Geology, p. 80, and Can. Naturalist, Vol. IX., No. 6.

cascades over greenish, and dark, fine diorite and light-gray, flinty crystalline, porphyritic quartz-felsite, the latter, still further up stream, becoming obscurely gneissic and mixed with dioritic, talcose, syenitic and chloritic rocks. Then come very slaty, coarse-grained, talcose granite or gneiss; gray, fine, silvery, pearly talc-schists; flinty felsitic and quartzo-felsitic slates, full of quartz veins, often pyritous. Similar schists occupy all the country hereabout, extending eastward to the head of Garden River.

Foot road. On the Foot road, south of the fine outcrops of Cambro-Silurian grit and slate near Glenshee, occurs a band of greenish, nearly compact felsite; pearly, soapy slates or schists, like those of Sutherland's River; micaceous hornblende-schists; silvery and pearly, talcose, chloritic and mica-schists, resembling a fragmental rock and with hard spots of quartz in imperfect crystals and grains. The schists are in many places veined with quartz, and extend to the road at Moose River post-office; in the valley of the river there is, however, a belt of Silurian.

Silurian outlier

On the road from Moose River to Blue Mountain, schists and fragmental felsites extend for some distance, but require further examination.* On the track between Robert Chisholm's and Smith's Lake, are schistose felsites, syenite and Silurian strata.

Head of the East River of Pictou.

Below the Blanchard road, also on Sutherland's River, are aluminous slates, resembling those of Coxheath; among them an impure variety of the fire-clay, fit for pottery,† with its characteristic interlocking plates. A red, compact porphyritic felsite, and a pearly, fine, soft, soapy, mottled, scaly shale, passing into a granular rock resembling a grit, are also present. Greenish, soft, fragmentary Louisburg shales: red, flinty, quartz-veined felsite; light-greenish, shaly, flinty felsite and similar rocks are, above the bridge, cut by dykes of dark-green diorite; they extend to the McInnes Settlement and beyond, toward the East River of Pictou.

Sutherland's River.

In the neighborhood of Sutherland's Lake, are reddish-gray, compact and granular felsite and quartz-felsite. In the marshes near the small lake to the southward, these rocks are in contact with Medina fossiliferous strata, and extend thence to Smith's Lake.

Silurian rocks. Silurian rocks occupy the road down the west side of Sutherland's River, from the Blanchard Road school-house to the bridge at Archibald Fraser's, where large blocks of fossiliferous sandstone are found. On crossing to the east side of the river, however, blocks of felsitic, hornblendic and other schists occur, mixed lower down with others of Silurian rock.

On a by-road to the right, up a brook, Silurian sandstone is in place

* Trans. N. S. Inst. Nat. Sc., Vol. V., p. 206.
† Geol. Survey Report for 1875-76, page 423.

for some distance; but beyond it on the main road are schists, some of which greatly resemble the Eigg Mountain Cambro-Silurian slates, to which series they may possibly belong, as well as the rocks at the falls of the river lower down. This point requires further study. The rocks at the watering-trough are, without doubt, Cambro-Silurian. Cambro-Silurian.

On the road across Sutherland's Mountain, past Sutherland's Lake to Blue Mountain, reddish, flinty, compact and granular, porphyritic felsite; greenish, soft, fragmental rock; quartz-felsite, with distinct grains of quartz; red syenite and allied rocks, are overlain by Silurian strata. Sutherland's Lake and Blue Mountain.

Syenite, diorite, felsite and quartz-felsite apparently cut the schists of Morrison and McGrath Mountains, the schists being of the usual variety and overlain by Cambro-Silurian grits. At the head of the East River of Pictou, between Smith's Lake and the Garden of Eden, the gray diorite, syenite, felsite and fragmental rocks are similar to those between Eden Lake and Black Brook, while everywhere in the neighborhood are patches of soft slate and sandstone belonging to the Cambro-Silurian, Silurian and Devonian systems. Whether the blending of these sedimentary rocks with volcanic matter, often seen along the contact, indicates a subsequent or a contemporaneous origin of the latter, or whether later intrusions have taken place along the line of contact, is yet obscure.

The syenite of Williams Point, Antigonish, and of the eastern side of the harbour* may be Pre-Cambrian, but is perhaps more likely of the same age as that which cuts the lower Cambro-Silurian rocks of James River. It is gray or reddish, coarse or fine, in places almost pure felsite, and sometimes holding black mica. It forms high precipitous knolls of irregular size and shape, rising three hundred feet above the sea, from which fine views of the surrounding country may be obtained; and it is unconformably capped by gray Carboniferous limestone, largely quarried, full of fossils—*Leperditia Okeni, Cyrtoceras, Conularia* and *Dentalium*—and containing galena. Antigonish.

The structure of Cape Porcupine, on the Strait of Canso, has been fully given in the Geol. Survey Report for 1879–80, page 9 F. The slates are more crystalline than those of the Cambro-Silurian, presumably older, and not appreciably altered near the contact of the syenite. Cape Porcupine

D. Cambro-Silurian.

The general distribution of the rocks of this system has been already sketched. They are placed beneath the Medina by Dr. Honeyman,†

* Transactions N. S. Inst. Nat. Sc., Vol. III., pp. 33, 37 and 199; Vol. IV., page 72, and Vol. VI., p. 312.

† Trans. N. S. Inst. Nat. Sc., Vol. V., p. 199.

include Sir. J. W. Dawson's Upper Cobequid series,* the grayish conglomerates of Wentworth, and the iron ore series of Londonderry mines.† But both Dr. Honeyman and Sir J. W. Dawson have included as Carboniferous large areas among the mountains, at Malignant Cove‡ and at Arisaig, in which the strata are of this age.§ Three distinct groups may be recognized, exclusive of the schists and felsites provisionally called Pre-Cambrian :—

Classification.

1. The lower flinty slates, quartzites and "whin"-like rocks of James River and Eigg Mountain ;
2. The soft reddish and olivaceous slates of Baxter's Brook and Brian Daly's Brook ;
3. The reddish and gray sandstone, grit and conglomerate of Bear's Brook.

The junction of the Silurian and Cambro-Silurian rocks is closely and accurately defined on the map ; the boundaries between the subdivisions of the latter require further study and, as they depend chiefly on the accurate determination of three somewhat similar sets of rocks in a region where continuous sections are not often attainable, and where fossils are scarce, some allowance must be made for their indefiniteness. The fossils found belong apparently to the middle group ; they consist only of obscure annelid markings, of a fragment of a cystidean stem and of certain obscure brachiopods. Perhaps, however, a more thorough search will show that they are abundant.

Fossils.

1. *Lower Flinty Slates and Quartzites of James River.*—These rocks, where largely developed, being cut by intrusive masses, chiefly of syenite, it might be supposed that the greater degree of alteration was due to the latter, and that they were only altered strata of the second and third groups. This, however, does not seem to be the case ; on the contrary, they probably underlie the soft shales unconformably.

Antigonish Hills.

An isolated hill-range of sedimentary and volcanic rocks lies west of the shore road from Antigonish to Morristown, including the Antigonish Sugar-loaf and the hills behind Ogden Pond.|| They consist chiefly of greenish-gray flinty, rubbly slates and quartzites, cut by numerous quartz veins and by dykes of syenite, mixed with reddish and greenish, ferruginous, chloritic trap and diorite. In the brook along the old Gulf road, red and green, splintery, pyritous slates are mixed with fragmental felsite. Where they come on the shore at McIsaac Point,

Old Gulf road.

McIsaac Point.

* Acadian Geology, Supplement, p. 79.
† Geol. Survey Report for 1885, pp. 52 and 53 E.
‡ Trans. N. S. Inst. Nat. Sc., Vol. VI., p. 315.
§ The Cambro-Silurian rocks of New Brunswick are described in the Geol. Survey Reports for 1879-80, p. 22 D ; for 1880-81-82, p. 15 D ; for 1882-83-84, p. 13 G, and 1885, p. 23 G.
|| Trans. N. S. Inst Nat. Sc., Vol. IV., p. 70.

Morristown,* they comprise grayish, greenish and reddish, jointed, coherent flaggy quartzite, sandstone or grit, drused with hæmatite, crossed in all directions by quartz-veins, cut by dykes every few yards, and resembling the upper group at Barney's River, but associated with greenish flinty slates like those of James River falls.

Sometimes the grits are so much altered and mixed with traps that at first sight they might be mistaken for felsite-breccias, especially where the dykes run in the bedding. These dykes contain films of hæmatite, calcspar, pyrites and a serpentinous mineral like that of Arisaig. In the lower part of Ogden Brook, Carboniferous conglomerate is underlain by greenish altered pea- and nut-conglomerate or breccia, like that of Beaver River, which appears again at the head of the brook. Rough cliffs of similar rocks are found in different parts of this mountain. On the brooks and roads south of Hallowell Grant post-office, they are more flaggy than usual, perhaps represent the Baxter's Brook group and are covered, near the school-house, by Carboniferous conglomerate.

Dysyntribite (?) Ogden Brook. Hallowell Grant.

In the much larger metamorphic area, which, beginning near Cape George, extends along the gulf shore to McAra's Brook, these rocks are again found. On the shore at Georgeville, below Hugh McPherson's house, the dark slates with lighter gray bands resemble the strata of Rogers Brook, Hallowell Grant, all being so jointed that they break into pieces seldom larger than a pigeon's egg. On approaching the coarse diorite which abuts against them on the west, they become more pyritous and porcellanous, and their resemblance to the "whin" of the gold-fields is remarkable. They are cut by dykes of diorite and by a white granular quartzite, containing usually a little hornblende and felspar. To the north-eastward, past two little brooks emptying into a fishing-cove, is another brook, beyond which a dirty-green, flinty, nearly compact conglomerate overlies the slates from which it is largely derived, pebbles of both dark and light-gray slate being numerous, with others of coarse crystalline syenite and diorite. But more abundant than these are pebbles of the quartzite just mentioned. This conglomerate is the same as that of Malignant Cove and probably not higher in the series than the Baxter's Brook group. Black slates and flinty sandstones, belonging also to one of these groups, have numerous small quartz-veins, which in the brook east of Georgeville and near the post-office at Greendale have been mined for silver. At the former place, talc and serpentine occur in some quantity in the vein which is thirteen inches thick, while the planes of the slates contain much graphite and pyrites. Similar rocks underlie the conglomerate at the mouth of this brook,

Georgeville. Conglomerate. Silver (?) mines

* Acadian Geology, p. 347.

Contact of Carboniferous and older rocks.

and on the shore road both east and west of it, being well exposed in the little brooks. The various lines of contact of the Carboniferous conglomerate, Cambro-Silurian conglomerate, syenite and slates above described will be seen on the map. Between Livingstone Cove and Ballantine Cove, Carboniferous conglomerate is perhaps everywhere present on the road, but to the south of it, greenish-gray, quartz-veined, James River slates are found in the brooks, and in the branch of Ballantine Brook near McNeil's, contain films of pyrites in the bedding. The light and dark-gray flinty slates and lenticular beds of bluish-gray

Livingstone Cove.

compact limestone on the shore near Livingstone Cove probably underlie the conglomerate mentioned above, the latter being in turn overlain, not far west of the cove, by Carboniferous conglomerate, containing pebbles of both these groups.

Up the brook about 600 yards southwest of Livingstone Brook, Carboniferous conglomerate is in place for some distance from the shore, but is succeeded below the road by fine outcrops of Cambro-Silurian conglomerate, greenish, fine, rubbly grit and soft quartz-veined slates, like those of Baxter's Brook. The black massive slate near the road might yield fossils, but the exposures are not good. Higher up are cliffs of greenish, quartz-veined, flinty rocks, with soft, very calcareous,

Volcanic rocks.

dark hæmatitic, chloritic and epidotic trap and diorite.

Malignant Cove

The conglomerate and associated Pre-Carboniferous rocks of Malignant Cove apparently represent the higher of the two groups at Georgeville, while underlying them, on the tributaries of Malignant Brook from the westward, are James River sandstone, grit and slate.

Silver (?) mine.

Not far above the mill at the shore road, search was made for silver in greenish and dark bluish-gray pyritous flinty rock, in thick and flaggy beds, cut by porphyritic felsite and diorite. Near the head of Arisaig

The Hollow.

Brook, the precipitous walls south of the Hollow are of felsite and diorite, which cut flinty slate and quartzite shown, but without definite dip, at the cascades of the little brooks.

Above the Trunk road, at the falls and cascades of the steep and

Doctor's Brook.

bouldery west branch of Doctor's Brook, similar strata are still more largely displayed, comprising greenish-gray compact sandstone or siliceous argillite, crystalline, greenish, pyritous, fine-grained and porcellanous argillite, with a somewhat obscure dip, greatly jointed and cut by dykes of greenish crystalline diorite.

The volcanic and sedimentary rocks on the east branch of Doctor's Brook, above an outlier of Carboniferous limestone, include patches of bottle-green, flinty conglomerate like that of the Georgeville shore. Farther south on the Pleasant Valley road, are outcrops of greenish

Back settlement of Arisaig

fine crystalline rocks; these are also found in the back settlement of Arisaig, the precipitous descent to the Little Hollow probably separat-

ing them from the overlying group. At the head of the various tributaries of the east branch are cascades down cliffs of massive Cambro-Silurian sandstone and slate, sometimes ribanded, and like the former cut by dykes.

Knoydart Brook.

The rocks first seen among the diorites of the head of Knoydart Brook, west of the little lake, belong doubtfully to the Baxter's Brook group; lower down, others of the flintiest description show the bedding by bands of different colors, as they do also at the watering trough near Dunmaglass.

Bailey's Brook.

At the west end of the Hollow, near Bailey's Brook, a knob of flinty sandstone and porcellanous argillite, with indefinite dip, is isolated from the main mass of these rocks in Brown's Mountain by Silurian and Carboniferous strata, or by reddish, sandy grits of the Bear's Brook group. In the mountain east of John McLean's, James River rocks are cut by dykes of porphyritic felsite and diorite.

Vamey's Brook

On Vamey's Brook, greenish-gray, flinty slates and sandstones, intersected by a network of minute quartz-veins, come from beneath the fossiliferous Silurian shales of the lowland and rise into a hill. On the main branch, below the mountain road, fragmental felsite and diorite are associated with slates which, at the road, are somewhat pearly, soft, greenish and finely laminated. The rocks of the west branch of Bailey's Brook and the head of Bruce and Bear's Brooks, are perhaps also of this age. The flinty slates and dykes of Right's River require no special mention. Above Clydesdale, massive, twisted, jointed, ribanded, white-weathering quartzite and slate are cut by dykes of dark crystalline diorite, and hold blotches of quartz and calcspar near the contact; they prevail also in the mountain west of the Pleasant Valley, and on the Brown's and Eigg Mountain roads.

Right's River

James River.

The typical rocks of this group found on James River succeeding red intrusive syenite consist of beds like the foregoing—light-gray and greenish gray, flinty, splintery, compact sandstone or siliceous slate, so coherent that the bedding, always obscure, is here distinguishable only by bands of color. Further up, the beds become more distinct, but are intersected by dark-green fine diorite, blotched with epidote and calcspar. Above the syenite on the first branch from the west, these rocks are full of quartz-veins, some of which are pink, and probably, from the syenite which again succeeds higher up and with alternations of argillite occupies all the district hereabout, and passes sometimes into massive granular felsite or diorite of greenish and gray colors. Near the Brown's Mountain road, and above the falls, are outcrops of whitish, fine, flinty sandstone or quartzite. Below the confluence of two large branches and just above the falls, greenish-gray flinty slates and sandstones are cut by dykes of fine pyritous diorite.

Intrusive rocks.

On other brooks to the westward of James River, syenite and gray diorite cut quartzite and siliceous slate. On one of these brooks, at a fall, is a vein or dyke, two inches thick and downward, of flesh-red, compact, and finely crystalline quartz-felsite, with a few grains of mica and hornblende. The mixture is homogeneous, and the grains not so large in the granular portion as in the syenite, yet the vein probably represents the syenite and is intrusive or newer than the slates. On another brook, associated with the siliceous rocks, is a dark, indian-red and green, coarse, granular diorite; in another, a compact, flesh-red quartz-felsite, holding porphyritic crystals of felspar, probably part of the red syenite mass in contact with the slates along a very irregular boundary and throwing veins a short distance into the latter.

Brierly Brook. On Brierly Brook and other brooks of the neighborhood above the railway are other dykes of reddish syenite in flaggy sandstone and

Iron ore. slate. West of the main branch are small traces of specular iron. Some of the Cambro-Silurian strata of Kerrowgare and Blue Mountain belong perhaps to this group, but the boundaries have not yet been defined.

2. *Soft Slates of Baxter's and Brian Daly's Brooks.*—The typical rocks of this Middle Cambro-Silurian group underlie the reddish-gray grits of Marshy Hope, apparently unconformably, although the relations of the two groups are often obscure and the boundaries doubtful.

Composition. They consist largely of contemporaneous volcanic materials, and even the sedimentary beds appear to be, in part, of similar origin. On the

Baxter's Brook. top of the hill, at the head of Baxter's Brook, outcrops of quartz-veined, flinty, reddish-gray grit, are in place on the winter road from Alexander McDonald's (Weaver) to the head of Beaver River. Eastward from these outcrops the detritus is greenish, smooth, somewhat pearly argillite, which is in place with fine, gray micaceous sandstone in the brook. Upstream, on the main branch above the fork, similar rocks are cut by dark-greenish, nearly compact diorite; while higher still come reddish-gray, quartz-veined, flinty sandstone and grit. Below the fork are cliffs of gray, slaty, porphyritic felsite, succeeded by red and green mottled, soft, friable slates or shales, with films of calcspar in the joints and small traces of hæmatite. Lower down, greenish and reddish flinty, fine-grained or compact, smooth, friable sandstone, and shaly or massive argillite, veined with quartz; and slates and massive argillite, extend to the telegraph road.

Brian Daly's Brook. The first rocks seen above the railway in Brian Daly's Brook,* are gray and reddish-gray sandstone, grit and conglomerate, largely composed of the debris of greenish and bluish-gray and reddish soft slates

* Trans. N. S. Inst. Nat. Sc., Vol. V., p. 199.

or argillites, like those of Baxter's Brook, which are in place, a little higher up, with flinty, splintery sandstone and more siliceous argillite. All these are overlain by the Medina belt of Marshy Hope valley. In the hill-range between Antigonish and Morristown, rocks of this group appear to be largely developed. At the head of a branch of North River, is a considerable breadth of gray and light-colored fragmental shales or slates, perhaps volcanic tuffs; and numerous similar outcrops in the neighboring branches, associated with syenite, greenish-gray, massive slate and quartzite or sandstone, and reddish-pink and gray, slaty felsite and quartzite. Lower down, and below the highest outcrops of Carboniferous limestone, are felsitic rocks and a beautiful red syenite passing into almost pure quartzite or quartz-porphyry. Silurian basin. Antigonish hills. North River.

In a small branch from the eastward, greenish, rusty, ferruginous and calcareous or dolomitic sandstone and shale, probably represent this group; the grit and conglomerate, near the school-house on the mountain, may also be doubtfully referred to it; while other outcrops in the neighborhood belong perhaps to the James River group. These rocks are well seen on the little brooks south of North River; on that to the north they comprise flinty, massive, fine sandstone, and greenish, silvery, smooth-bedded slates, with crystals of iron-pyrites, cut by dykes of syenite.

On the north branch of Right's River, about a mile above the railway bridge, the little brooks from the eastward show massive cliffs of greenish-gray and gracefully banded argillite and flinty, greatly jointed, rubbly, quartz-veined, pebbly sandstone and grit, like the rocks of Malignant Cove and Morristown. The land in the neighborhood is good and well cultivated. The slates are cut by dykes of gray, fine, epidotic, hæmatitic diorite, containing quartz-crystals in vugs. Right's River.

The Hallowell Grant slates have already been described.

Underlying the Carboniferous conglomerate in Livingstone Cove Brook, above the road to Ballantine Cove, is a bottle-green Pre-Carboniferous conglomerate with a band or vein of broadly crystalline calcspar or limestone; also, black slate, like that of McNeil's Brook and the shore at Georgeville, but less porcellanous, with shiny, structureless graphitic markings. Higher up, are black and gray, quartz-veined slates and soft, light-gray sandstone. Above the road in the brooks nearer Ballantine Cove, are outcrops of dark slates full of spots of pyrites, which is also in films between the layers, with many veins of white oily quartz. Livingstone Cove.

Bluish-gray flinty slate, probably of the James River group, occurs in some parts of the hill, and not far from the shore road.

On the shore, east of Georgeville, at the mouth of McPherson's Brook, the dark and light-gray, flinty rocks, seen higher up the brook, are Georgeville.

overlain by the bottle-green Pre-Carboniferous conglomerate of Livingstone Cove, which contains many pebbles of the slates and trap, and is well seen on the reefs at low water extending west to the next fish-house, where it is interstratified with very dark slate, succeeded farther west by a band of green conglomerate, fifteen feet wide. Quartz-veins run in the bedding of this conglomerate and irregularly in the dark slate. Both appear to skirt the coast outside a nucleus of James River rocks; the slate being softer than that of the James River group, rich in pyrites in films, crystals and spots, and holding lenticular calcareous and siliceous layers which may be fossiliferous.

Contact of Carboniferous and Cambro-Silurian rocks at Livingstone Cove.

On the shore at Livingstone Cove, the Carboniferous conglomerate is unconformably underlain by greenish and reddish slates, massive, fine, flinty sandstone and nut- and egg-conglomerate, intersected by greenish calcareous trap and porphyritic diorite, by quartz-veins, sometimes exceeding one foot in thickness, and by others of whitish calcspar, of one inch and less. The conglomerate, which is very much altered, is composed of pebbles of syenite, quartz, epidote and flinty argillite.

Veins.

Conglomerate.

To the westward, finer rocks predominate, as already stated.

The conglomerate at the point of next cove is redder, and besides pebbles of black slate and diorite, holds many of red syenite.

Up the next brook to westward, the cliffs nearest the shore are of light and dark gray flinty shales and flags, sometimes papery and pearly, which should yield fossils, and are underlain upstream by more flinty rocks with trap dykes.

Malignant Cove

The reddish and bottle-green very flinty conglomerate around Malignant Cove Pond, cut by dykes of dark diorite and reddish porphyry, is mixed with quartzose sandstone above the bridge on the shore road, and with slaty, coarse, conglomeratic grit and red slate, resembling some of the Upper Cambro-Silurian rocks of Marshy Hopé. These form the walls of a gorge at the grist-mill, and near the saw-mill, are interstratified with greenish, flinty, quartzo-feldspathic rocks as flinty as those of James River, and sometimes so crystalline that they might at first sight be mistaken for porphyries and fragmental Louisburg breccia.

These strata are probably the same as those associated with limestone on Livingstone Brook, on the shore at the mouth of McPherson's Brook, Georgeville, and on McNeil's Brook, from which fossils were obtained; but whether certain beds do not belong to the upper, or Bear's Brook group, is not clear. They must be carefully distinguished, however, from the Carboniferous conglomerate higher up the brook. Below Blind Allan's shop are flinty James River rocks, cut by diorite.

Conglomerates of two periods of formation.

Gulf road at Maryvale.

To this group probably belong, also, the peculiar rocks of the brook which crosses the Gulf road from the westward, immediately north of

Maryvale—cream-colored, light-green and dark bluish-gray, rusty-weathering clay-slates, with a few hard bands of light-green sandstone, passing into compact quartzite and underlain by brownish slates, like those of Sunnybrae, the Keppoch, Baxter's Brook, and other places, associated with light-colored slates, containing white porphyritic spots, perhaps of volcanic origin, and cut by veins of a flinty mixture of opaque quartz and ankerite. Pits have here been dug in a brown, flinty friable rock, which contains films of calcspar, hæmatite and serpentine in the joints, and irregular veins of calcspar. Near the road, outcrops of massive, gray, flinty sandstone or quartzite, with a reddish tinge, are cut by red syenite, which contains very little hornblende. These rocks, perhaps, cross the road in the high knolls which bound the Carboniferous strata of Malignant Brook. Mining operations at Maryvale.

At the mouth of the little brook, about a mile east of McNeil's Brook, greenish, compact diorite is in contact with greatly altered fine grit and reddish conglomerate like that of Malignant Cove. Volcanic and sedimentary rocks west of Malignant Cove.

The first rocks seen above the shore road in McNeil's Brook are reddish porcellanous, fine friable argillite and greenish-gray flinty sandstone and argillite, cut by dykes of diorite, and interbedded with light-gray and whitish, somewhat micaceous sandstone and grit, often loose in texture. Higher up are bluish and blackish, very flinty, pearly, twisted slates, probably of the same formation as those of the shore at Georgeville, from which were obtained certain narrow, fine graphitized wavy markings, probably trails of annelids. McNeil's Brook. Fossils.

Just below the falls are red slates and greenish, earthy, massive concretionary sandstones, associated with dark hæmatitic traps and diorites. Dirty-greenish and reddish-gray soft argillites are, above the falls, cut by coarse, dark granular diorite; and higher still, greenish-gray, soft argillaceous shales show markings of fucoids and an obscure cystidean stem. Fine exposures occur on the branch of McNeil's Brook, at the fork of Angus Campbell's road, where the red calcareous slate and gray-greenish more flinty slate strongly resemble the rocks of Baxter's Brook; and the gray and greenish, ribanded, quartz-veined, flinty slate and grit, perhaps the highest beds of the James River group. Westward of McNeil's Brook, and some distance above the shore road, are several outcrops of hæmatite among ledges of greenish-gray flinty sandstone and shale, surrounded by red slates, and cut by the greenish-gray massive diorite and traps of the neighborhood. Volcanic rocks. Fossils.

At Angus Campbell's gate, red slates are mixed with syenite and trap; and in the small brook to the northward, whitish, flinty quartzite, with reddish and gray felsite and quartz-felsite. Lower down this brook, the quartzite overlies the red argillite of the little branch from

the left, and is overlain by cliffs of greenish and cream-colored, micaceous, more or less sandy shales, with flinty quartzose layers, spotted with ankerite, often mottled with red. At the Gulf road these slates are covered by Carboniferous sandstone; but in the next brook to the southward, again appear, mixed with breccias, reddish and greenish-gray compact quartz-felsite or syenite and dark-green diorite; underlain higher up by tuffs and rocks probably belonging to the James River group.

Cambro-Silurian rocks of the Gulf road

The soft rusty-weathering slates nearest the iron ore west of the Gulf road evidently belong to this group; but higher up are more flinty, ribanded slates, some also rusty and apparently interbedded with traps containing streaks and amygdules of opaline quartz and calcspar.

On the second brook crossing the Gulf road, north of Maryvale, similar calcareous and dolomitic, rusty-weathering slates are crowded with small crystals of iron-pyrites, interstratified with a greenish breccia or conglomerate, and with gray, massive and slaty, soft trap-

Black slates.

like and fragmental rocks. Higher up are black, crumbling graphitic slates like those of Georgeville and McNeil's Brook. The resemblance to the Baxter's Brook rocks is more striking higher up the brook. They are underlain by another band of greenish conglomerate, formed apparently from the underlying James River group.

Doctor's Brook.

On the road up Doctor's Brook, south of the Hollow, red slates with interstratified breccias, flinty sandstones, and banded quartzites and hæmatite are well seen for some distance, and are then underlain by James River rocks, the contact with which is again seen not far from the Trunk road, on the road through the back settlement. Red slates are in place for seventy-three yards above the bridge over Doctor's Brook on this new road.

The Hollow.

In all the little branches south of the Hollow, these red, concretionary slates, associated with tuffs and other volcanic materials, include

Iron ore.

many deposits of iron ore. On the Trunk road are outcrops of greenish-gray, soft, serpentinous, chloritic and calcareous slates, penetrated in all directions by threads of quartz.

South of the crossing of Doctor's Brook the James River rocks probably begin. On the branch east of the Trunk road the volcanic rocks nearest the main brook are succeeded upstream by greenish, flinty argillite, reddish and greenish mottled, hæmatitic and calcareous

Iron ore and limestone.

argillite, passing in places into pure hæmatite and limestone, and associated with bedded traps and with greenish, evenly-bedded argillaceous sandstones. These rocks strikingly resemble some of the Devonian strata of McAra's Brook; they extend to the deep bouldery valley, or Little Hollow, in which this brook takes its rise, and from which another begins to run to John and Andrew McDonald's. In the

small brook west of McDonald's, traps are succeeded upstream by flinty rocks, veined with slaty, oolitic, hæmatitic limestone, which has been dug. Iron ore of Doctor's Brook.

A little higher, greenish, flinty, compact sandstone, in part thick-bedded and nearly white, reddish or brownish, micaceous, compact or fine-grained quartzite, sandstone and red slate, include a band of impure hæmatite one foot thick, apparently enclosed between layers of rusty, greenish-gray and cream-colored slate and sandstone, cut by diorite, trap, and large masses of white quartz.

On the west branch of Bailey's Brook are cliffs of greenish and gray flinty, splintery argillite and quartzite, containing calcspar and greatly jointed, which perhaps belong to this group, as well as the small indefinite exposures in the adjoining branch of Barney's River, which flows from Munro's clearing. Bailey's Brook. Barney's River.

On the branch of James River crossing Brown's Mountain road near the county line, the rocks are, perhaps, in part at least, of this group, consisting of gray flinty grit and porcellanous slate, whitish and cream-colored quartzite, cut by dykes of diorite. At New Strathglash and on the road to the post office at Brown's Mountain, the soft slates abound, but become more flinty near this post-office. Between the bridge at New Strathglash and Marshy Hope, light-gray and whitish flinty siliceous slates are cut by flesh-red syenite or nearly compact quartz-felsite, and succeeded lower down by reddish-gray fine sandstone grit, conglomerate and greenish, fine, brecciated argillite, probably belonging to the highest group. Similar rocks are also found at the head of Right's River. James River. Syenite. Right's River.

In the first little glen east of Marshy Hope railway station, whitish and reddish, flinty, quartz-veined, compact sandstone or quartzite is followed by red and green soft argillite, easily splitting into flags several feet square, sometimes almost replaced by quartz-veins; other neighboring brooks expose outcrops of sandstone, grit and slate. Marshy Hope.

In the brooks above the railway, east of James River, the contact of the Cambro-Silurian slates with the syenitic and dioritic rocks is well seen; the former are in part flaggy and thick-bedded, jointed, altered and arenaceous, splintery, with small quartz-veins.

The Marshy Hope Silurian strata form a narrow trough between hills of Cambro-Silurian rock. In the brook crossing the railway from the northward, east of the county-line, are the gray slates of Baxter's Brook. On Pushee's road no Silurian rocks appear, nor does the detritus indicate any in the fields south-west of Lindsay's old stage stables. The brooks from the north-east at the 30th mile-post and at the end of Glenbard road, expose greenish, flinty argillites, cut by dykes of felsite and quartz-felsite. On this road, near the railway, are Silurian basin of Marshy Hope.

outcrops of reddish-gray sandstone, green, soft slate, and flinty grit. On the brook from the road, at Hector Grant's, are greenish and reddish, soft, splintery shales, with films of hæmatite in the joints, and bands of flinty, quartz-veined, compact and fine-grained, reddish-gray sandstone, and grit, apparently belonging to the upper group; and among them an outcrop of bright-green, soft, black-spotted trap. Below the trap, the cliffs display reddish-gray, splintery sandstone and soft slate, veined and blotched with quartz and calcspar. The boundary between the two groups, however, is not distinct; and the same may be said of the rocks at the head of Bear's and Bailey's Brooks.

Boundary obscure between groups 2 and 3.

The hill in the rear of Brian Daly's house, Marshy Hope school and post-office, probably marks the limit of the Silurian rocks, the road being thus approximately their southern boundary; while the hill on the north, out of which these rocks extend at least to the first bridge, follows about fifty yards from the railway nearly to Oulton's road. At the 27th mile-post, Cambro-Silurian strata are probably not more than 150 yards south of, if they do not come into, the road, and the closing of the glen, near Rory Grant's, seems to indicate the end of the basin.

Pleasant Valley

Although most of the Cambro-Silurian rocks in the neighborhood of Pleasant Valley, seem to belong to the lowest group, yet near the top of the Carboniferous valley are soft, greenish, calc-veined slates, perhaps of the middle group.

Keppoch.

On the Keppoch, the most easterly outcrops of this group, seen in a little brook immediately west of St. Joseph's Lake, succeed a reddish and grey, porphyritic felsite, which underlies Carboniferous rocks. They consist of brown or chocolate-red argillite, with a tinge of green, with harder layers of sandstone, cut by diorite dykes. Upstream are blocks of fine grit, perhaps Carboniferous. On the roads west of this brook, the green slate and gray flinty sandstone underlying the Carboniferous conglomerate and limestone, are as usual cut by dykes and apparently associated with fragmental felsites, like those to the southward, which have been classified as Pre-Cambrian.

Beaver River.

On Beaver River, above McLean's mill, greenish, smooth-bedded, splintery slates, underlie Carboniferous conglomerate, and are cut by dykes of greenish, coarse diorite. In Hartshorn Brook, greenish argillites, containing blotches of white calcspar and of a mixture of quartz and calcspar, sometimes three inches thick, have a cleavage oblique to the bedding but with the same strike, and are associated with a breccia or conglomerate composed entirely of fragments of soft green slates: this may either be on the line of a fault or be derived from fragments of the James River group. A similar breccia is again seen on the railway near Barney's River station, in contact with intrusive rocks. Outcrops occur at intervals up to the head of this brook and also on

the adjoining brooks; they are always somewhat massive, flinty, and seldom show the dip.

Higher up the Beaver River, near McLean's road, are cliffs of gray and greenish, siliceous slate, more or less splintery, somewhat pearly, in contact with greenish, porphyritic felsite and quartz-felsite, containing hornblende, iron-pyrites and epidote, and giving the slates at the contact a flinty, porcellanous aspect and prismatic cleavage, which breaks them into long pieces at right angles to the bedding. This outcrop is on the right branch above the fork. The cliffs of the left branch show gray, bluish-gray and greenish, pearly, evenly-bedded, siliceous slates, with a tinge of red, associated with sandstone and containing threads and irregular blotches of quartz. On the road near McLean's, the felsitic and dioritic rocks, sometimes nearly compact, contain also quartz and calcspar, massive and fragmental, some fragments being one inch in diameter.

Quartz veins.

On Coillteach Brook the boundary between the greenish, pearly, siliceous slates and the felsites to the southward, is along a green, fine diorite, gray granular quartz-felsite and gray, porphyritic felsite, seen only at the contact.

The slates are full of white quartz, generally in the bedding, and in some places nearly replaced by it: large masses of barren quartz appear also in the felsite; this felsite, which has an obscure bedding, and seems to pass into the slate, is in part pebbly or brecciated, and might belong to either group, although lower down it has rather the appearance of an intrusive rock.

Barney's River.

Nearly all the Cambro-Silurian rocks on the various branches of Barney's River, appear to belong to the upper or Bear's Brook group.

The strata of Rory Grant's Brook, apparently belong largely to the middle division, although the grit and sandstone of the hill and the grit and conglomerate at the head of the brook, resembling those of Malignant Cove, are perhaps newer.

Contact with Silurian.

On McIver Brook and on the middle branch of Barney's River, the rocks immediately beneath the Medina are apparently of the Baxter's Brook group; and if so, indicate its want of conformity with the Silurian.

Above the carding-mill, on the river, they consist of greenish, reddish and whitish grit and pyritous sandstone, associated with granular and porphyritic felsite and diorite, bright red and green, mottled, fragmental rocks, and also with slates resembling those of Baxter's Brook. On the branch flowing from the new road near Irving's, the slates are cut by diorite and by greenish and reddish, soft, chloritic traps. Near the confluence of this brook, Barney's River shows greenish and gray, somewhat pearly slates and whitish, pyritous grit, overlain by Medina sandstone.

At their contact with the syenitic rocks of the mountain toward Munro's, the slates do not seem to be more porcellanous than usual.

Piedmont Cambro-Silurian rocks.

Those of the hill south of Piedmont Valley, belong in part to the Baxter's Brook group, and are cut by masses of syenite and other intrusive rock. On the southern slope of the hill, Medina sandstone is underlain by reddish grit of the higher group; underlain in turn by reddish, soft slates and flinty, splintery slates, like those of Glenbard, by gray and greenish slates, and on the northern slope, by greenish and reddish banded slates.

Avondale.

On the top of the hill, near Avondale railway station, at John McLeod's house, red syenite is in contact with greenish, Cambro-Silurian slate, while nearer the station and also toward Wm. Murray's house, greenish-gray, earthy, Silurian sandstone and slate are in place.

On the little brook, thirty yards west of Piedmont station, brownish, soft Carboniferous sandstones, are underlain by greenish slates, seamed with a network of dark veins, greenish and gray, calcareous, massive sandstone and slate, and reddish and greenish flinty argillite. On the hills, which are for the most part cleared, fine outcrops of all these rocks can be easily examined. On the Wagner road, sandstone is in contact with greenish, quartz-veined, almost papery, Baxter's Brook slate.

Between the road and the top of the hill northward, mottled red and green, soft, pearly slates, veined with quartz, resemble certain slates seen on Sutherland's River. On the mountain farther north, these are cut by reddish and gray, flinty, compact felsite and quartz-felsite, holding small crystals of pyrites and passing into reddish fine syenite. Nearer Piedmont greenish-gray and reddish ribanded slates, cut by dykes of soft, greenish-black diorite, cross the road, succeeded by dark bluish-gray and reddish flinty slates, compact or fine-grained,

West River of Antigonish.

mottled sandstone or quartzite and fine grit. At the head of the Ohio settlement, the gray and greenish-gray flinty slates of Callahan Brook, already referred to, are perhaps Cambro-Silurian. In the minute

Gold (?)

quartz-veins of the gorge, gold is reported to have been discovered.

Black Brook, St. Mary's.

Similar slates, found among the felsites on the road to Black Brook, are probably also of the same age, as well as the small outliers of reddish sandstone of the upper Black Brook Lake, and the dark slate of the lake near Gunn's.

On the shore of the upper lake, reddish sandstone, grit and conglomerate, which may belong to the upper group, are almost certainly in place; and from the abundance of blocks of sandstone and argillite along the road, it may be inferred that such rocks occur there also, although felsitic rocks prevail everywhere in the neighborhood.

Black Brook, not far above the St. Mary's road, cuts through bluish-

ks of the mountain toward ay, fine, micaceous, coherent slate, doubtfully Cambro-Silurian, rest- Contact of
porcellanous than usual. g on reddish and gray, flinty, compact quartz-felsite, at contact with Cambro-Silurian slates with felsites.
alley, belong in part to the hich no metamorphism is noticeable. It contains fucoids and passes
ses of syenite and other in- to fine sandstone, but is essentially argillaceous and so cleaved that the
he hill, Medina sandstone is p is obscured. At the lower part of the outcrop it is dirty-green,
oup; underlain in turn by umbly and very rusty, or papery and dark bluish-gray, with about
tes, like those of Glenbard n feet of gray calcareous argillite full of minute, hard crystals, pos-
orthern slope, by greenish ly produced by its contact with the quartz-felsite. The purple,
herent argillites, found higher up the Black Brook, are perhaps also
railway station, at John mbro-Silurian, although they may be Devonian and a continuation
act with greenish, Cambro- those of Lochaber.
also toward Wm. Murray's The red, greenish and gray slates and conglomerate of Campbell East River of St. Mary's.
tone and slate are in place. rook, Green Brook and the Garden of Eden, are also perhaps newer
Piedmont station, brownish, han Cambro-Silurian. On Campbell Brook the conglomerate of the
by greenish slates, seamed st branch is somewhat friable, massive and jointed, with minute
gray, calcareous, massive ins of specular iron, and associated with marl and grit. It contains
sh flinty argillite. On the obbles of the syenite, felsite and similar rocks upon which it rests,
fine outcrops of all these t also of red and whitish, flinty sandstone and grit. On Garden
gner road, sandstone is in ver the slates above Fraser's are bluish and greenish-gray, flinty and
st papery, Baxter's Brook ritous, but are followed upstream by red, soft slates.
On the west side of Eden Lake, irregular areas of Baxter's Brook Eden Lake.
ill northward, mottled red tes, presenting considerable variety, are cut by dykes of felsite, but
h quartz, resemble certain t more metamorphosed than usual at a distance of three feet from
mountain farther north, e contact; so that the general great metamorphism of these strata is
ompact felsite and quartz- arly not dependent on these intrusions.
passing into reddish fine On the Copper Mine Brook, above Eden Lake, are large outcrops
nd reddish ribanded slates, these rocks, but whether they are contemporaneous with or newer
cross the road, succeeded an the neighboring schists and fragmental felsites, has not yet
s, compact or fine-grained, en determined.
At the head of the Ohio Above the syenite and Silurian rocks of the lower part of the little Head of the East River of Pictou.
slates of Callahan Brook, ook which crosses the road between Eden Lake and Kerrowgare, about
Silurian. In the minute mile east of the East River of Pictou, appear good outcrops of gray
have been discovered. d greenish-gray, massive, rubbly argillite, ferruginous, calcareous and
the road to Black Brook, obably dolomitic, cut by dykes of greenish, fine diorite. Higher up
as the small outliers of ledges of flinty, rusty-weathering quartzite or grit, overlain by
Lake, and the dark slate ay, sandy, pyritous, fine slates, often very dark, containing veins of
monite which have been worked, but are apparently of no value; Iron ore.
ndstone, grit and conglo- d higher still, reddish and greenish flinty argillite and fine
oup, are almost certainly ndstone.
f sandstone and argillite Greenish and reddish argillite occur in the East River below Smith
rocks occur there also, ke, at its confluence with a little brook from the eastward, in con-
the neighborhood. ct with red syenite; while below the confluence are outcrops of red-
oad, cuts through bluish- h and greenish ribanded slate and sandstone.

Sunnybrae. Immediately above Sunnybrae bridge, on the north bank of the East River of Pictou, black Clinton slate is in place; one hundred and fifty yards upstream is an outcrop of Medina sandstone; and one hundred yards higher, reddish, flinty, compact, Cambro-Silurian quartzite, full

Iron ore. of films of specular iron. At the mouth of the brook from the church and school, the fine sandstone or quartzite, greenish and gray slate, coarse grit and reddish and greenish soft argillites, in stripes or bands,

Fossils. resemble the rocks at Dunbar's on the opposite side of the river, in which obscure brachiopods, were found, and also those of Doctor's Brook. At the church are Baxter's Brook slates; on the next brook to the eastward, blackish and gray, rusty-weathering, rubbly slates, in

Volcanic rocks. indefinite thick beds, with light and dark-greenish trap and porphyritic

Iron ore. and fragmental felsite and diorite, blotched with epidote, quartz, and films of specular iron.

The detritus in the road above Sunnybrae is Cambro-Silurian as far as the church; the associated volcanic rocks are apparently not newer: they require no special mention and their extent will be seen from the

Thompson Brook. map. They come from beneath Silurian strata in Thompson Brook, in a belt of no great width, above which are greenish, siliceous slates, succeeded again by Silurian. To their greater hardness are due

Blanchard Brook. cascades of considerable beauty in Blanchard Brook, below the cliffs of Silurian and Cambro-Silurian at the mill-pond; these rocks consist of reddish, purplish and greenish, porphyritic, flinty felsite and breccia, and include aluminous shales, containing much calcspar and

Iron ore. specked with micaceous iron ore. The fragments of the breccia are of every size, but usually smaller than a pea; the dip is obscure.

Silurian rocks. Silurian rocks occur higher up, with nearly horizontal dip, succeeded again by bright-green, fragmentary and nearly compact, soft breccias, with films of calcspar and serpentine in the joints.

On the road from Sunnybrae church to Blanchard, Cambro-Silurian slates give place to massive, green diorite, to flinty, gray and reddish porphyritic felsite, to trap and to reddish, fragmental slates, which occupy most of the road to the McInnes settlement near Sutherland Lake, from the lake to the Blanchard road and thence southward as shown on the map.

McLellan's Mountain. The upper and middle groups can also be separated between Bridgeville and Sunnybrae, Springville and McLellan's Mountain; but the tracing of the boundary requires further surveys to be made.

French River. The areas on the east branch of French River, at the Blue Mountain church and elsewhere in the vicinity, require no special description. On the branch of French River flowing from Robert McLeod's, gray and greenish slates are associated with fine, quartz-veined sandstone. On the river above the confluence of this brook, are fine exposures of

greenish, soft, ribanded slates and sandstones, cut by dykes of porphyritic diorite and felsite, which for a few inches from the contact render the slates porcellanous.

Pre-Carboniferous rocks of the Pictou coal-field.

The rocks first seen on Sutherland's River,* beneath the Carboniferous strata of the Pictou coal-field,† belong to this group; greenish, flinty argillites or slates, resembling those of Beaver River are mixed with dark-green trap in the gorge with a succession of fine falls at Park's mills, where the cliffs rise to a height of fifty feet. The cliffs above the lowest fall are composed of greenish, siliceous slate, blotched with quartz. Above the bridge, however, large outcrops of dark and light-green trap and reddish-gray, hæmatitic, flinty, compact felsite, quartz-felsite and red soft argillite, in shaly layers, are succeeded by reddish-gray, fine, massive, jointed Upper Cambro-Silurian conglomerate and grit, and continue to the bridge on the St. Mary's road, where they are overlain by Medina and higher strata, remarkably rich in fossils.

Park's mills.

Volcanic rocks.

Upper Cambro-Silurian.

Medina.

After a long interval of Silurian slates, greenish, smooth-bedded, somewhat pearly, wrinkled and papery, coherent slates, resembling the slates of the upper part of Vamey's Brook, and interrupted by masses of greenish, fine, pyritous diorite, containing much quartz and epidote, extend far up the stream, which here forms several cascades and falls. The rocks seen near Alma mills, at the crossing of the railway bridge, are somewhat similar, and among them is a greenish breccia like that of Hartshorn Brook; but Sir J. W. Dawson reports the discovery of Devonian plants; so that the strata of this brook are, no doubt, newer.

Devonian rocks of the Middle River of Pictou

3. *Upper Cambro-Silurian Rocks or Reddish-gray Sandstone, Grit and Conglomerate of Bear's Brook.*—Some of the Cambro-Silurian strata of the Morristown Hills and of Livingstone and Malignant Coves may, as above stated, belong to this group, which is, however, most largely developed on the various branches of Barney's and French Rivers.

On the east branch of Barney's River, east of the road at the railway station, rusty-weathering Silurian slates are underlain by reddish-gray, very flinty conglomerates or quartzites, associated with gray, red-spotted, compact, quartz-veined, porphyritic felsite, as seen near the mouth of Bear's Brook.

Barney's River.

Up this brook the volcanic rocks are succeeded by dirty-green, greenish-gray and dark-bluish, splintery, striped, slates; succeeded again by felsite, in part obscurely granular; and, still higher, by greenish and gray flinty argillites and compact sandstone, like those of Baxter's Brook. Fine outcrops of flinty slate, compact quartzite, sandstone and conglomerate, cut by felsites, soft calcareous traps and

Beaver's Brook.

* Trans. N. S. Inst. Nat. Sc. Vol. III., p. 69, and Vol. IV., p. 463.
† Geological Survey Report for 1886-89, p. 6.

Volcanic rocks. fine porphyritic diorite are seen in the brook and its branches, the sedimentary rocks being slightly altered at the contact. At the falls, in the main branch are greenish-gray argillite and sandstone, sometimes speckled red; at the upper falls of forty feet, greenish fine diorite, slate and flinty felsite are associated. At Charles W. Oulton's, near the head of the brook, slate, flinty, quartz-veined sandstone and grit are cut by a mass of gray granular syenite and diorite.

Limestone. The south branch of Bear's Brook presents abrupt cliffs of greenish-gray, evenly bedded, splintery, siliceous argillite, with calcareous bands, full of calcspar veins, passing into impure crystalline limestone, cut by gray, greenish, bluish-gray and blackish, fine, pyritous diorite or obscure granite, the felspar being in whitish distinct grains. The alteration along the dykes is not great. Higher up, and also at the head of the east branch of Barney's River, the argillites are apparently overlain by reddish and greenish fine sandstone, massive, thick-bedded or shaly. In the adjoining brooks, reddish-gray fine grits and argillites are met with, and on the railway, mixed with reddish and gray coarse syenite, quartz-felsite and a breccia like that of Hartshorn Brook. Porphyritic felsite and diorite, and flinty, greenish porcellanous rocks are found near the mouth of Bear's Brook.

Contact with Silurian. On the old post road opposite, reddish fine conglomerate and sandstone, full of reticulating veins of quartz, are overlain by greenish, tough, flinty, nearly compact Medina sandstone, that has been traced both up and down Barney's River.

Bailey's Brook. At upper Bailey's Brook, a belt of reddish and bluish-gray coherent grit and of flinty, quartz-veined sandstone and nut-conglomerate follows the old mountain road, underlying Silurian fossiliferous strata, and underlain in turn by the flinty rocks of James River, which can be

Keefe's Brook. traced to a track between the head of Keefe's Brook and William McDonald's road to the northward.

Below the road in Keefe's Brook, reddish-gray fine grit is associated with greenish-gray, somewhat resinous, ribanded, pearly slate, like that of Baxter's Brook. Grit and sandstone, with minute quartz-veins, also occur on the west branch of Bailey's Brook, on Brown's Mountain road, near the county-line, and at the head of the branches of James River in the vicinity.

Barney's River station. The crests and precipices of the hills east* of Barney's River railway station show sparkling quartzose, pebbly grits, underlying the Silurian rocks of the valley, the contact being well seen in the triangle

Contact with Silurian. formed by the railway, the telegraph road, and the road down the middle branch of Barney's River.

*Transactions N. S. Inst. Nat. Sc., Vol. V., p. 195.

Near the head of Bruce Brook they are associated with gray, reddish and greenish porphyritic breccia, and granular, fine diorite. At the east end of the old Crockett road, grits and quartzites are in place, overlain toward the west end by Silurian strata. Equally good exposures of conglomerate and coarse grit, cut by veins of quartz and blotched with calcspar, present themselves on the west branch of Barney's River, above the bridge at Robinson's, surrounded by and underlying Silurian strata; and also in the hills south-east and east of Kenzieville, containing pebbles of syenite and slate, and associated with red porphyritic felsite or breccia, and soft, purple amygdaloid. The porphyry first seen on the large branch which enters at Stalker's bridge, is succeeded by reddish-gray sandstone, grit, breccia, and fine, dark hornblende-rock or diorite; by flinty, coarse, pebbly grit and conglomerate, and greenish-gray, fine, quartz-veined sandstone; and again, above Alexander Bannerman's, by light-gray soft trap, red compact porphyry and flinty diorite. On the western branch a greenish slate, like that of Beaver River, and a red argillite, like that of McNeil's Brook, both belong apparently to the Baxter's Brook group.

Bruce Brook.

West Branch of Barney's River.

In the small brook from the westward at Sutherland's, grit and nut- and egg-conglomerate are again exposed; the pebbles include a red and purple porphyry, like that of the river, and some of the altered grits bear a strong resemblance to the fragmental felsites.

Conglomerate.

In the little brooks running north into Piedmont valley, east of the railway station, many large blocks of reddish-gray, flinty, quartz-veined quartzite, grit, conglomerate and felsite probably indicate this group. On the top of the hill, behind the station, are knobs of quartzite and grit, overlain toward French River by Medina strata. Grit and conglomerate, Baxter's Brook slates and syenite occupy the western end of the hill. Their contact with the Silurian and Carboniferous rocks has been carefully traced. In the east branch of French River, above the Piedmont road, a cliff of Cambro-Silurian quartzite and reddish grit protrudes from the bank on the north side, and is immediately overlain by Clinton slates, the Medina being here wanting. There is no evidence of faulting, and the black slates seem to be nearly horizontal. The flinty, whitish quartzites and gray and rusty quartz-veined grit seen east of the school at Beaver Lake, and on some of the brooks north of the East River of Pictou, are doubtfully Cambro-Silurian.

Piedmont.

Contact with Silurian and Carboniferous.

Clinton resting directly on Cambro-Silurian.

East River of Pictou.

In contact with Medina sandstone, in the east branch of French River, are greenish coarse grits, with crystals of pyrites, passing into egg-conglomerate, which holds pebbles of the red Cambro-Silurian argillite of the mountains. On the next brook to the westward, Silurian rocks are underlain by grit, in turn succeeded by gray, greenish and reddish slates.

East branch of French River.

Near Paul and Alpine Grant's, south of Glenshee, similar strata are penetrated by fine porphyritic trap, a flinty conglomerate, containing pebbles as large as cocoanuts, of reddish porphyry and other felsites. Near Glenshee, McGrath's Mountain, and in the country to the southward, reddish conglomerate and grit, in thick beds or massive, are overlain by Silurian sandstone. Greenish slate and quartzite are occasionally present, but most of the beds are coarse. In the McCulloch settlement, a conglomerate containing large pebbles and even boulders, crossed by numerous small veins of quartz, is cut by reddish and greenish compact and granular syenite, porphyry, pyritous diorite and amygdaloid. Wallace Brook displays traps interbedded with conglomerates, and underlain by a broad belt of greenish and gray slate, probably of the middle group, and by the schists described as Pre-Cambrian, the latter being well exposed and full of quartz-veins. In the neighborhood of Meiklefield post-office are outcrops of the reddish grit and trap of Wallace Brook, in contact with Silurian rocks.

Contact with Silurian and Pre-Cambrian.

The reddish flinty grit above Park's mills in Sutherland's River, on the outskirts of the Pictou coal-field, has been already described (page 33 P) as belonging to this group, and its distribution and relations to the strata above and below also indicated.

E. Silurian.

Extent.

Rocks of this system lie in the limited areas mentioned on page 6 P, in valleys or among hills composed of the strata already described; and pass beneath Devonian, Carboniferous or Permian strata. They occupy only a small portion of the region indicated by Sir J. W. Dawson,* and colored Silurian on his geological map; but more nearly that as limited in the Supplement, page 76. For details concerning them, the publications of the list given in Acadian Geology, pp. 10 to 12, may be consulted, particularly the paper by Dr. Honeyman on "The Geology of Arisaig," in the Quarterly Journal of the Geological Society of London, Vol. XX., p. 33. These strata are everywhere crowded with marine fossils, which range, as stated in this paper on the authority of Mr. Salter, from Medina to Lower Helderberg, but subsequently supposed by Dr. Honeyman to range as low as the Hudson River.† A large collection, made last summer at Arisaig and Lochaber by Mr. T. C. Weston, has been given to Mr. Ami for examination, and will be placed in the Geological Survey museum, with other fossils previously obtained by Dr. Honeyman and Mr. Weston. Others, the result of many years' collecting by Dr. Honeyman, are exhibited in the provincial museum at Halifax.

Range of fossils

* Acadian Geology, p. 560.

† Trans. N.S. Inst. Nat. Sc., Vol. VI., pp. 309 and 319, and elsewhere.

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T. C. WESTON, PHOTO., 1873

IVES-PROCESS : G. E. DESBARATS, MONTREAL.

SECTION AT STONEHOUSE BROOK, ARISAIG COAST, NOVA SCOTIA.

SHOWING TRAP DYKE CUTTING UPPER BEDS OF LOWER HELDERBERG.

The following groups are so distinct that they can usually be recognized apart from their fossils: Classification.

E 1. Medina,	Division	A	of Dr. Honeyman.
E 2. { Lower Clinton,	"	B	"
E 2. { Upper Clinton,	"	B′	"
E 3. Niagara,	"	C	"
E 6. Lower Helderberg,	"	D	"

An approximate section of these rocks underlying Carboniferous conglomerate and trap on the Gulf shore between McAra's Brook and Arisaig pier, where they are most accessible and well exposed, will serve to show their composition and general characters. The direction of the shore is about 53°. Arisaig section

SECTION OF SILURIAN ROCKS AT ARISAIG IN DESCENDING ORDER.

E 6. Lower Helderberg.	Feet.	Inches	
1. Reddish and purplish altered flags with bright emerald-green blotches and layers; more or less argillaceous, flinty and splintery, containing thin calcareous layers full of blackened shells. The red and purple beds greatly predominate; they end about fifteen yards north-east of McPherson's Brook. Dip 166° < 46°.....	100	0	Red rocks. McPherson's Brook.
2. Dirty-green, greenish and gray quartz-veined flags and shales, holding encrinites and shells in abundance. Seen in Stonehouse Brook as well as on the shore. Veins cut across the bedding and are sometimes three inches thick. Perhaps unconformable to 1. Dip 207° < 41°. End at the mouth of Joseph McDonald's Brook.....	310	0	Stonehouse Brook. Joseph McDonald's Brook.
3. Dirty-greenish rocks finely ripple-marked, full of fossils. Dip 203° < 32°.....	205	0	
4. Dirty-green and gray, rubbly or prismatic, rusty-weathering argillo-arenaceous flags. The bottom of Dr. Honeyman's Group D.—Lower Helderberg or Ludlow Tilestone. (Quarterly Journal of the Geological Society of London, 1864.) Dip 194° < 38°.....	393	0	
5. Indian-red crumbly prismatic marl, with a thin band of gray limestone full of fossils. In the upper part mixed with bright-green patches and full of calcareous nodules, like the rock of Indian Brook, Cape George. The green of the beds immediately overlying is brighter than usual, and the whole mass is more or less concretionary and nodular. This is Dr. Honeyman's "red stratum," Op. cit. p. 336, and is also described in Mr.			Red stratum.

SECTION AT STONEHOUSE BROOK, ARISAIG COAST, NOVA SCOTIA.
SHOWING TRAP DYKE CUTTING UPPER BEDS OF LOWER HELDERBERG.

		FEET.	INCHES.
	Weston's section and shown in View No. 6.* Dip 169°<34°. It has been traced more than half a mile eastward of the Trunk road.....	30	0
	E 3. NIAGARA.		
	6. Greenish argillaceous and calcareous rocks, with thin bands of limestone. Dip 169°<37°. Ends at the mouth of a little brook.....	95	0
	7. Dirty-greenish and gray, more argillaceous and crumbly, with numerous layers of gray limestone remarkably rich in fossils. Dip 171°<26°—44°.....	328	0
	8. Light-gray more or less argillaceous rock. Dip 189°<44°. —66°.....	128	0
	9. Dark-gray and bluish-gray argillites, breaking into knife and needle-shaped fragments; hard flaggy bands and a few small layers of limestone rich in fossils. The proportion of coherent bands to the great mass of the argillites is, however, very small. Dip 177°<48°....	50	0
Cone-in-cone.	10. Dark shales in cliffs; very few hard bands. A fine concretionary mass of cone-in-cone limestone, four feet in diameter and full of shells, lies in the shales, which are also rich in fossils. Large spherical concretions, probably also derived from these beds, lie on the beach. Dip 176°<38°.....	200	0
McAdam's Brook.	11. Dark shales, as in 10. To the mouth of McAdam's Brook, where the dip is 164°<36°.....	128	0
Fault?	12. Dark shales, like 10, but with more hard bands. Dip 164°<36°. Here the dip turns to 202°<42°, but probably indicates only an unimportant local undulation, for a short distance further it is 165°<37°.....	58	0
Veins.	13. Dirty-greenish and gray, prismatic, somewhat flinty calcareous argillaceous rocks, with occasional veins of quartz and calcspar and thin layers of fossiliferous limestone. Dip 168°<36°. Reefs and low cliffs.....	175	0
Fault?	14. Dark-gray and greenish argillite, jointed or broken into small pieces, and containing large calcareous concretionary masses and beds very rich in fossils. In a distance of fifteen chains on the shore, the dip changes from 168°<37° to 134°<23° back to 153°<27°, and, ten chains farther east, to 189°<40°.....	86	0
	15. Dark-gray, rusty-weathering shales, not unlike those of Barney's River, containing thin concretionary layers of light-gray fossiliferous limestone. In nearly continuous cliffs and reefs, but thickness obscure owing to changes in the dip. Probably not more than..... Dip at the base 176°<27°.	45	0

*One of a series of 21 views, taken by Mr. T. C. Weston, in 1873, copies of which are in the Geol. Survey museum.

	FEET.	INCHES.	
E 2. Upper Clinton.			
16. Light-green shales, with thicker and more numerous hard bands, which are sandstones rather than limestones and not so rich in fossils. Some of the layers have a brownish tinge. Forty yards west of the contact with 15, a small brook (Smith Brook) falls over the cliff. These form apparently the highest beds of Dr. Honeyman's Group B′ (Upper Clinton). Geol. Jour., 1864, page 336. A small fault or disturbance separates 15 from 16, the dip of the first green rocks being steeply west, while at a distance of five yards to the eastward they dip 174° < 11°. This fault is probably an upthrow on the east side, by which the red band representing the iron ore, and seen in Smith Brook, is concealed on the shore			Fault.
	32	0	Iron ore.
17. Green shales with flaggy layers of light-gray, fine and nearly compact flinty sandstone, seldom six inches thick. In the sandstone are threads of quartz and blotches of calcspar in the shales, but the general absence of veins is remarkable. At the top an undulation makes the dip 212° < 11°, after which it is 179° < 19°			Veins.
	53	0	
18. Green shales, like 17, with some of the layers of flinty sandstone one foot thick. Dip 181° < 20°, but the lower beds are greatly contorted, as if for an upthrow fault on the east side			
	63	0	
19. East of this point the shore rocks are greatly disturbed, and 50 yards east dip 113° < 28°; at 45 yards further 16° < 12°; at 40 yards further, 303° < 29°, flattening a short distance further east to < 6°, and turning to 254° < 8° at 31 yards further; 80 yards beyond, to 219° < 23°, while at 334 yards from the first mentioned disturbance, the dip is 156° < 50°, and at the mouth of Arisaig Brook, 176° < 37°. In the first part of this interval, the B′ green shales and flags—sandy, micaceous and very evenly bedded—are on the shore, with a few thin brown layers, succeeded further east by dark-gray B crumbling argillite, with occasional bands of light-gray flinty sandstone, like the strata of 15			Change of dip. Arisaig Brook.
	—	—	
E 2. Lower Clinton.			
20. Dark-gray or blackish, rusty-weathering, crumbly, papery argillites, with scarcely a trace of a hard band, seen in cliffs near the mouth of Arisaig Brook. The relation of these rocks to 18 is not clear: they may underlie them either directly or after a gap. North-east of the mouth of Arisaig Brook, they are exposed, for about 250 yards, in descending order. The shore then			

	FEET.	INCHES.
runs on the strike. The thickness of B rocks here exposed—the dip rising to $<49°$ near the bottom—is...	345	0

21. North-east of the little brook and boat-landing, where this section ends, the dip changes to $96° < 17°$, then to $16° < 45°$; at 235 yards to 186°, and 30 yards further to 79° steeply. No estimate can consequently be here made of the thickness. At the lobster factory, the dip is $98° < 35°$, and between this point and the flinty quartz-felsites of Arisaig pier, only obscure outcrops occur of dark, crumbly, papery shales, above high water, and of the following:—

Arisaig pier.

E 1. MEDINA.

22. Dirty-greenish and gray, rusty-weathering, argillaceous, usually more or less massive, flinty sandstone, obscurely seen at the base of Arisaig pier, but well exposed to the eastward, and variously estimated at 163 and 201 feet. Dr. Honeyman's Division A, or Medina 182 0

Total thickness..... 3006 0

Mr. Weston's section.

The following ascending section, measured by Mr. Weston in Joseph McDonald's Cove, shows in more detail the beds immediately underlying No. 5 of the preceding section, which contains Nos. 17 to 21 of Mr. Weston's section.

	FEET.	INCHES.
1. Olive-green even-bedded argillaceous shales, with bands of a similar rock, but much harder, containing more lime and silica and breaking with a conchoidal fracture.	3	3
2. Green even-bedded argillite, with fucoids.....	1	4
3. Calcareous sandstone, with *Favosites*.....	0	3
4. Green argillaceous shale.....	0	3
5. Compact argillaceous limestone, breaking with an uneven fracture and holding *Rhynchonella* and other obscure fossils.....	0	5
6. Green argillaceous shale, with fucoids and *Rhynchonella*	0	4
7. Green argillaceous shale, interstratified with bands of calcareous sandstone and thin beds of limestone holding *Rhynchonella*, *Modiolopsis* and other fossils..	5	0
8. Green argillaceous shale, with thin beds of light-gray limestone holding fragments of encrinites, *Rhynchonella* and *Modiolopsis*.....	5	0
9. Hard, argillaceous, calcareous shale, with splintery fracture	3	0
10. Calcareous shale with thin bands of limestone crowded with *Rhynchonella*, *Modiolopsis* and other forms....	2	0

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IVES-PROCESS.: G. E. DESBARATS MONTREAL.

T. C. WESTON, PHOTO., 1873.

SECTION IN JOSEPH McDONALD'S COVE, ARISAIG COAST, NOVA SCOTIA.
SHOWING JUNCTION OF NIAGARA AND LOWER HELDERBERG.

	FEET.	INCHES.	
11. Green argillaceous shale, with bands of calcareo-argillaceous sandstone containing a small coral	1	2	
12. Light-gray limestone	0	2	
13. Green argillaceous shale, with bands of calcareous sandstone and limestone, holding *Favosites*, *Rhynchonella* and other fossils	3	0	
14. Light-gray limestone with *Rhynchonella* and fragments of other fossils	3	0	
15. Light-gray limestone with *Rhynchonella*, *Modiolopsis* and encrinites. These beds also hold black nodules made up in some instances of fragments of *Rhynchonella* and other brachiopods, an analysis of which shows them to be phosphatic	2	0	Phosphatic nodules.
16. Green argillaceous shale with a few thin bands of limestone holding phosphatic nodules as above; also fossils of the genus *Tentaculites*, *Homalonotus Dawsoni* and other forms	13	0	
17. Green and red even-bedded shales holding *Modiolopsis*, *Rhynchonella* and other fossils	2	0	
18. Maroon-coloured argillaceous limestone, with splintery fracture, holding nodules of light drab-coloured limestone	12	0	
19. A limestone similar to the preceding, but highly charged with elongated nodules, having a position transverse to the bedding	1	0	
20. Maroon-coloured argillaceous limestone, as above	5	0	
21. Limestone similar to the preceding, but of a more shaly nature, and having numerous light-green patches	10	0	
22. Green argillaceous shale and limestone, resembling the above and holding obscure fossils, among which are a *Lingula* and a *Discina*	15	0	
Total thickness	88	2	

Arisaig synclinal. Faults. Contact with Pre-Cambrian, Devonian and Carboniferous.

The structure at Arisaig is a syncline, six miles long and one mile and a half wide, extending from McAra's Brook to McNeil's Brook, bounded on the south by the fault indicated by the Cambro-Silurian escarpment of the south side of the Hollow; and on the north by the Pre-Cambrian series of Doctor's Brook, Frenchman's Barn and Arisaig pier; overlain to the westward by Devonian and Lower Carboniferous strata. A block less than a mile wide seems to have been thrown up by two faults running north and south between Smith Brook and a point east of the Trunk road. The bottom of the Silurian system is well defined by the presence of the two lowest groups, the Medina sandstone resisting disintegration and rising high on the slopes of hills composed of Cambro-Silurian rock, while the Lower Clinton black slates with lingula nodules, although deeply denuded in the valleys, are found in cliffs flanking the rivers. Some particulars concerning the different groups in the areas above mentioned will now be given.

E 1. Medina.

Extent. The Medina is apparently present in all the areas except that of Cape George. At Arisaig it is exhibited in a narrow belt from the pier eastward to Beech Hill Cove. In Doctor's Brook, at its contact with the felsites, it consists of dirty-greenish and more or less argillaceous
Fossils. sandstone with flinty siliceous layers. From the cove west of this brook many of Mr. Weston's fossils were obtained.

Vamey's Brook The Silurian strata of Vamey's Brook are probably Medina, but are of limited extent, and although fossils are abundant, none were collected.

Marshy Hope basin. Resting upon Cambro-Silurian grits, along the railway in Marshy Hope valley, is a long narrow trough of gray and of greenish, rusty-weathering Silurian sandstone well displayed in the little brook east of Lindsay's old stage-stables, where the former consist of gray flinty pea-conglomerate with beautifully mottled, pink, brown and yellow porphyritic, compact and fragmental felsite and quartz-felsite; the latter of comparatively unaltered sandstones. The strata have been fully described by Dr. Honeyman,* and the fossils enumerated as follows:

Fossils. "Similar (*i.e.* A.) rocks.. in the Marshy Hope part of the Antigonish and New Glasgow road, at the Antigonish and Pictou county-line.... contain *Petraia*, *Lingula*, *Cornulites* and a *Cyrtoceras*, ... and at the west end of the Marshy Hope... abundance of *Athyris* in casts."

Lochaber fossils. On the west side near the head of Lochaber† in John McNaughton's Brook, Dr. Honeyman obtained *Petraia* and other fossils. A small collection, including *Bellerophon*, *Athyris*, *Chonetes* ?, *Leptocœlia*, *Strophomena subplana* ?, *S. rhomboidalis*, encrinites and other forms, was made here in 1885; another by Mr. Weston and Mr. Robert in 1886. The rocks consist of dirty-gray and greenish, micaceous, white-weathering slates, blotched with quartz; and further west, of greenish,
Contact with Devonian and Pre-Cambrian. quartz-veined, sparkling quartzite and slate, overlain toward the south and north by red Devonian slate, and underlain by the traps of the hill. More evenly bedded slates are found in other brooks, as for example in McGillivray Brook, a branch of West River; but the whole band is small, although including, according to Dr. Honeyman, at the north-east end, the characteristic fossils of C. A small patch crosses Lochaber to the eastern shore north of the chapel.

Avondale and Sutherland's River basin. A larger basin extends from Avondale† up Barney's River to Kenzieville, then to the east branch of French River and to Sutherland's River, containing important areas of both the lower and upper groups. Its boundaries are both defined: at Avondale and Glenshee

* Trans. N. S. Ins. Nat. Sc., Vol. IV., p. 443, and Vol. V., pp. 194 to 199.
† Trans. N. S. Inst. Nat. Sc., Vol. IV., pp. 76 and 440; Canadian Naturalist, Vol. V., p. 294.
‡ Trans. N. S. Inst. Nat. Sc., Vol. III., p. 9; Vol. IV., p. 193.

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Cyrtoceras, ... and
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John McNaughton's
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199.
Naturalist, Vol. V., p. 294.

it plunges beneath Carboniferous strata, but in most parts of its course is in contact with Cambro-Silurian rocks. All the Silurian areas are singularly free from volcanic intrusions as compared with the Cambro-Silurian, but the rocky ridge south-east of Kenzieville is intersected by dykes of dark fine crystalline diorite. Other features of interest in connection with this basin will be again referred to. Few volcanic rocks.

On Moose River, near the post-office of that name, a Silurian trough, possibly of this age, lies among the older schists. Another belt runs down the East River of Pictou, generally on the north side from near its head to Springville.* On the upper part of the river the basal sandstone and overlying black slates alone are present, while toward Springville, higher rocks prevail, characteristic fossils abounding in all. On the brooks near Beaver Lake, Kerrowgare and Sunnybrae, Medina and Clinton fossiliferous strata are in contact with Cambro-Silurian and perhaps older rocks, and are overlain to the southward by a wide belt of Devonian gray slates. In the black slate, near Kerrowgare, search was made for coal, several pits being sunk to a depth of about twenty feet, and $400 wasted in the search. Moose River basin. East River of Pictou basin. Search for coal.

In Blanchard Brook, not far above the bridge at Sunnybrae, Silurian sandstone, rich in fossils, is underlain by porphyritic and other Cambro-Silurian rocks, followed again upstream by Medina sandstone.

On the shore of the little lake, south of Sutherland Lake, whitish, greenish and bluish-gray micaceous, compact quartzite and argillite are cut by dykes of dark-gray calcareous trap. Rocks of similar character are found in the brook from this lake, as far as the road, where they contain fossils, much of the land being barren. Sutherland Lake basin.

E 2. Lower Clinton.

These rocks, as they occur at Arisaig, have been described by Dr. Honeyman in the papers already referred to. At the mouth of Arisaig Brook they are dark, rusty-weathering, papery slates, containing hard concretionary bands full of fossils. They extend to the old mill below the shore road, where many fossils were collected by Mr. Weston, among them two species of graptolites. They must be of considerable thickness, but are too much crumpled to be accurately determined. Unlike the rocks to the westward, which are not greatly disturbed, those east of Arisaig Brook are nearly vertical, sometimes overturned. In the brook east of the old road and west of Arisaig chapel are dirty-greenish and bluish-gray slates, probably the upper part of this group, succeeded in one of the branches by higher rocks, Arisaig Brook. Graptolites.

* Acadian Geology, p. 568; Supplement, p. 76: Trans. N. S. Inst. Nat. Sc., Vol. III., p. 8, and Vol. V., p. 209.

Iron ore.

includin a band of red hæmatite, two feet thick at the western side of the brook, but thinning out to one foot on the east side, the outcrop being only four feet long. The hæmatite is cut by a quartz-vein, which also cuts the enclosing green slates. The ore, by the way in which it replaces the slates across the layers, partaking of their bedding, seems to be a more or less concretionary contemporaneous mass like the limestones at the mouth of Arisaig Brook. Covered by twelve feet of coarse stratified gravel, below the road, in the brook, are good outcrops of dark slates, which continue to the shore, and are underlain by Medina sandstone, which in turn gives place to the Frenchman's Barn series. The shore road is on a belt of black slate the whole distance from Arisaig to Doctor's Brook, newer strata being everywhere to the southward. In the small brook at the carriage factory, below the road, they are underlain by Medina sandstone, greenish-gray, wrinkled, rippled, coherent, micaceous, flaggy and thick-bedded, containing lingula, encrinites and other fossils, underlain by the felsitic rocks; and the same succession is found in Doctor's Brook.

Medina and Pre-Cambrian? underlying the Clinton black slate.

Bailey's Brook.

On the east branch of Bailey's Brook are soft, gray, crumbly argillaceous shales and black slates, cut by quartz-veins which carry a small quantity of iron pyrites, and have been mined. They contain hard bands, have a variable dip and show no fossils, although in blocks, apparently derived from them, were found brachiopods like those in the hard concretions at the mouth of Arisaig Brook. The relation of these to the Cambro-Silurian strata of the neighborhood will be understood by reference to the map.

Mine?

Barney's River.

The contour of the hills and valleys of Barney's River depends on the distribution of the Silurian and Cambro-Silurian rocks; and the troughs of the former can be plainly defined from the tops of the hills. They seem to have been deposited in depressions among the Cambro-Silurian hills, just as the Carboniferous limestone and conglomerate among those composed of Pre-Carboniferous rocks. Where Silurian strata come from beneath the Millstone Grit in Barney's River, below John McPhee's house, they consist of greenish flinty sandstone, from the thread-like meshes or joints of which water oozes depositing a small quantity of salt. Upstream these are overlain in cliffs by soft gray and greenish rusty-weathering argillite, containing obscure fucoids. Higher still are Clinton shales—dark, bluish-gray, papery, micaceous, somewhat sandy, rippled, and broken into pieces by cross-joints.

Salt spring.

Dykes.

A dyke of dark fine diorite or hornblende-rock cuts these slates: its effect in some parts is not discernible; in others, the slates are rendered somewhat more porcellanous and coherent near the contact, although a few feet away the proximity of the dyke would not be suspected.

In the west branch of Barney's River, from the mouth of William Murray's Brook, soft, greenish argillaceous shale, probably Upper Clinton, paves the brook for some distance downstream, and is cut by a dyke of flinty, trappean rock, sixty feet wide or more, of the most stair-like aspect, the jointed blocks being so arranged that one might by their means scale the face of the cliff. It overlies, or has overflowed, the shales, which are considerably altered at the contact and filled with blotches of calcspar, although the bedding is not much disturbed, the layers being cut clean off where they rise against the dyke. West branch of Barney's River. Dyke.

The scenery of the gorge is picturesque, the birches and spruces rooted in the mural, furrowed cliffs, contrasting agreeably with the rough masonry of the trap and the long lines of bedding of the shales. Lower down, arenaceous layers, two inches thick, accompany the shales.

In the middle branch above the fork of the east branch, nearly continuous exposures of gray slate occur, cut in one place by a dyke of dark-gray diorite and full of small veins of mixed calcspar and quartz. Higher still, another dyke is in contact with greenish argillite, just below the telegraph road. Above the road, bluish-gray, soft, papery argillite, breaking into long needle-shaped pieces, is underlain by flinty, coherent Medina sandstone. On the east branch of French River, above the Piedmont road, the fine outcrops of these rocks succeeding the Medina, contain the very beautiful lingula-nodules described by Dr. Honeyman. Middle branch of Barney's River. Dykes and veins. Lingula nodules in French River.

Below the Carboniferous rocks of the west branch of French River, are others which form the extension of the Cambro-Silurian ridge of the Piedmont hills, comprising reddish, compact or fine-grained syenite or quartz-felsite; diorite, conglomerate and quartzite, followed by gray, soft, Silurian shales which extend a great distance above the road, and are overlain by gray and reddish, micaceous, flinty sandstone, containing a small spiral shell, brachiopods, encrinites and other fossils. Above Archibald McPhee's are gray, greenish and bluish-gray shales, with sandy, micaceous, flaggy layers, often greatly contorted, interstratified with bands, one foot thick and less, of greenish or bluish-gray micaceous, shelly, flinty sandstone, with half-inch quartz-veins mixed with ankerite. Higher up, the shales are crumpled, papery and crumbly, soft and micaceous, and the bands of flinty sandstone or quartzite sometimes five feet thick. W. branch of French River. Fossils.

E 2. Upper Clinton. *

These rocks as they occur on the Arisaig shore and in French and Barney's Rivers, have been already described. They are well seen

* Trans. N. S. Inst. Nat. Sc., Vol. III., p. 13, and Vol. IV., p. 52, line 4.

Arisaig and Doctor's Brooks

above and below the bridge on Arisaig Brook, where they consist of gray and greenish slates and flags, overlain by the strata containing the bed of iron ore; also above the shore road, in the brook at the carriage factory, and in the east branch of Doctor's Brook. In Doctor's Brook, above the shore road, are greenish-gray, quartz-veined, pearly, soapy slates, interrupted by a knob of greenish flinty felsite, containing quartz; beyond, the slates, which contain thin layers of gray limestone, bear a striking resemblance to those near Dewar's mills in Barney's River (p. 45 P, line 2,) and are thickly set with fucoids, encrinites and brachiopods. Upstream they become more flaggy and are succeeded by dirty-greenish, calcareous, higher rocks.

Smith Brook.

On the shore, Mr. Weston collected graptolites of at least two species from a bed about 480 paces east of the mouth of Smith Brook (p. 39 P, line 6).

Faults.

The faults in the green rocks east of this brook, mentioned in the section, are perhaps only thrusts or folds without great displacement. The last, fifty paces west of the graptolite beds, seems to be only a crumpling of a mass of these strata about fifteen yards wide, accompanied by a thrust of the eastern rocks a few feet over the crumpled portion, and perhaps a corresponding displacement between the latter and the western undisturbed rocks. On account of the undulations between this point and the mouth of Arisaig Brook, no good section can be obtained. The thickness is, consequently, uncertain, but might, perhaps, be ascertained from other sections. The contact with the overlying E 3 group is by a fault, the edges of these strata running into those of E 2 on the reefs; but the amount of throw has not been determined.

Fault along the Hollow.

Other faults, including the great dislocation which separates all these rocks from the Cambro-Silurian along the Hollow, may be studied on the map. The E 2 group ends at the little cove 100 paces west of Arisaig Brook, but the boundary between the upper and lower groups of E 2 is not very clear. They do not resemble E 3, nor can these latter be confounded with E 1, the most siliceous of the Arisaig series.

French River.

Among the nearly continuous outcrops of the east branch of French River, rocks, probably Upper Clinton, hold graptolites.

Moose River.

The greenish slates of Moose River, already described (p. 43 P, line 7), are, perhaps, of the same formation. They hold fossils in abundance, and are well seen in the river for a short distance below the bridge, forming a small outlier among older strata.

East River of Pictou.

John McDonald's Brook,* about two miles below Sunnybrae, on the south side of the East River of Pictou, flows among cliffs and reefs of rock, apparently in part of this age. At the bridge on the post-road are soft, soapy, evenly-bedded, dark bluish-gray and gray argillaceous

*Trans. N. S. Inst. Nat. Sc., Vol. III., p. 65.

shales, jointed and veined with threads of quartz, and containing a few entomostracans. Further south, argillites are associated with greenish and brown sandy shales and sandstones, with thin layers of light-gray limestone, very like the rocks of the west branch of French River above Glenshee. Above them, in the brook, are massive Devonian (?) quartzites full of specular iron, perhaps owing their alteration to a mass of rusty-weathering whitish granular rock seen in a cliff on the left, and traceable for some distance from the brook. Immediately above this, at the next bend of the brook, at the mouth of a brooklet from the westward, are similar rocks, together with a banded, porcellanous, black and gray argillite. Above this tributary, there extends as far as an old dam, greenish pearly slate, to which other Devonian rocks succeed. These strata, which require further examination, may be wholly of Devonian age. Devonian rocks

E 3. NIAGARA. *

About four hundred and fifty yards west of Indian Brook, on the shore near Cape George, light-gray and reddish evenly-bedded quartzites, covered on the surface with worm-burrows (?) and overlain by a concretionary nodular, very calcareous bed, sometimes bright-green, with layers of bright-red argillaceous shale, perhaps the equivalent of the "red stratum" of Arisaig (p. 37 P, line 42), and cut by diorite and syenite, underlie Carboniferous conglomerate. The quartzites are studded with small black spots or phosphatic nodules, obscure encrinites, *Cornulites serpularius*, a *Chonetes*, and other fossils.† Further west, another patch consists of light bluish-gray broken quartzite or sandstone, with a few black nodules; greenish quartzite and soft bluish-gray crumbling argillite, with small, hard gray limestone concretions and thin layers; dark-purple, red and green crumbling argillite and sandstone, full of calcareous nodules. These rocks are very rich in fossils—*Spirifer*, *Rhynchonella*, *Lingula*, two species of *Beyrichia*, upper and lower valves of *Discina*, and other forms.† Cape George. Phosphatic nodules. Fossils.

In McAdam's Brook, at Arisaig, the red stratum between this and the next group above crosses below the road, near the fork of the two branches, and can be traced from this point westward to the shore. It is also found in Arisaig Brook, in that west of Arisaig chapel, and on the old road east of the Trunk road. Above the road, in Smith Brook, gray, massive, flaggy and shaly sandstone and slate are succeeded at a ten-feet fall by massive, maroon-colored argillite, which would seem to be a depauperated form of the iron ore band; McAdam's Brook. Smith Brook.

* Trans. N. S. Inst. Nat. Sc., Vol. III., p. 7.
† Determined by Dr. Honeyman.

Contact with Devonian.

above which is a considerable thickness of shales, lying in a synclinal, and covered by red Devonian slates.

Iron ore of Arisaig Brook.

The iron ore of Arisaig Brook, from which Mr. Weston made a large collection of fossils in 1886, and of the brook to the eastward, apparently belongs to this group. Where cut, on the Trunk road, it varies in thickness from one foot three inches to two feet six inches, is shaly and oolitic, full of fossils, like the Blanchard ores, veined with quartz and calcspar, the containing rocks being thrown into small sharp folds.

Doctor's and McNeil's Brooks.

In Doctor's Brook, this group is well developed. Near the mouth of McNeil's Brook* is a small outcrop, apparently of this age, of greenish and reddish soft argillite, not well seen. To the eastward, as far as Malignant Cove, few rocks are met with.

E 6. Lower Helderberg.

Mr. Billings' description of fossils.

The Arisaig fossils described by Mr. Billings (Palæozoic Fossils, Vol. II., Part I.), were all collected by Mr. Weston from the upper part of this formation, west of Stonehouse Brook, where fish remains were also obtained by him. Its base is seen at the red stratum in Joseph McDonald's Cove. Some of the entomostraca collected from this neighborhood have been described by Prof. T. Rupert Jones.†

Sutherland's River.

A large development of Lower Helderberg and underlying Silurian strata occurs in Sutherland's River, above the St. Mary's road.‡ Immediately above the bridge are high cliffs of gray, fine, smooth, somewhat slaty, crumbling argillaceous shale, with more coherent layers of micaceous sandstone; succeeded higher up by shelly shales and flags, associated upstream with greenish, flinty, quartz-veined fine sandstone or quartzite, crowded with fossils; and with greenish, more coherent, and siliceous rocks, containing large spheroidal concretions abounding with shells. In a cliff, about a mile above the road, a greenish, massive calc-veined trap and porphyritic, finely crystalline felsite, containing little hornblende, are seen to cap the argillites. Above the trap are light greenish-gray fine micaceous flinty sandstones, or quartzites, with threads of quartz and much calcspar in the joints. Flinty fine sandstone and argillite form a beautiful gorge, with falls and cascades fifteen or twenty feet high, the river coming down in two rocky parallel runs, nearly on the strike, with an island twelve feet high between. In this gorge are large concretionary masses or rolls, full of fossils. Higher still are outcrops of greenish, flinty, fossiliferous sandstone, with patches of coarser grit and layers of gray, fine, coherent micaceous

Volcanic rocks.

* Trans. N. S. Inst., Nat. Sc., Vol. IV., p. 51.

† Transactions N. S. Inst. Nat. Sc., Vol. V., p. 313, and Quarterly Jour. Geol. Soc., Vol. XXVI., p. 492.

‡ Trans N. S. Inst. Nat. Sc., Vol. III., p. 71, and Vol. IV., p 463.

argillite, with quartz-veins sometimes one foot in thickness. These are succeeded by Cambro-Silurian, and perhaps older strata. The rocks of this formation at Blanchard and Springville* have been examined by Sir J. W. Dawson and Dr. Honeyman, but many details of their distribution have yet to be ascertained. Quartz veins.

F. Devonian.

As already stated,† a broad belt of rocks, similar to those regarded in New Brunswick and Newfoundland as Devonian,‡ extends from the Strait of Canso to Lochaber, thence keeping south of the East River of St. Mary's and of the East River of Pictou to strike the Intercolonial railway near Glengarry, form the high land south of Truro, and pass unconformably beneath the Carboniferous of Stewiacke River. A second belt of the highest members of this series extends from the Arisaig Trunk road westward to Bailey's Brook. Similarity to Devonian of New Brunswick and Newfoundland.

The strata of the first belt are separable into three distinct groups, corresponding closely with those of New Brunswick, as follows:— Classification.

Lower Conglomerate Group	= Bloomsbury Conglomerate
Middle Gray Sandstone and Slate Group	= Dadoxylon Sandstone and Cordaite Shale
Upper Red Slate and Sandstone Group	= Mispeck Group.

A zone of the lowest group, five or six miles wide, runs due west from Guysborough Harbour to South River Lake, keeping south of Roman Valley. The second and by far the most largely developed group occupies most of the country north of Guysborough Harbour and Roman Valley, to the Strait of Canso, Upper Tracadie and Merland, and extends in a narrow belt on both sides of the lower group as far as Lochaber, where it is only half a mile wide, increasing, however, to four miles at Kerrogware, and still more to the westward. The upper group, nowhere exceeding six miles in width, runs from Merland to the westward of Lochaber. At the base of this or the top of the preceding group, or possibly forming an independent sub-division, is a belt of greenish and red slates and rusty-weathering, flinty, gray sandstone containing iron ore, which has been worked at several places. The upper rocks are found again near Union railway station, and also at McAra's Brook. Distribution. Possibility of a fourth group. Iron ore.

When the Devonian rocks on the Strait of Canso and Cape Breton were examined in 1878, § they had not been subdivided. It may be Devonian of Cape Breton.

* Trans. N. S. Inst. Nat. Sc., Vol. III., p. 65.

† Page 6 P; Geol. Survey Report for 1885, p. 62 A and 50 E.

‡ Geol. Survey Report for 1870-71, p. 170. Acadian Geology, p. 502, and Supplement, p. 69; Murray's Geological Survey of Newfoundland, p. 43.

§ Geol. Survey Report for 1877-78, p. 16 F., and Report for 1879-80, p. 32 F.

well, therefore, to supplement the description of them by a few remarks; although further investigation is necessary to indicate clearly the areas occupied by the different groups.

Carboniferous limestone.

The limestone of St. Peter's, Campbell Hill and Tom's Brook* is Carboniferous, as shown on the sheets 17, 20 and 21 of the map. The rocks of the district are for the most part Middle and Lower Devonian, except the red argillite (p. 19 P) in some of the L'Ardoise brooks and elsewhere, as on McNab Lake, Tom's Brook, the west branch of McNab Brook, the St. Peter's road not far north of McNab Cove (p. 22 P) and west of Salmon Creek chapel, Detter Brook,† and the north side of Madame Island (pp. 35 and 38 P). On the mainland, those in the neighborhood of Melford Creek (p. 41 P), Eddy Cove and Middletown are probably Upper Devonian.

Mistake in Report for 1879-80.

When the Geological Survey Report for 1879-80 was written, only the rocks of the shore at Harbour Bouché had been examined; and in the section on p. 44 F. three distinct groups are included. Nos. 1, 2 and 3 of the section belong to the Carboniferous conglomerate. G 1 m.; No. 5, appears to be the only Devonian rock; while No. 4 is, as there doubtfully suggested, the limestone of Plaster Cove and Pirate Harbour, unconformably overlying the other groups. This was partly corrected on sheet 22 of the Report for 1882-83-84; but it was not then known that the limestone of Blue Cape (p. 61 F.), instead of passing south of Harbour Bouché to join the outcrop on the shore at North Canso, runs out to the shore between Cape Pond and Cape Jack; that consequently, the measures between Cape Pond and North Canso, although Carboniferous, belong to the basal gronp; and that the limestone of the section at North Canso probably overlies these Horton shales unconformably at their junction with the Devonian. The Devonian rocks are also shown too near the railway between Little Tracadie River and the winter road east of the 68th mile post. The relation of the different groups on the Cape Breton side of the strait is still somewhat obscure, owing to the number of unconformities. On sheet 22, a small patch of calcareous Horton shales has been omitted‡ immediately east of the Pre-Cambrian boss there shown. It is near a band of black slate like that seen half a mile north of McDonald Brook on the Nova Scotian side and also in the road near the mouth of Horton Brook, which is probably distinct from the calcareous shales, and appears again on the railway near Cape Porcupine, west of Port Mulgrave behind the limestone quarry (p. 61 F.), at the mouth of Pirate Harbour, and thence

Mistakes on Sheet 22.

North Canso.

* Geol. Survey Report for 1877-78, pp. 18 and 21 F.
† Geol. Survey Report for 1879-80, p. 34 F.
‡ Acadian Geology, p. 391.

for some miles close along the shore. It is perhaps also the black band of Oyster Pond Brook (p. 50 F), and of Arichat Harbour and Head (p. 37 F). As already pointed out, some or all the rocks of Horton's, Brown's, Lamey's, Queensville and McMaster's Brooks (p. 51 F), may belong to the Horton Group; but their unconformity to the overlying limestone is evident. Unconformity of the Carboniferous limestone and conglomerate.

In the millbrook at Mulgrave, between the mill and the shore, the exposures consist of greenish and gray, flinty, flaggy sandstone and conglomerate, largely composed of red syenite debris, and probably representing the rocks round Cape Porcupine. The rocks of Hartley's Brook are much more altered. On Pirate Island, red argillite and Arichat conglomerate, veined with quartz, are underlain by the black slate, which follows the shore nearly to Steep Creek, where a patch of Carboniferous limestone comes in. From the bridge eastward, quartz-veined conglomerate and fine, reddish-gray sandstone and argillite resemble the rocks of Auld Cove, and should perhaps not be separated from the Horton Group, but may represent transition beds between the Carboniferous and Devonian. Port Mulgrave. Pirate Cove. Outlier at Steep Creek.

On the shore, near the end of the Middletown road, reddish fine sandstone and shale, jointed and flinty, accompany dirty-green or gray coherent and slaty argillite. Following this road, outcrops of coarse conglomerate, grit and red and purple argillite, perhaps Upper Devonian, are met with; and further out, green argillite, showing a small *Lepidodendron* and purplish, greenish and gray slates, often pearly and mottled, like those (p. 49 P, line 11) at or below the base of the upper group. In the railway cuttings immediately east of Cape Porcupine station, are banks of dirty greenish-gray flinty slate or fine sandstone. At the 74th mile post, greenish flinty conglomerate is succeeded in a cutting by dark slates and greenish or dark flinty sandstone. Similar alternations follow the railway to the shore, conglomerate being particularly abundant east of Auld Lake. In the little brook crossing the road half a mile east of North Canso school, flinty, gray and greenish-gray quartz-veined quartzite has a vertical strike along the stream. Lower down the dip is 120° < 45°. This probably points to a downthrow on the east side, which may extend to Mathy Settlement. Middletown. Cape Porcupine. North Canso. Fault.

Lower Conglomerate.

Lower Devonian strata run from Guysborough Harbour to South River Lake, and are also found about Cape Porcupine, but the whole group requires further study, the line of demarkation between it and the red and green slates being less satisfactorily defined than the boundary between the two latter; and the large development of con- Obscurity in the boundary.

glomerate being in part, perhaps, connected with the volcanic masses which occupy the district in which it occurs.

Tracts not previously subdivided.

On the eastern side of Guysborough Harbour, at Ragged Head,* Madame Island and elsewhere, there are also large tracts of conglomerate.

Guysborough Harbour.

On the west side of the harbour, below the Boylston drawbridge, is a reddish coarse conglomerate, like that of Ragged Head, blocks of which are seen also in the Carding-mill Brook for a great distance up

Trap.

stream, and also in the fields towards the shore. Many blocks of trap occur west of Cutler Cove, but no outcrops.

Iron ore.

Along the road to Guysborough Intervale, on the south side of the harbour, above the bridge, whitish-gray flinty sandstone, grit, slate and conglomerate form a high, rocky hill. Hæmatite is universally found in films and spots, and sometimes in large quantity in the brooks

Cuddiby Lake.

and on the hills. Gray sandstone, disturbed by dykes of diorite, succeeds to greenish and purple slates on the road to Cuddihy Lake.

Chedabucto Bay.

Reddish and light-gray quartzite, very coarse, coherent sandstone and conglomerate are displayed on the back roads and fields in this vicinity, also associated with trap; along the shore, and on the shore road from Guysborough to Salmon River, no other rocks are in place, except on the south side of Ingersoll Creek, where they are in contact with Carboniferous, as on the opposite side of the harbour.† Following

Salmon River.

the roads up Salmon River, this formation is exposed, with a doubtful easterly dip, the river being the boundary between the gold-bearing series and the Devonian for a great distance; for, if in places the latter occurs on the east side of the river, it can only be on the flats.

At the second bridge the water is deep, but not tidal; the strata on the right bank are doubtful flinty quartzose rocks of the whin and granite series, which also cross to the left bank about 300 yards above the bridge. In the brook that flows into the river, immediately above

Graphitic slates mined.

the bridge on the Tor Bay road, are several pits, in which search was made for coal or plumbago in a black broken slate. Higher up, the brook comes across jointed conglomerate and sandstone, with layers of soft green shale, full of matted plants. Higher still, and apparently underlying, are dark, micaceous, graphitic or coaly, sandy shales, also

Fossil plants.

full of plants; greenish and gray flinty slates and quartzites, holding *Psilophyton*, cut by calcspar veins, with much hæmatite and a wonderful abundance of silvery mica. Some of the finer beds are very like the green slates of the base of the higher group, but coarse beds greatly predominate. The pebbles of the conglomerate are of whin, often gneissic, but none of granite were seen.

* Geol. Survey Report for 1879-80, pp. 36 P and 48 P.

† Geol. Survey Report for 1879-80, p. 46 P; Acadian Geology, p. 350.

About half a mile higher, flinty whin of a very light color is in the river, while on a track to the road, conglomerate is evidently the country rock. Conglomerate is well exposed on the Salmon River road, but still better on the old road and its branches. Between the two roads at Roachvale, blocks of conglomerate abound, while above the old road in the School Brook, bluish and greenish-gray slate and quartzite, massive or shaly, dip upstream at a moderate angle. Higher still, light-gray flinty slate and quartzite again dip upstream, and still higher are penetrated by a small dyke of gray amygdaloid, associated with conglomerate, a large barren vein of quartz being near the contact. Roachvale.

In McAllister's Brook no rocks are laid bare up to the old road, but above this road greenish and blackish brecciated strata, full of threads of quartz, and like those of page 52 P, line 32, contain specks of copper pyrites, and have been worked for copper. With them is associated a soft grit, and immediately above, trap, syenite and porphyry. Soft light-gray shales are again visible at the top of the cascades, somewhat pearly, and like those in which copper was found at Erinville. Slates of the same character occur in Cuilnamuc Brook, and in all cases, perhaps, belong to the middle group. Higher up this brook, however, is an interesting display of dark, rusty, compact quartzite, conglomerate and slate, containing small pyritous quartz-veins, succeeded by diorite and trap. On the Cuilnamuc road, near Ogden, blocks of bluish-gray slate, sandstone and conglomerate accompany others of diorite and felsite, dykes of which alter the former on North Branch Lake. Tom McDonald's hauling-road, near Reid's, displays columnar amygdaloid, intersecting red sandstone and other greatly altered rocks, veined and blotched with quartz; and again on the lake southwest of Grant Lake, gray, greenish and reddish slates are cut by trap. Near the outlet of Grant Lake, mottled slates of similar colors, serpentinous, altered, and sometimes very coherent, are mixed with conglomerate, and on the wood road from this lake to the shore road, red argillite, purplish grit, sandstone, conglomerate and trap accompany whitish, flinty sandstone or quartzite. Similar exposures occur about Ross and Campbell Lakes, conglomerate and quartzose sandstone being also in the brook from Ross Lakes, both below the fork and in the branch from the westward. From the road at Farrell's, southward to the Glencoe shingle-mill, blocks of conglomerate appear for a short distance, while near the mill the rocks consist of bluish-gray pyritous slate, flinty sandstone and conglomerate. From this point to Kinney's, gray slates occur. On the lakes in the neighborhood, however, conglomerate and red flinty slates, containing much specular iron and cut by dykes, extend to Croak's Lake, and a great part of the way to Farrell's. McAllister's Brook. Copper "mine." Cuilnamuc Brook. Volcanic rocks. Grant Lake. Ross and Campbell Lakes. Iron ore.

Glencoe. At Glencoe, the gray flinty quartzite and slate, which occupy the road from Erinville, are succeeded, from Shea's Brook northward to the school, by bluish-gray slates; these, near the school, by green and red soft slates, perhaps of the upper group, the structure being somewhat obscure. Near Shea's Lake are outcrops of flinty flags, Arichat quartzite or sandstone; on the lake shore, reddish-gray fine sandstone and smooth red argillites have seams full of blotches of white calcspar.

Roman Valley. This lower Devonian formation consists of flinty gray quartzite, grit and conglomerate on the shore of Cuddihy Lake; and in the adjoining tributaries of Roman Valley, of greenish-gray slate and sandstone, obscurely interstratified with porcellanous slates.

Giant Lake. On the road from Erinville to Giant Lake, purple argillite, bluish-gray flinty sandstone and conglomerate are occasionally seen, cut on the road to Hoppenderry by dykes of diorite, and well exposed nearer South River. The dark and bluish-gray splintery slates of Porter River and the small tributary south of Angus McIsaac's belong probably to

South River of Antigonish. the middle group, as well as those about the head of South River and the dark slates in the north-west branch of Salmon River above the copper mine. These latter are associated, higher up, with trap and diorite, to which succeed sandstone or quartzite, containing hæmatite and pyrites, and, about the lakes, conglomerate and shale.

Following the roads from Roman Valley to Upper South River, we meet with rocks of this formation in contact with higher Devonian strata. On the shore of Flat Lake, and as far down McPhee's mill-brook as McGillivray's mill, flinty sandstone, grit and conglomerate are *in situ*, cut here and there by dark-gray amygdaloid, and covered with green soapy slates.

South River Lake. No conglomerate was seen at the head of South River Lake on the west side; but on the east, ledges of conglomerate, like that of Giant Lake and Arichat, seem to run parallel to the lake, but without any well defined dip. Further from the lake, near the outlet of a small

McNaughton Brook. lake on McNaughton Brook, are cliffs of very coarse conglomerate, with patches of flinty sandstone or quartzite, cut in places by trap dykes and containing pebbles of white grit or sandstone, like the Guysborough quartzites. It is associated with a grit so much altered as to pass for a granular quartz-felsite.

Trap. Following down the brook, similar exposures are seen; and between it and the main brook the grits and sandstones are in contact with a knob of fine trap, which also crosses the brook, in which it is succeeded downstream by bluish and greenish-gray flags, apparently belonging to the upper group and overlying the conglomerate, but divided from it by a mass of trachytic rock, a spur of which cuts the slates lower down.

Fossil plants. From these flags many plants were collected by Messrs. Weston,

Robert and myself, including "fragments of stipes of ferns, also a *Sigillaria*, with narrow ribs, but not determinable," thought by Sir J. W. Dawson to belong probably to the lower part of the coal formation or Millstone Grit. They are followed downstream by flinty sandstone and shale, causing cascades in a gorge. Crossing northward from the mouth of the gorge at the head of the intervale, the overlying rocks, consisting of flinty quartzites, cut by trap, are succeeded by green slates like those at the base of the upper group, (p. 49 P) overlain as usual by reddish, purple and bluish-gray slates and flinty quartzose sandstones, stained with specular iron, often in connection with the quartz-veins which in great numbers cut these rocks. In the upper part of McNaughton Brook, and also in McMillan Brook, slates and conglomerates are broken by masses of trap. Lower down in the latter brook the conglomerate again gives place to gray and dark slates and quartzites, containing specular iron and ankerite; and the same sequence will be observed on the west side of Lochaber, along Roman Valley and other contacts still to be described.

Higher strata. Trap. Iron ores.

Middle Gray Sandstone and Slate Group.

To the upper part of this group, or the lower part of the next, belong probably the green and rusty slates just described in McNaughton Brook. As they here underlie the red slates, all the gray beds being wanting; but sometimes, as in the McAra's Brook belt, are not found with them; and as they are also absent from the great band of gray sandstone and slate along the East River of Pictou, they perhaps constitute a distinct group. This can no doubt be determined further west, and in the meantime they will be included here.

Reasons for separating a fourth group.

Although plant-remains are not absent from the lower and upper groups, they are nowhere so abundant as in the intermediate group which includes the beds of Tracadie and Riversdale, from which plants were collected by Messrs. Weston and Robert. The greenish argillite and flinty sandstone, gray, quartz-veined, white-weathering sandstone and grit, above the railway bridge in Little Tracadie River, perhaps belong to this group, and are also found at Grosvenor,* at the head of the Mathy Settlement and at the outlets of Summers Lake.

Fossil plants. Grosvenor.

Below the still waters in the north branch of Tracadie River, and in other neighboring brooks, bluish-gray and greenish, somewhat nacreous slates alternate with bands of quartzite; and on the road from Upper Big Tracadie to Boylston, with conglomerate and quartzite. In the colored settlement at Silvey Brook, and also at the head of Brymer Brook, the slates are bright sea-green. In Tracadie River, above

Tracadie River.

* Geol. Survey Report for 1879-80, p. 43 F.

Upper Big Tracadie post-office, light-bluish and greenish-gray pearly slates or shales are interstratified with bands of the most coherent quartzite and greenish-gray nut-conglomerate. Blocks of diorite were also found, but not in place. In Silvey and Hurlbert Brooks these rocks are full of quartz-veins, and the slates of the barrens between Five Mile Lake and the Mathy Settlement, and in Meagher Brook, contain veins more than one foot thick. Above McGillivray's mill, bluish-gray slate and quartz-veined quartzite undulate in gorges with cascades and pools, being sometimes curiously rippled. In the cliffs of a brook from the westward, below the above mentioned post-office, light bluish-gray micaceous slate is associated with shaly, fine, flinty sandstone, full of small veins of quartz containing ankerite, which weathers rusty. In a dark shiny slate with a few such veins, search was made for gold in a shaft twenty feet deep.

Quarts veins.

Gold sought.

North side of Guysborough Harbour.

On the north side of Guysborough Harbour, near Brymer Brook (Sheet 24 of Geological Survey Report for 1882-83-84), the hills show outcrops of slate, with veins of milky quartz, which in the brook are associated with felsite and trap, bluish-gray shaly limestone, coarse gray quartzite and grit.

Quarts veins.

Limestone.

In Paul Leet's Brook, not far above tidewater, a vein of quartz, one foot thick and less, runs in the bedding of sea-green argillites. At the falls and cascades higher up, greenish and dark-gray slate and sandstone veined with white quartz, contain blotches of ankerite or ferruginous calcspar, sometimes six inches thick. Some of the veins show masses of quartz six feet wide, but not continuous, displacing the beds. The rocks are in part so mixed as to form a breccia, and are associated higher up with greenish conglomerate.

Quarts veins.

In Brandy Brook a considerable display of quartz-veined quartzites and slates is seen, and also on the upper reaches of Tracadie, Guysborough and Afton Rivers and the Monastery Brook about Merland and South Merland. Above Merland school, flinty sandstones contain argillaceous, softer, ferruginous nodules about the size of a hen's egg.

Merland.

Guysborough River.

In the branch of Guysborough River flowing from Gavin's Lake, are bluish and reddish-gray, flinty quartz-veined quartzites. From the confluence with a branch from another lake, greenish-gray slates, cut in the bedding and across it by quartz-veins, continue as far as the road at the head of this lake and to the post-office at South Merland.

Mira Falls.

In the main stream above Mira Falls, strata resembling those of the Monastery Brook are seen. High cliffs overhang the falls and the gorge below, in which dark gray slates, associated with flinty sandstone and quartzite, have been quarried. The pieces of coal said to be found in the river are, probably, derived from the drift, which is largely composed of soft Carboniferous debris. Slates which have been

Drift coal.

Slate quarry.

quarried occur in all the neighboring brooks. At and above Mira Falls, they dip nearly vertically downstream. The concealed spaces are too great to admit of a section being made; but the thickness of strata exposed, after making due allowance for repetition by folding, is evidently very great.

Mink and Atwater Brooks

In Guysborough River, the reddish and gray jointed sandstone and porcellanous slate seen above the Mink Brook, perhaps belong to the lower group. Atwater Brook displays light-gray, flinty quartzose conglomerate, grit and slate, streaked with green and rusty pyritous bands. In Butler's Brook are ledges of grayish quartz-veined sandstone and slate, and near Fitzgerald Lake the quartz-veins are spotted with ankerite, and have been mined.

Quartz veins mined.

Monastery Brook.

Grayish slates and quartzites are also exposed at falls and cascades, cliffs and rapids above Durney's sawmill, on the Monastery Brook. From these rocks below the mill, a collection of fossils, made by Mr. Weston, and examined by Sir J. W. Dawson, yielded "*Lepidodendron corrugatum*, *Stigmaria* rootlets, and remains of ferns, perhaps *Cyclopteris Acadica*," forms supposed to be characteristic of the Lower Carboniferous (Horton Series).

Fossil plants.

Afton River.

Gray slates are in the Merland road, from the Monastery road eastward; while the red rocks to westward of the fork are probably higher. Grayish slates and quartzites, including the bright-green slates of Silvey Brook, occupy the Afton road for some distance. In Afton River, immediately below Boyle's at Upper Afton, the slates of Durney's mill are found exposed, and overlain toward Flynn Lake and New France by the upper red rocks and by Carboniferous strata. At the cross-roads at Healy Lake and at Delahanty's, green and gray pearly slates, with red bands, indicate the upper part of this group.

Fossil plants.

Following down Afton River, from the outcrops mentioned above, gray slates and sandstones at the road contain minute elongated, carbonized markings of plants, probably rootlets. Lower down, jointed, flinty, reddish and greenish micaceous shale and flaggy sandstone are associated with whitish quartz-veined quartzites. Underlying Carboniferous marl and conglomerate in the west branch are white and red irregularly-bedded quartzite and slate, belonging apparently to the highest group. Some distance to the southward, between Keys Lake and Black River, the junction of the middle and upper groups is again recognized in outcrops of reddish quartz-veined slate, gray and greenish pearly slate, compact and fine-grained sandstone, and rusty-weathering gray slate and sandstone like those of South River (p. 55 P, line 14); and again, near Caledonia Mills, Hughie's Lake, and Alder River post-office, the rocks at all these places being spotted with specular iron ore. From Hughie's Lake

Contact with Carboniferous.

Junction of middle and upper groups.

Iron ore.

westward to South River, only a narrow belt of the green slate and hæmatitic sandstone or upper part of this group appears, the gray slates having been removed by faulting or denudation; it again widens in the direction of Goshen and Lochaber, and includes a great thickness of plant-bearing strata. The green slates, when in contact with masses of trap, are altered into a rock resembling soapstone or serpentine.

South River of Antigonish.

The greenish and bluish-gray slate and sandstone near the foot of South River Lake are probably of the same age. On the east side of the lake, a great part of the road is occupied by blackish coarse diorite,

Diorite.

crumbling to a brown or rusty sand, and having altered the slate and sandstone with which it is in contact.

McPhee's millbrook.

At McPhee's mills, purple slates of the upper group occur. Immediately above the road a wild and beautiful rocky gorge shows quartz-veined white-weathering quartzite and purple slate, underlain higher up by bright-green and gray slates and flinty sandstones, sometimes graphitic, containing large irregular masses of white quartz,

Quartz veins.

Iron ores.

covered with films and spots of specular iron. About a mile above the mills, soft greenish slates enclose small lenticular layers of brownish ferruginous limestone or ankerite, and in other respects strongly resemble the rocks of Guysborough Harbour (page 56 P). In the branches from the south, as already stated, the lower conglomerate comes nearly to the main brook. In the eastern branch of the large brook from H. McDougall's on the north side, reddish and greenish flinty slates, dip $161° < 79°$, are veined with calcspar and quartz, and asociated with bluish-gray, micaceous, pearly slates, holding a very obscure *Psilophyton* and dipping $325° < 85°$. In the branch to the westward these rocks show the same changing dip. The fact, therefore, that the slates and quartzites seen nearest the conglomerate seem often to dip under it does

Pyritous veins mined.

not prove that the former is older. The pyritous veins of these two brooks have been mined, and indications of specular iron also followed. Red slates follow the road to the westward, but conglomerate is in place 325 yards west of the road to Vernal. Red and green slates, with hard bands and rusty-weathering slate and sandstone, extend thence to John Chisholm's, being succeeded everywhere to the northward by the upper red slates.

South River Lake.

From their contact with the upper group at McPhee's mills, greenish and gray slates run up South River and along the west side of South River Lake to Goshen. Near the outlet, and in the brook from the westward, they consist of yellowish, silvery and greenish-gray slates

Pyritous quartz veins.

and quartzites intersected by threads of quartz, full of pyrites and often micaceous. On the lake shore, below the church, gray quartzites

Iron ore.

with veins of quartz and specular iron, are interrupted by trap and diorite.

In Hattie's millstream, at the mill above the road, bluish-gray, very flinty slate dips 346° < 55°. The dioritic and syenitic rocks of this neighborhood are very crystalline and gneissic. At the Polson's Lake copper mine the detritus is dark slate, veined with quartz, which has been dug in one of the pits behind the main shaft; whereas in others it is the light-gray siliceous argillite, which in the outlet brook is associated with dark-gray argillite and micaceous sandstone, with impressions of fucoids. On the south side, at the foot of the marsh, is a hill of greenish-gray quartzite, greatly broken and spotted with specular iron, interstratified with wrinkled slate, veined with epidote, and probably in the vicinity of intrusive rock. On the hill further east, the wrinkled slates are composed of a mixture of quartz, felspar and hornblende, cut by dykes of black hornblende-rock. Blocks of these rocks extend to the outcrop of whitish marble, and nearly to the lake.

Hattie's millstream. Volcanic rocks. Polson's or Copper Lake copper mine. Fucoids. Marble.

On the road from South River Lake to Copper Lake, greenish slate and sandstone are again seen; to which, between Copper Lake and Lochaber, the upper red slates and quartzites succeed. At the lower end of Copper Lake, very dark, almost black, argillaceous sandstone, in thick and flaggy beds, contains geodes of specular iron. In the brook near Ireland Lake, reddish sandstone, flinty argillite and dark bluish-gray papery argillite, containing blotches of quartz, are in contact with gray and greenish trap and diorite, with threads of specular iron. Gray Devonian slate apparently occupies all the road through Goshen to the mill at Pringle Lake, where blocks of Carboniferous grit abound; and grit is unquestionably in place at the South River road. Out Tate's and McDonald's road to the eastward, Devonian slates are probably present past the first house and to the brook about 300 yards from the main road, beyond which Carboniferous rocks begin. There can be here no mistaking the change from Carboniferous to Devonian. On the road at the lake west of Pringle Lake, is a hill apparently of slate; but the boundary to the westward is obscure. In the brook which follows the road from Goshen to South Lochaber, however, gray and whitish slates and quartzites resembling those of Birchtown, Clinton and Pirate Harbour are well exposed and contain obscure fragments of *Psilophyton*. In a large branch from the southward is a quartzose conglomerate, with pebbles as large as a plum. In another branch are small bands of bluish shaly limestone containing specks of copper pyrites. They are first seen on the Sherbrooke road near the head of the little lake between Lochaber and Two-Mile Lake, but between this point and Sandy Lake are doubtful. Between Lochaber and the head of Two-Mile Lake the land is low and swampy. In Hattie's Brook, the first outcrops are whitish granular quartzite or

Iron ore. Goshen. Junction of Devonian and Carboniferous. Fossil plants. Limestone and copper ore. Lochaber and Two-Mile Lake

Hattie's Brook. altered grit, like that seen on the road to Goshen from the foot of Lochaber. At the end of the clearings, a thick band of gray, micaceous, fine sandstone is followed upstream by greenish shales or slates; and still higher by large outcrops of white flinty quartzite on barrens as rocky as those of Grand River. Above a small pond and haymarsh, is a cliff of greenish and gray, micaceous, fine, flinty sandstone, splintery, white-weathering, rusty in places and spotted, like the quartzites of Loch Lomond, with minute traces of specular iron in the joints. This outcrop is not far below Hattie's Lake, on the shores of which the rocky barrens end and there is a clearing on good soil. In the brook at the head of the lake, dark bluish-gray, flaggy and slaty micaceous argillite or very fine sandstone is followed by dark slates, underlain by greenish-gray, fine flinty sandstone and arenaceous shale, containing large scales of mica; and by white quartzite and grits, as far as Hugh McMillan's clearing. In County Harbour River, above Eight Island Lake, gray, compact micaceous quartzite contains minute veins of quartz. On the roads south of Argyle, on that to Duncan McIntosh's and on those toward Goshen, similar rocks are cut by small dykes of trap. About a mile west of Yellow Lake, the boundary of the gray argillaceous Carboniferous sandstone and Devonian slates is seen.

Barrens.

Country Harbour River.

Argyle.

Junction of Devonian and Carboniferous.

The rocks of Erinville and Salmon River have already been described. The higher green strata are not seen, being probably covered by the Carboniferous. At the contact near the confluence of the north branch, the difference between the Devonian micaceous sandstone and bluish-gray wrinkled slate and the overlying Carboniferous sandstone is as unmistakable as at Pringle Lake.

Lochaber. The contact between the upper red slates and green slates is well seen on the roads in Middleton, at the foot of Lochaber, and on the west side of that lake, the latter being associated with dark bluish-gray, pearly, friable slates, like those of Copper Lake, and with rusty-gray argillite and sandstone, spotted with specular iron and veined with calcspar or ankerite. The dip is south-easterly or north-westerly at a very high angle.

Traces of iron ore.

Devonian and Carboniferous in Boggs Brook. In Boggs Brook, near the head of Two-Mile Lake, not far above the road, are reddish and greenish flinty sandstone and grit, probably Carboniferous. Higher up, at the picturesque old saw-mill, are flinty grits like those on the Goshen road and at Hugh McMillan's, perhaps also Carboniferous; but in a small branch above the road are dark bluish-gray, papery Devonian slates, succeeded in the main brook by coarse rocks, probably Upper Devonian.

Silurian and Devonian of McNab Brook. Further north, McNab Brook traverses both the middle and upper groups near their contact with the Silurian. Near the road, the red argillites and quartz-veined quartzites of the latter form cliffs with

a series of falls and cascades of great beauty. At the top of the falls, where the brook approaches the track to Murphy's, gray shales contain *Psilophyton* and obscure ferns. Downstream, the few outcrops indicate the usual succession above these shales—greenish and cream-coloured pearly slates, with veins of quartz, sometimes eighteen inches thick, which contain chlorite but no metallic matter, overlain by red slates. The slates upstream, where the brook crosses the track, are obscure, and may be either Devonian altered by traps, or older. The greater part of this track is in the greenish slate found everywhere in the neighborhood from Peter Murphy's eastward to the little lake and north-eastward to the head of Callahan Brook. Where Callahan Brook becomes rapid, compact, flinty, splintery, greenish and bluish-gray slates form cliffs, down which the water tumbles tumultuously twenty-five feet in cascades and a fall which have cut a ravine with walls more than fifty feet high, through the mouth of which a man can barely squeeze. If the slates are, as above suggested, Devonian, the light-colored and reddish compact and granular quartz-felsite and syenite of the neighborhood would seem to be newer and intrusive.

Fossil plants.

Quartz veins.

Callahan Brook on West River Antigonish.

Age of the volcanic rocks.

Overlying the felsites in Jordan Brook are highly graphitic slates, so black as to have been dug for coal; followed downstream by white, flinty quartzite, like that of the Goshen road, and by quartz-veined, pyritous dark slate and bluish-gray, flinty, micaceous sandstone and grit. About twenty yards below the fork above the settlement is an exposure of greenish-gray slate; while flinty, purplish altered sandstone, perhaps Carboniferous, is found along the west side at the settlement. In McKay Brook, also, above the St. Mary's road at the tannery, bluish-gray and black slate occurs, as well as in the country to the eastward.

Graphitic slates mined for coal in Jordan Brook, East R., St. Mary's.

McKay Brook.

The northern boundary of the Devonian belt, which extends along the East Rivers of St. Mary's and of Pictou, is well defined, whereas the junction with the Carboniferous on the south is often obscure, owing partly to the barren, unsettled character of the country, and partly to the similarity of the gray slates and quartzites to the shales and sandstones derived from them. In general, however, this boundary, as shewn on the map, may be taken as correct; it is seen more or less distinctly on the track which runs westward through the barrens from Newtown, as well as in the various brooks. In this belt none of the greenish pearly slates seem to occur, nor the red rocks of the upper group.

Southern boundary of Devonian and Carboniferous obscure.

From the confluence of Black Brook, flinty, coarse, white glassy quartzite, like that of the Goshen road, the foot of Lochaber, Grand River and Clam Harbour barrens, extends in fine cliffs for some distance up the East River of St. Mary's. The flinty quartzite and

East River of St. Mary's.

dark argillite of the road to north and east belong probably to this group, and for a great distance to the westward the road forms the boundary. Immediately south of David A. Sutherland's, barrens as rocky as those of Grand River show blocks nd outcrops of coarse, quartz-veined, rust-spotted grit or quartzite, well seen also in Sutherland's Brook, below the fork of the branches from Long and Elbow Lakes, associated with gray argillite, breaking into irregular pieces a foot long and two inches wide. At the fork, gray and bluish-gray crumbly slates contain obscure *Stigmaria* rootlets, and are overlain by thick beds of white-weathering, flesh-red and white grit or quartzite, containing quartz-veins, seldom large, running in all directions and very numerous. Immense ledges of quartzite occur in various parts of this district and around the lakes. The cliffs at the cascades below the fork mentioned above show gray, fine argillaceous micaceous sandstone, mixed with the finest and most flinty quartzite, flecked with specular iron in the joints. In the branch from Gunn Lake, and again, above this lake, are ledges of white, glistening Grand River quartzite, varying from compact to coarse, pebbly grit, breaking into innumerable, irregular, angular pieces, usually smaller than a hen's egg, and fit for macadamizing roads. In Sutherland's Brook, the first rocks of the cliffs at the cascades below this branch are greenish-gray and gray flinty sandstone and slaty argillite, the more shaly portions, particulary the gray beds, yielding fragments of plants. Fine, micaceous, quartz-veined sandstone, and red and green mottled argillite, flinty grit or quartzite, with lines of jointing that might be mistaken for bedding,—in alternate thin bands, or in great masses, sometimes finely rippled, but generally splintery and difficult to examine,—are succeeded lower down by bluish and greenish-gray, smooth-bedded, micaceous argillaceous shale, interstratified with fine-grained, micaceous, quartz-veined sandstone and grit, and with layers of dark-gray graphitic shale, from which Mr. Weston collected a large number of badly-preserved plants, which resemble rhizomes of *Psilophyton*.* In a bed of white, flinty, coarse quartzite, not far above the confluence with East River, is a fine *Stigmaria*, surrounded by graphitic matter. The quartz-veins carry a small quantity of ankerite. Similar outcrops occur both above and below the confluence in East River, are also displayed in unbroken cliffs in the gorge above Campbell Brook, and below the Garden of Eden pass into a nut-conglomerate, forming the walls of the gorge with its nearly vertical beds. As exposed everywhere about the lakes south of East River, these rocks present no features of special interest; their dip is indicated on the map. The strong resemblance to the Dadoxylon sandstone of New Brunswick scarcely needs to be again pointed out.

Barrens.

Sutherland's Brook.

Fossil plants.

Quartz veins.

Trace of iron ore.

Fossil plants.

Graphitic shales.

Ankerite.

East River of St. Mary's.

Similarity to New Brunswick Devonian.

*Determined by Sir J. W. Dawson.

Bare ledges of white quartzite and flinty conglomerate, with large pebbles of white quartz, occur in the barrens southwest of the Gut and of Beaver Lake, and strike across the road from Sunnybrae to Caledonia. The gray, shaly and flaggy graphitic quartzose rocks west of the head of Eden Lake are probably of this age. Eden and Beaver Lakes.

In the East River of Pictou, below Kerrowgare, bluish-gray and blackish, contorted, pyritous, graphitic, polished slates, greatly broken, contain veins of a rusty mixture of calcspar and quartz resembling those of Roman Valley and of Deyarmond's at Pembroke, near Stewiacke River. They strike down the river, and are seen in other brooks from the southward. In the mill-brook, a mile and a half above Sunnybrae bridge, they are exposed at the mill, too much cleaved to yield fossils, but succeeded in cliffs higher up by quartzite, sandstone, and grit, interstratified with bands of greenish and bluish-gray micaceous slates and flags, containing numerous markings of *Psilophyton* allied to *P. glabrum* and *P. elegans*, and obscure *Cordaites*.* In the branch from the westward, these strata are associated with greenish and reddish soft shales, spotted with hæmatite; in places the sandstones are traversed by veins of limonite, one of which, about four inches thick, cuts across the stratification, is mixed with sandstone into a sort of breccia, and throws threads through it. Black slates are found in other branches of the East River, nearer Bridgeville, but have not yet been examined. East River of Pictou. Graphitic slates. Sunnybrae. Fossil plants. Hæmatite and limonite.

The track from Sunnybrae to Archibald Cameron's house, at the West River of St. Mary's, crosses good exposures of Devonian rock, about a mile south of Peter Cruikshank's house, where they consist of white quartz-veined quartzite, bluish-gray micaceous slate, and spotted red and green slate, the quartzite being cut by small veins of limonite, and stained blood-red, as in Sutherland's Brook. The country is more or less barren throughout, covered with blocks of quartzite, which has sometimes a slight pink, sometimes a bluish-gray or purple tinge. The greenish-gray, flaggy, micaceous sandstones, near the logging-camp, at the crossing of Bryden Brook, with gray and rusty layers, full of comminuted plants, are probably still Devonian, although immediately beyond, the blocks of gray conglomerate are Carboniferous. West River of St. Mary's. Iron ore. Barrons. Junction of Devonian and Carboniferous in Bryden Brook.

On the roads about Trafalgar, toward Lorne, and in the vicinity of the French settlement north of Ellen Brown's Lake, slates and quartzites underlie rocky barrens of great extent, very little of the land being fit for cultivation. At West Branch Lake, however, blackish slate begins, and the country is better. Near Nelson's, they are overlain by Carboniferous rocks, a belt of which extends down the Trafalgar and Lorne. Junction of Devonian and Carboniferous at Trafalgar.

* Determined by Mr. Ami.

West River, having the granite and whin of the gold-bearing series on the south.

Devonian rocks on the railway in Colchester county.

Along the Intercolonial railway, from West River station, about 31½ miles from Pictou, westward to beyond the 33rd mile-post, only a few blocks of white-weathering sandstone and greenish quartzite are seen. Then begin smoothly-bedded, gray argillites, with bands

Fossil plants.

of rust-spotted flinty sandstone, full of *Cordaites;* and still further west, overlying these, are gray shale and sandstone, containing prostrate trunks of trees, the sandstone predominating. These are precisely like the rocks of the barrens near the Garden of Eden, and are overlain by similar rocks, interstratified with layers of red and green crumbly shale, and thin bands of dark shale, containing plants and trees. Good exposures of reddish and greenish shale and sandstone, having occasionally the texture of underclay, are found near the 34th mile-post; these rocks are not unlike the Carboniferous rocks near Wallace bridge and include blackish and gray argillite, with layers of flinty sandstone,

Carbonaceous shale, with ironstone nodules.

About 300 yards west of the 34th mile-post is a cliff of blackish carbonaceous shale, full of small hollow concretions of iron-stone in numerous thin layers, seldom exceeding half an inch in thickness, the intervening layers of cordaite-shale being from one to two inches thick. Above these follow flinty, ochre-spotted grit, quartzite and shale, succeeded by red and greenish shale, with bands of quartzite, at the 35th

Fossil plants.

mile-post. From these rocks Messrs. Weston and Robert collected *Lepidodendron corrugatum, Stigmaria ficoides* and stipes of ferns.*

Barrens.

They extend to the westward in rocky barrens, and include a band of siliceous underclay, with *Stigmaria* and erect trees. The highest strata occur at the siding and 36th mile-post, the dip varying from 316° < 53° near West River to 355° < 68° at the top. If the sequence is unbroken, as seems probable, the thickness cannot be less than 6,065 feet, nearly all of which is exposed, the railway running nearly due west. For about a mile and a half further, these rocks are repeated; they are then obscure, the dip being reversed at an angle of 80°, at a probable fault,

Ironstone.

but decreasing again to 40° near the 39th mile-post, where the iron-

Riversdale.

stone band again reappears, and the measures are again troubled for some distance. About three-quarters of a mile east of Riversdale

Limestone.

station is a band of greenish and gray crumbling, impure, rubbly limestone, quartzite and calcareous shale, from the vicinity of which

Fossil leaves and fruit.

Messrs. Weston and Robert obtained a new species of *Calamites* of great interest, with leaves and fruit, and a *Sphenopteris*.† With the plants

Shells.

are also found at many places good specimens of *Anthracomya*

* Determined by Sir J. W. Dawson.

† Determined by Sir J. W. Dawson, who considers the rocks as probably Lower Carboniferous or Millstone Grit.

(*Naiadites*) *elongata* and *A. lævis*. At the 40th mile-post, half a mile west of Riversdale, the dip is 161° < 60°, at the beginning of a continuously ascending section, which shows 3,531 feet of alternations of gray and brownish flinty quartzites and slates, forming a very barren country, and no doubt a repetition of the section* east of Riversdale; overlain by 6,468 feet of red beds of the upper group, the summit of which is reached at the shanty, half a mile west of Union station. Beyond the shanty these upper beds are, for a mile and a half, repeated in descending order; they are then folded or troubled, covered on the line of the railway by red rocks of Triassic age, but run on a ridge south of Truro, where they were recognized by Dr. Ells.†

Red rocks of the upper group at Union.

Contact with Triassic.

On the road south from West River station are gray shales and sandstones like the foregoing; dark argillite and quartzite, containing quartz-veins and minute seams of ankerite in the joints.

Devonian of Stewiacke.

Upper Red Slate and Sandstone Group.

The rocks of this group, on the rocky barrens along the railway, consist of red or brownish shales or slates, with bands of quartzite or flinty quartzose, glistening sandstone. As they have been examined only on the railway, on a road between Truro and Stewiacke, and on another between Pembroke‡ and Riversdale, they will not be again referred to at present.

Upper Devonian rocks underlie the Carboniferous in another large area between upper Tracadie and the College, west of Lochaber; a third extends from Arisaig to Bailey's Brook.

Upper Devonian of Tracadie and Lochaber.

On Tate's road (sheet 22), from the contact of the Carboniferous west of Grosvenor, red and purple quartzites and argillites extend to the old post road. To the westward, on this road, are greenish and gray rocks, probably at the top of the middle group. Purple and red slates also occur on the Mathy road. In Tracadie River, at the Salmon Hole, is a flinty, reddish-gray sandstone, perhaps Carboniferous, and lower down, greenish flinty grit, traversed by minute threads of quartz, and passing into nut-conglomerate. If, as seems probable, these represent the strata of the "big cut" on the railway (page 71 P), a tongue of Carboniferous conglomerate would seem to run up this valley to the bridge at the post-office.

Carboniferous and Devonian of Tracadie.

* Acadian Geology, Supplement, p. 48, l. 30.
† Geol. Survey Report for 1885, p. 50 B.
‡ Acadian Geology, p. 560, l. 40.

Monastery Brook.

At Breen's mill, on the Monastery Brook, reddish and greenish-gray glistening sandstone or quartzite is associated with softer, shaly beds, and overlain by Carboniferous limestone and red soft marl.

Black River of Pomquet.

At Backlands, Fraser's Grant and New France, red slates and quartzites abound on the brooks and roads. In Black River, below the old road, gray flinty argillite, dipping 111° < 50°, is underlain at the post road by red argillite and quartz-veined sandstone. Lower down, a belt of greenish slate shows a south-easterly dip; but the prevailing rock is red argillite. In the tributaries from Fraser's Grant, and in the main river below them, red argillite, having a south-easterly cleavage-dip, and greatly jointed and broken, rises into rough, picturesque crags. The harder bands, interstratified with the argillites, alone mark the dip. The river is almost continuously rocky, in gorges, with cascades and falls for several miles, and exposes layers of white, flinty, quartz-veined quartzite among the prevailing red; below which, crumbly red and green soft shales and sandstones, with thin bands of rusty limestone, indicate the beginning of the Carboniferous basin, the contact of which is again seen in Pomquet River, not far above the bridge at Meadow Green, where the Blue Cape limestone and associated strata rest upon reddish flinty sandstone, rusty-weathering quartzite, and red argillite or slate, veined with quartz, and well exposed near Beauly.

Contact with Carboniferous.

South River and Lochaber.

Red or purple rocks, more or less argillaceous, are displayed in the South River of Antigonish for three hundred yards below the bridge at Fraser's mills; mounds then indicate the probable crossing of Carboniferous limestone. In the brook along the road to Lochaber, blocks of red argillite occur, and outcrops are found in all the brooklets from the southward. Where the road turns away from the brook, red slate is in place thirty yards above an old mill, with Carboniferous limestone one hundred and fifty yards to the westward. Above Fraser's mills, red or brown, scaly, micaceous, quartz-veined argillites are seen in South River and all its branches, as well as in the brooks running to Lochaber, the veins holding chlorite and crystals of transparent quartz. On the road from Copper Lake to Lochaber, the bluish-gray and greenish rocks of the middle group are overlain by red and purple shales containing a little specular iron.

Contact with Carboniferous.

Iron ore.

In the brook at Lochaber chapel, pearly, soapy slates, of the usual shades of red and purple are continuous to the top of the hill, where they are underlain by gray, bluish-gray and green slates of the same character, resting in turn upon greenish and gray quartzites holding specular iron in the joints and veins.

On both sides of Lochaber, red and purple and dark bluish-gray

slates and quartzites are well exposed, associated on Crockett Island* with green slates and a band of Arichat conglomerate.

In Hurlbert Brook at the saw and grist mills, a fall thirty feet high cuts through red slate and quartzite, dipping about 100°<50°. Above the fall, the brook is rapid for some distance, then opens out into a marshy lake and chain of alder-marshes and ponds, above which is a fork. In the northwest branch, red slates dip 111°<69°, turning more to the south higher up. Red slates are in all the neighboring brooks.

In the little brooks near the foot of Lochaber, on the west side, red and purple slates and sandstones, quartz-veined, broken by joints and containing traces of specular iron, rise into fine cliffs.

The rocks of McNab Brook have been already described. On the track from Peter Murphy's to Lochaber, the blocks of reddish altered sandstone which abound with others of greenish pearly slate, belong apparently to this group.

Near the copper mine at the College, reddish sandstone and argillite are found not far from fragmentary rocks, perhaps Pre-Cambrian; while at the mine, a greenish granular diorite is associated with copper ore, mixed with a large quantity of specular iron. On the road north of Angus Cameron's, Devonian argillite is cut by intrusive rock. Down Boggs Brook, below the little lake, reddish-gray, fine, flinty sandstone and smoothly bedded argillite, with a few veins of quartz, are succeeded by flinty, reddish-gray sandstone and fine, white siliceous rock, weathering cream-colored and streaked with threads of quartz, well exposed at a cascade. At another, are cliffs of reddish-gray coarse, flinty grit and fine conglomerate, with minute veins of quartz, passing into coarse conglomerate, with blotches of specular iron and beautiful crystalline aggregations of quartz.

Lochaber copper mine.

Boggs Brook.

Iron ore.

The gorge with cascades near the foot of the rocky portion is cut through flinty, fine sandstone, grit and conglomerate, the thickness of which must be considerable. Conglomerate also crosses the road north of the foot of the lake about one hundred yards from the lake road; it is cut by veins of quartz, and is so unlike the red slate group, and so like that at the base, that it will possibly be found to be a recurrence of the conglomerate of the east side of South River Lake (p. 54 P).

At William McDonald's and at John Carroll's, red and purple slates are abundant. On the track between Carroll's and Garvie Lake, felsites appear.

Upper Devonian Rocks of Arisaig and Bailey's Brook.

Of these rocks, at McAra's Brook, Dr. Honeyman says:† "They are certainly not Lower Helderberg, and may, therefore, be Devonian . . .

Age as defined by Honeyman.

* Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 76.
† Trans. N. S. Inst. Nat. Sc., Vol. III., p. 13.

By Dawson.

Upon these, the lower Carboniferous conglomerates lie unconformably, . . . the line of junction being behind a mass of amygdaloid." By Sir J. W. Dawson, they are also apparently regarded as Pre-Carboniferous,* although not separated from the Silurian.

McAdam Brook,

Succeeding a synclinal of Lower Helderberg strata, in McAdam Brook,† is a great thickness of indian-red and reddish gray soft slate and calcareous, micaceous sandstone, cut by veins of white barren quartz, with vugs holding crystals of quartz, which are found in nearly continuous outcrops for about half a mile, and beyond this point, at

The Hollow.

intervals, as far as the Hollow ("Bruin's Highway"), interstratified with a few feet of greenish-gray micaceous quartzite, showing obscure remains of plants.

Stonehouse Brook.

About 183 paces west of Stonehouse Brook, on the shore road these rocks dip 183° < 20°, but are variable. Stonehouse Brook and the head of Joseph McDonald's Brook present exposures, principally of

McAra's Brook

red slate. Good exposures are also cut by McAra's Brook, behind the mass of amygdaloid at the shore, consisting of red, flinty, micaceous, jointed sandstone and slate, often concretionary, interstratified with

Copper.

greenish thick-bedded and flaggy sandstone, containing traces of carbonate of copper and iron pyrites; the brook being rocky up to the

Fossil plants, fish and foot-prints.

shore road. From the latter, a collection of fossils was made by Mr. Weston, comprising fragments of plants and fish-teeth, not certainly determinable, together with certain interesting footprints like *Protichnites carbonarius*.‡

Dunmaglass.

Devonian rocks, broken by dykes, are found as far as the head of this brook, on the road to the Hollow, in all the district from the Hollow northward, in the valleys of Dunmaglass, but rising, also, into

Knoydart Brook.

high peaks among the hills. Downstream in Knoydart Brook, below Dunmaglass, they are admirably displayed in a clean, beautiful valley, with either a rocky or pebbly floor, contained by mural crags or steep, mossy slopes, from which the trees meet overhead. The red argillites

Dykes.

are so greatly cleaved and jointed that the dip can be obtained only on the few accompanying bands of reddish and bluish-gray fine sandstone; they are cut by dykes of fine calcareous diorite, are sometimes spotted green, contain greenish, concretionary, hard bands

Contact with Carboniferous.

and nodules, are seldom pearly like the red slates of Lochaber, and are unconformably overlain by Carboniferous strata, the junction being plainly seen above John McGillivray's mill.

Ardness.

The boundaries of the different formations, closely traceable here and towards Ardness by excellent outcrops, are shown on the map.

* Acadian Geology, p. 316, line 4, and Supplement, p. 49, line 15.
† Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 56.
‡ Supplement Acad. Geol., p. 55.

In the brook from the southward at Ardness post-office, soft, reddish Carboniferous conglomerate and marl are succeeded immediately above the road by red, calcareous, concretionary Devonian argillite. This extends, with occasional greenish bands, to the Hollow, on the slope of which the dip is 300° < 10° at the contact of layers of sandstone and argillite; while the dip of the cleavage, replaced by lines of jointing nine inches apart in the sandstone, is 204° < 70°, and might easily be mistaken for bedding. Near Vamey's Brook, red slates surround the hill of Silurian rock, and high ridges on the east side of the brook show cleavage planes running 246° to 271°. Vamey's Brook

The reddish-gray fine sandstone, underlying Carboniferous limestone, in the east branch of Bailey's Brook, is probably Devonian. It is succeeded upstream by brick-red argillite, and still higher, by traps and Cambro-Silurian slates. Bailey's Brook.

The red siliceous hæmatitic rock at Avondale post-office may also be Devonian. Avondale.

G. Carboniferous.

The general distribution of the groups which contain all the Carboniferous strata exposed in this region is given at page 7 P of this report.

These groups are:

G 1m. Carboniferous Conglomerate.
G 1. do. Limestone.
G 2. Millstone Grit.

G 1m. Carboniferous Conglomerate.

The rocks of this group resemble those described in previous Geological Survey Reports* and seem to lie unconformably to the Carboniferous limestone. This unconformity, as seen at the Strait of Canso and Antigonish, at Lake Ainslie, Margaree Forks and other places† is not merely local, as stated by Sir J. W. Dawson,‡ and the supposition|| that "a portion at least of this division is probably contemporaneous with the Carboniferous limestone formation" can be regarded as true of only a small portion of it. The great difference of thickness in so many places in adjoining areas cannot, in the absence of faults, be ex- Unconformable with the Carboniferous limestone.

* Geol. Survey Reports for 1875-76, p. 394; for 1876-77, p. 437; for 1877-78, p. 23 F, and for 1882-83-84, p. 37 H.
† Sheets 11, 13, 14 and 22 of Report for 1882-83-84.
‡ Supplement to Acadian Geology, p. 102.
|| Geol. Survey Report for 1876-77, p. 437.

plained otherwise than by unconformity similar to that found in New Brunswick, and noticed by Mr. Robb, Mr. Brown and Professor Hind* in Cape Breton. The whole series of Lower Carboniferous rocks in New Brunswick is considered at page 354 of the Report for 1876-77, and an unconformity between two of the divisions described on page 355. In the Report for 1878-79, page 16 D, the question of the age of the Albert shales, which correspond with this lowest Carboniferous group at the Strait of Canso, is discussed, and also their relation to the Devonian; and in the Report for 1885, p. 33 E, a section is given, subdivisions 1, 2, 3 and 4 being of this group.

Similarity to the Albert shales.

Distribution.

The principal areas of this formation are: 1. At Tracadie and Harbour Bouché. 2. On the peninsula north of Antigonish. 3. At McAra's Brook. 4. In the long trough extending from Salmon River Lakes to Trafalgar.

1. *Basal Carboniferous Rocks of Tracadie and Harbour Bouché.*

North Canso.

The strata of North Canso are described in the Report for 1879-80, p. 61 F, and in the present report at page 50 P. At the lighthouse, reddish-gray argillite and flinty sandstone resemble the Devonian strata of Union station. In the little brook, up which the shore road climbs, a mile east of the head of Harbour Bouché, the reddish and gray soft shales and fine, micaceous sandstone are perhaps the same as those found in the railway cuttings east of the station. About one hundred and fifty yards west of the school, very flinty rocks, probably Devonian, are on the road and in the hill to the south; but two hundred yards from the school, Carboniferous argillite is again on the road, indicating an irregular boundary.

Little Tracadie.

The land about the head of Little Tracadie Harbour, from T. W. Kinney's to John Chisholm's Brook, is very rocky with reddish-gray, coarse, crumbling Carboniferous grit and conglomerate. On Tate's road, at the railway crossing, these rocks become much more coherent, and contain blotches and veins of quartz; and some distance south of the crossing are underlain by red Devonian slates and flinty quartzites, the former perhaps representing the first rocks seen on the shore of Harbour Bouché, which are also traversed by quartz-veins, and underlain by light and dark-gray papery shales, crenulated on the strike, passing into pure limestone and including flinty bands of greenish rippled sandstone, jointed into small pieces, covered on some surfaces with shrinkage marks and containing concretions of compact limestone; these occupy the shore for about half a mile south-east of the lighthouse, and are, according to Sir J. W. Dawson, the equivalent of the Horton shales.

Quartz veins. Contact with Devonian.

Black shales and limestone.

* Geol. Survey Reports for 1872-73, p. 173, and for 1882-83-84, p. 45 H.

At the grist-mill, north of the 67th mile-post, are indefinite outcrops of greenish-gray, flinty, fine grit and reddish conglomerate, blotched in the joints with quartz and associated with fine argillaceous sandstone and shale. Similar rocks, found in Little Tracadie River and other brooks of the neighborhood contain pebbles of red syenite, whitish quartz-felsite, red fine sandstone and compact, quartzose grit or quartzite, often as large as a goose's egg. On the railway, near the 66th mile-post, are reddish-gray fine sandstone and argillaceous shale, not unlike the strata of Janvrin Island and Hawkesbury. In the "big cut" between Tate's road and Little Tracadie River, and also south of the railway on the roads to the eastward, are greenish, very flinty, quartz-veined grit, conglomerate, quartzites and purple slates, which perhaps indicate a passage to the Upper Devonian. Reddish crumbling argillite, at the crossing of Little Tracadie River, and again nearer Harbour Bouché, is associated with greenish flinty sandstone and grit or quartzite. At the 70th mile-post, reddish sandstone and argillite are found; while still further east are rocks unmistakably Devonian—gray quartzites and bluish and greenish-gray slate. Conglomerate.

The flinty, coherent grit and argillite, immediately above the second mill and underlying the limestone in Monastery Brook, probably belong to the base of the Carboniferous rather than to the Devonian. They end about half a mile upstream, being underlain by the gray slates and sandstones, from which fossils were collected by Mr. Weston. Monastery Brook.

2. *Basal Carboniferous Rocks of the Peninsula north of Antigonish.*

The rocks in this area are precisely like those described above, except that, in addition, there are found small seams of coal or black bituminous shale, which have been, to a small extent, worked; the conglomerate is, as a rule, also more friable, although, in several places, cut by dykes of igneous rock; it everywhere underlies unconformably the limestone and plaster of the next higher group, and is well exposed in the brooks and on the shore. Coal. Dykes.

Indian-red coarse conglomerate and sandstone, and red and green marl, apparently of great thickness, occupy a broad belt in Ogden Brook, associated with gray beds containing coal. On the shore, near Cribbean's Head, the conglomerate which overlies the Cambro-Silurian strata is red, gray and greenish, friable and thick-bedded, with bands of reddish argillaceous shale and rusty sandstone, enclosing fossil plants and trunks of trees. Ogden Brook.

North of Lakevale, similar rocks, often calcareous, contain layers of blackish argillaceous shale, and red and green shale, but the prevailing Black shale.

rock is conglomerate, composed of pebbles of great variety—of diorite, syenite, porphyry and greenish Cambro-Silurian slates, quartz-veined grit, conglomerate, and all the Pre-Carboniferous rocks hitherto described. Further north, blackish-gray sandstone and conglomerate, full of large scales of silvery mica, come in contact with reddish porphyritic trap, and are covered by twelve feet of reddish, impure, concretionary limestone, overlain by red marl, conglomerate, and other fine, concretionary layers; and, still further north, by limestone. A short distance south of Ballantine Cove, coarse conglomerate, reddish fine sandstone, and a bed of underclay, containing *Stigmaria* and carbonized plants, are cut by trap dykes, the conglomerate being noticeably altered only at the immediate contact, but containing minute veins of white calcspar, which also fills most of the cells of the amygdaloid. Some of the pebbles of the conglomerate are easily recognized fossiliferous Silurian rocks, while among them is also a whitish and light-colored saccharoidal limestone, like that of Georgeville. The extent of this formation about the cove is indicated on the map. The conglomerate of the cliffs on the steep, rough shore to the northward contains pebbles three or four feet in diameter, and is cut by threads of calcspar, which cross both pebbles and matrix; it can be easily examined at low water, the reefs extending one hundred yards from the base of the cliffs; it forms the steep point of Cape George, extends to Indian Brook, and beyond the Silurian bosses is largely composed of pebbles and blocks of this series, including syenite and diorite, sometimes several feet in length, in a matrix of reddish nut- and egg-conglomerate. Further south-west, the conglomerate is nearly vertical and overturned, much more coherent and gray, passing into coarse pebbly grit, and running in unbroken cliffs to Livingstone Cove, where it overlies Cambro-Silurian slates and conglomerate, of the detritus of which it is there in great part composed.

Dyke.

Limestone.

Ballantine Cove

Underclay.

Cape George.

Fossil plants and fishes.

In Dawson's Acadian Geology (p. 346) is a description of a number of fossils collected from Cape George, by Dr. Honeyman: *Lepidodendron corrugatum*, *Cyclopteris Acadica*, *Acrolepis* and *Palæoniscus*. The shales from which they were obtained, are said to be precisely similar to those of Horton Bluff, and "similar shales occur further to the westward, holding the same fossils, and are stated to be so rich in bituminous matter that hopes are entertained of utilizing them as a source of coal-oil.* The beds....in Right's River are probably of the same age. In the vicinity of Morristown there are red sandstones, conglomerate and gray sandstone, the latter containing *Calamites*, *Sternbergia*, and other coal-formation fossils, and, no doubt, higher in

Coal oil.

Right's River and Morristown

*Cf. also Trans. N. S. Inst. Nat. Sc., Vol. IV., pp. 70 and 455.

the series than the beds last mentioned." As already stated, these beds seem rather to belong all to the same group, and to underlie the Carboniferous limestone. Near Ogden Pond and Lakevale,* pits have been dug for coal in black bituminous carbonaceous shale, associated with grit and conglomerate; gray, rusty-weathering, micaceous shale and flaggy, false-bedded sandstone passing irregularly into the coarser beds and containing broken plants. Several large trunks of fossil trees, having the bark converted into coal, have also led to the search for coal on and near the shore in this vicinity. In one of the beds of gray coarse sandstone, a seam four or five inches thick, but only six feet long, tapers to a point at both ends, being probably derived from a large fossil trunk.

Coal formation fossils (?)

Coal pits.

On the Beaver road, gray and reddish mottled micaceous sandstone and shale are again interstratified with black bituminous shale, worked for coal. Sometimes the sandstone is nearly white, weathers rusty, and passes into gray grit and conglomerate. The red and the gray conglomerates seem to be the same, for one is always near or mixed with the other. On the highland of Cape George, the red calcareous variety is always present, and usually also in Ballantine Brook and the other northern streams, passing in places into limestone-breccia and traversed by minute veins of calcspar.

Conglomerate.

On the barrens or commons about Greendale, Heffernan Marsh and Malignant Brook are good outcrops of bluish and greenish-gray coarse sandstone, grit and conglomerate, like those of the shore. In Graham or Sinclair Brook,† the coarse rocks are associated with mottled, reddish and greenish sandstone and marl, containing plants; and in the branch called W[illegible]sh Brook, with dark bluish-gray shale.

Barrens.

The l[illegible]about Cape George is very fertile and well settled, although high, being underlain by calcareous conglomerate. The glens of the Cape are singularly beautiful. In Malignant Brook, at the bridge, a mile and a half above the mouth, the Carboniferous sandstones and conglomerates are more altered than those just described, which is perhaps due to the amount of folding and tilting to which these rocks have been subjected. The land along the road up the east side from this bridge is not thickly settled, the soil being for the most part rendered too rocky for cultivation by blocks and outcrops of gray sandstone and pebbly grit, sometimes quarried for rough work in building. In the brook, good exposures begin not far below the sawmill at Maryvale, fine and coarse, thick-bedded and flaggy, gray sandstone and conglomerate, very micaceous and like the rocks of the St. Mary's Carboniferous basin, containing, among others, pebbles of red syenite, and of the

Malignant Brook.

Barrens.

Quarries.

*Acadian Geology, page 349.

†Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 69, and Vol. VI., p. 313.

red Cambro-Silurian grit of Malignant Cove. Near the mill, black, pearly, polished, graphitic, argillaceous shale has been dug for coal, and is interstratified with dirty greenish-gray and gray soft micaceous argillite, coarse grit and flaggy sandstone. Upstream, some of the rocks are so flinty, slaty, jointed and broken that, at first sight, they might be mistaken for Cambro-Silurian; the associated conglomerate also weathers very much like that of Malignant Cove, but is not so flinty, and is, moreover, interstratified with reddish fine grit, shale and rippled, micaceous sandstone. At the mill, comparatively soft, crumbling conglomerate is associated with black shale. In the north branch of Malignant Brook, above the road to the backlands, are outcrops of gray micaceous sandstone and conglomerate, sometimes nearly compact, thick-bedded, jointed and flinty, like quartzite, which, toward the Hoffernan Marsh road, hold the black shale in which coal was sought. The same association of flinty rocks with more crumbly strata has been frequently pointed out in this formation. Some of the beds of gray, brown or rusty-weathering sandstone could not be distinguished from Millstone Grit; but, there is no evidence that all these rocks do not underlie the limestone of Hallowell, Grant, Lakevale and Antigonish. Immediately above the bridge at Maryvale, greenish-gray fine sandstone, cut by minute threads of calcspar, is followed by three feet of black, calcareo-bituminous, graphitic shale, breaking with smooth, polished faces so as to resemble coal, and cut in all directions by threads of calcspar, associated with greenish crumbling argillite and massive, gray, coherent, coarse and fine sandstone and grit, containing spots of coal and impressions of *Lepidodendron*. On the old Gulf road, black shale detritus is abundant near the head of Malignant Brook.

Coal pits.

Resemblance to Millstone Grit.

Black shales and coal.

Fossil plants.

At the bridge on Right's* River at Murphy's mills, fine exposures of reddish crumbling nut- and egg-conglomerate, dark shales and patches of fine sandstone are interstratified with small bands of limestone, and contain *Lepidodendron*. Up the eastern branch are outcrops of bright-red conglomerate confusedly bedded; and also on the road between North Grant and Pleasant Valley, running up the valley far above the sawmill on the Eigg Mountain road. A thickness of several thousand feet of strata is displayed in these brooks, unless there is some repetition by faulting; while at other places, as at Williams' Point and the limestone quarry on the old Gulf road, the conglomerate is altogether absent, and the limestone rests directly upon Pre-Carboniferous rocks.

Right's River near Antigonish.

Thickness.

In the little branch at the Clydesdale school, the conglomerate, which is for the most part calcareous, is stained green with copper, and

Clydesdale.

Copper ore.

* Acadian Geology, Supplement, p. 49.

interstratified with a band of dark calcareous shale or impure limestone, at least six feet thick; it is unconformably underlain by greenish flinty argillite and gray sandstone, holding pebbles of these rocks, one foot and less in diameter. Limestone.

The conglomerate found in the brooks north of the railway west of Murphy's mills, in a narrow belt underlying the limestone, requires no special mention: it is reddish, friable, of variable texture but usually coarse. The same may be said of the outcrops in Beaver River, Hartshorn Brook and Ohio River, which include, as usual, patches of fine sandstone and marl, among coarse beds, with pebbles three feet long. Contact with the overlying formations.

Large blocks of this conglomerate on Beaver River above the branch from McEachern Lake, indicate perhaps an outlier among the older rocks. Outlier in Beaver River.

3. *Basal Carboniferous Rocks of McAra's Brook.*

A description of these strata is given at page 89 P in connection with the Carboniferous section of the sea-shore at Merigomish.

4. *Basal Carboniferous Rocks of Salmon River Lakes and the West River of St. Mary's.*

That some doubt exists whether the rocks of this belt, in whole or in part, are not rather Millstone Grit, has been stated on page 7 P. No separation into groups has, however, been found possible; the strata are like those just described, except that finer beds predominate; and plants collected from them by Mr. Weston, on the Goshen Road, are, according to Sir J. W. Dawson, characteristic of the Lower Carboniferous (Horton series); so that, for the present, in the entire absence of stratigraphical evidence to the contrary, they will be so considered. The structure of the numerous obscure north-east and south-west anticlines which appear to cross this belt will be indicated on the map, as far as they can be made out in the few outcrops. These rocks lie, throughout the entire length of the belt, on the gold-bearing series (Lower Cambrian) on the south, and the Devonian on the north. The country occupied by them is for the most part low and barren, rocky or marshy, covered with innumerable shallow lakes from which long, sluggish, parallel streams flow a little east of south into Salmon and Country Harbour Rivers and into the East and West Rivers of St. Mary's, the last being not far from the southern boundary of the belt from Glenelg westward to its termination above Trafalgar. Possibly Millstone grit. Anticlines. Boundaries. Barrens.

In the river below the chapel at Salmon River Lakes, are gray coarse sandstone, grit and conglomerate, of loose texture and variable dip. Half-a-mile below, the dip is 237° $<$ 5°, the sandstone being false- Salmon River.

bedded, rusty-weathering, with pebbly patches. Similar rocks, still lower down, associated with reddish-gray fine sandstone, dip easterly at a low angle, although nearly vertical a short distance upstream. A little lower, the dip of gray grit and conglomerate is $75° < 45°$; still lower, $31° < 40°$; and again, $80° < 50°$ near the contact of the Devonian rocks. To confound the latter with the Carboniferous here would be impossible, the Devonian being typical Grand River quartzites and slates. To define closely the boundary to the eastward is impracticable, but the Carboniferous sandstones do not come into the Ogden clearings, to the Cuilnamuc road, or probably further east than the head of the marshy lake below the post road. The boundary at Three-Cornered and Round Lakes is also uncertain, few outcrops being exposed; but is evident at Pringle Lake. The conglomerate in the road at the chapel is a gray, rusty-weathering, coarse, friable variety, succeeded above the lake by gray sandstone full of silvery mica, with a variable, often steep dip, probably indicating faults.

Contact with Devonian.

With the gold-bearing rocks.

Overlying the whin or quartzite of the gold-bearing series in the brook flowing from Hurley Lake, come gray fine sandstones and grits, like those seen on the Salmon River roads, interstratified lower down with rough, coarse conglomerate, composed of pebbles and large boulders of whin. In other branches of Country Harbour River, similar rocks are found. The road from the beautiful Eight-Island Lake, towards Lochaber shows for some distance bluish-gray soft argillite and gray and reddish-gray fine grit and sandstone, often very flinty, veined with quartz, and holding graphitized plants, perhaps Carboniferous. The sandstones of the rocky clearings west of McMillan Lake (page 60 P) are flinty, quartzose, veined with quartz and in part quartzites, associated with shaly and flaggy, argillaceous rocks, which are probably the doubtful rocks of the road. From Trout Brook, above the crossing of this road near Two-Mile Lake, Messrs. Weston and Robert made an important collection of fossils from similar sandstones and argillites. The latter are somewhat slaty, or jointed vertically at irregular, short intervals apart, so that pieces break out, two inches long, two wide, and three-quarters of an inch thick, and smaller. No true slate is found among them, but all are somewhat altered and have a flinty ring when struck; not far above the bridge, and extending a short distance above a ten-feet fall, beyond which the banks are low and the stream swampy, the more sandy beds contain a large quantity of mica, dipping upstream at a very low angle. The plants determined by Sir J. W. Dawson are *Lepidodendron corrugatum*, plentiful; *Stigmaria*, probably rootlets of the above species; *Cyclopteris* (*Aneimites*) *Acadica*, *Sphenopteris*, not determinable but like *S. artemisifolia*. Large numbers of *Cythere* were also detected in the shales.

Trout Brook.

Fossils.

Southward along the post road, these obscurely slaty rocks yield the blocks so largely used in building walls hereabout; they strike along the road for some distance past Fisher's mills, and dip at a very high angle toward the river. At the mill-dam, however, in the river and at the road, they turn at right angles and dip nearly vertically down stream, extending thence to the head of Two-Mile Lake. Round the foot of this lake, and for some distance along the west side, no rocks are in place, but the detritus is the same as that near Fisher's mills. In the brook near the head of the lake, reddish and greenish, tough argillaceous shales dip 137° < 18°, associated with flinty, whitish, rusty-weathering sandstone and grit, composed chiefly of quartz, with blocks of which the ground is covered. Around the shores of the little lake emptying into this brook, the land is also very rocky. Sherbrooke road.

In the first little branch of Boggs Brook (page 60 P), above the road, reddish-gray and gray flinty micaceous sandstone, grit and argillite dip 228° < 27°, resembling the rocks of Hugh McMillan's and Trout Brook and also those of the barrens in the neighborhood of St. Peter's. In the main brook, nearly opposite, similar strata, containing plants, dip 162° < 82°. Upstream, gray, greenish-gray and reddish, jointed, flaggy, micaceous argillite and fine sandstone dip 176° < 80°. Immediately below the mill is a flinty, pebbly grit, while at the dam, whitish, compact quartzite dips 178° < 85°. The outcrops on the road above the bridge are like those near Fisher's mills, but strike 180°. In the brook flowing from the south into this brook a little higher, bluish-gray pearly slates, with obscure graphitized fragments of *Psilophyton* represent the Devonian rocks of South Lochaber. Boggs Brook. Devonian rocks

Rocks precisely like the above are found in the brooks between Country Harbour Cross Roads and Melrose, sometimes in nearly horizontal bedding, at other times with a steep dip; and also between Eight-Island Lake and the Upper Cross-Roads, St. Mary's, where the rusty soil, blocks of gray, fine, flaggy, rusty-weathering sandstone, and sluggish, swampy brooks bring to mind the Millstone Grit districts near Sydney. In the neighborhood of Holy Hill, this formation comprises gray, greenish-gray and rusty, coarse and fine, very micaceous sandstone and argillite, containing stems of plants; bluish, calcareous, micaceous shales and flags, and gray conglomerate, with pebbles of whin and flinty sandstone, the dip of which is variable, the strata being tilted and broken. Country Harbour. Resemblance to Millstone Grit.

In Big Meadows Brook, the first outcrop below the road between Lochaber and Newtown consists of whitish, rusty and greenish-gray, sometimes very fine and flinty, but also pebbly, sandstone, containing minute veins of a mixture of ankerite and specular iron. No other rocks are in place for a great distance downstream, when gray and East River of St. Mary's.

reddish sandstone and argillaceous shale, micaceous, broken by joints, not greatly altered, and with a large predominance of the shale, are succeeded by reddish-gray, fine, micaceous, flaggy, wavy sandstone and argillite, finely ripple-marked. Down the East River of St. Mary's, from the confluence to the Lochaber branch, no rocks appear; but upstream, gray, flaggy, false-bedded, jointed sandstone covers the surface with blocks, rendering much of it unfit for cultivation. Up the brook from the south, opposite Neil Gunn's, and in Greenfield, narrow ridges of gray coarse and fine sandstone run between the branches, the dip being surprisingly variable.

Dip variable.

On the east side of Mitchell Lake reddish and greenish, crumbling, argillaceous sandstone and shale skirt a small portion of the shore. At the mill in the brook below, greenish shale and sandstone dip 306°<50°, and thick-bedded, gray sandstone is also found in some of the branches flowing into the lake, associated with shales and flags. The various outcrops of gray, greenish-gray, shaly and massive quartzose sandstone and grit which occur throughout this district do not require special mention. In no place are the exposures sufficiently good to yield a continuous section.

The rocks of Whidden Brook are like those of Big Meadows Brook, Fisher's mills, and the brooks at the head of Two-Mile Lake.

West River of St. Mary's.

Nearly all the tributaries of the West River cut through rocks like the foregoing, but only a few of these need be specified. In Archibald's mill-brook and Glencross Brook are gray and reddish sandstone and coarse conglomerate; in Clark and Indianman Brooks, gray and whitish, rusty-weathering, flinty, shaly and flaggy sandstone and conglomerate, with reddish and greenish shaly bands.

In Donald McDonald's Brook, below Hattie's bridge, gray fine and coarse sandstone and slate full of broken plants, contain many layers of light-gray, rusty-weathering clay-ironstone, one inch thick and less, streaks of coal and dark shales, with films of calcspar. They extend up to the contact with the Devonian slates and quarzites. In Sutherland's Brook, are similar alternations, mostly of coarser beds. Hattie's Brook and Lake show gray, coarse, coherent sandstone, reddish-gray, compact, altered sandstone, dark greenish-gray ferruginous argillite, reddish and bluish-gray argillite, succeeded, upstream, by slate and quartzite, with minute quartz-veins. These rocks, for the most part coarse, are found at intervals on all the roads and in the river and brooks. In the Big Barren Brook, for some distance above the river, good outcrops of coarse sandstone and conglomerate are followed by finer sandstone and shale, full of *Lepidodendron* and *Cordaites*, and again by coarse grit. The pebbles of the conglomerate are derived principally from the gold-bearing series. Near Bryden Brook, on the

Ironstone.

Coal.

Fossil plants.

Conglomerate.

track from Sunnybrae (page 63 P), a gray, coarse, friable conglomerate, contains pebbles, as large as cocoanuts, of rocks seen higher in the brook and described as Devonian.

The conglomerate is probably only in patches in the sandstones and shales of the river at Archibald Cameron's, which consist largely of dark argillaceous shale, sometimes very coaly, greatly jointed and coherent, but without quartz-veins. Higher up the river, below a dam and not far from Trafalgar, are fine outcrops of gray coarse grit and conglomerate, largely composed of pebbles of the underlying granite and gneissic rock, and succeeded upstream by reddish-gray fine and coarse pebbly sandstone in rocky ledges. In the vicinity of Ellen Brown's Lake, this sandstone is again met with, not far from the contact of Devonian quartzites and slates. Coaly shales.

G 1. Carboniferous Limestone.

A perfectly well defined base for this formation is given by the Blue Cape limestone, the outcrops of which, to the westward, at North Canso, Pirate Harbour, Lennox Ferry, St. Peter's, the Bras d'Or Lake, and other places have been already described.* It is overlain, at no great distance, by an important belt of gypsum, and rests unconformably upon all the formations from the Pre-Cambrian to the Carboniferous conglomerate. The contact of this limestone with the Devonian rocks of Guysborough Harbour has been already referred to.† At another point, at the mouth of Ingersoll Creek, the limestone is gray and reddish-gray, impure and concretionary, often shaly, contains hæmatite, and is mixed with conglomerate. Limestone and gypsum.

Another patch of limestone, not indicated on sheet 24,‡ is found on the shore road, at the north end of the bridge over Steep Creek, underlain by greenish, flinty, quartz-veined sandstone and conglomerate, by a considerable thickness of brown, red and green, mottled, splintery shales, and by black friable argillite or slate, with brown, calcareous concretions, becoming more flaggy and sandy at the base. Steep Creek.

The limestone on the shore at North Canso, is apparently overlain by indefinite outcrops of greenish crumbly argillite and papery shale, with a band of red and green mottled shale; although the dip is so irregular that the exact relation of the different beds is obscure, the first rocks to the westward dipping $275° < 33°$, the limestone, after a concealed interval, dipping $325° < 19°$ to $340° < 25°$, and the underlying greenish flinty quartzite, in which it fills a depression as on the opposite side of the Strait, $0° < 19°$. North Canso.

* Page 50 P of this Report; Acadian Geology, p. 350; Geol. Survey Report for 1879-80, p. 56 F, 61 F, etc.

† Geol. Survey Report for 1879-80, p. 59 F.

‡ Geol. Survey Report for 18 2-83-84.

Blue Cape limestone traceable unbroken for 37 miles.

From the outcrops at Cape Pond and Blue Cape, the limestone passes under the sea to Barrio Head, running thence unbrokenly to the head of the Ohio settlement, about thirty-one miles, thence by St. Joseph, James River and Antigonish to Morristown, twenty-six miles further; it reappears on the shore at Knoydart* and runs about eight miles to Avondale, where it is overlapped by Millstone Grit as

Folds.

far as the margin of the Pictou coalfield. In the Antigonish basin it is frequently repeated by north-east folds, which will be readily understood from the map, some of which bring up Pre-Carboniferous strata.

Outliers.

Outlying patches occur also at the College, at Hallowell Grant and Doctor's Brook, and a narrow belt extends up the East River of Pictou from Springville to Sunnybrae.

Tracadie limestone quarry.

Antigonish Basin.—At T. W. Kinney's, southwest of Tracadie Harbour, several hundred tons of limestone have been quarried and burnt. The lime makes an excellent mortar with two-thirds sand, and has also been used with good effect on wheat- and grass-land. The limestone is bluish-gray, shaly and thick-bedded, oolitic and veined with calcspar. About Giroir's and Black Bridge, at the head of Tracadie Harbour, are several outcrops of reddish and green fine coherent sandstone, gray dirty limestone and purplish-weathering soft sandstone. On the shore at Barrio Head, are beds of greenish calcareous shale with nodules of more or less impure limestone; gray smooth

Shells and plants.

calcareo-bituminous shales holding obscure shells; red and green, mottled argillite, jointed and ripple-marked; and reddish and gray sandstone, wavy and false-bedded, too shaly for building, containing streaks of coal and *Calamites*. Beneath one band of this sandstone is

Coal.

a layer of dark argillaceous shale with rootlets, streaks of coal and pyrites, which has been mined for coal, and is again underlain by shales, which occupy the shore for some distance east, becoming in places dark and slightly bituminous, and interstratified with thin layers of red shaly sandstone and nodular masses of impure limestone. These rocks extend to the mouth of Little Tracadie Harbour.†

In the Monastery Brook, above the shore road, are high cliffs of reddish-gray, greenish and dark-gray shale, sandstone and marl, containing calcspar in minute veins in the bedding, in nodules, in vugs and in sheets in the joints. Near the monastery, these shales are

Gypsum.

associated with gypsum, underlain by twenty or thirty feet of gray bituminous limestone, in layers from four feet to nine inches thick, with fluorspar in calcspar veins. In the adjoining fields, gypsum is in place in mounds, white and without crystals, or saccharoidal and full of crystals of anhydrite. On the road to Tracadie wharf, broken land

* Gesner's Geology, p. 134.
† Geol. Survey Report for 1879-80, p. 61 P.

perhaps indicates also the occurrence of gypsum or limestone among the soft rocks, but no outcrops are met with.

Alexis Head, Tracadie.

On Alexis Head, banks of gravel and boulders are succeeded by cliffs of red, gray and greenish smooth shales, mottled and in alternate layers, with bands of fine sandstone, often beautifully ripple-marked, but having the ripples interrupted by small pits, which give them a rhombic appearance. The marls and shaly and false-bedded sandstone at the west branch of Tracadie Harbour, contain broken plants. The few outcrops between Tracadie and Bayfield, consist of red sandstone and shale, with green and gray bands, containing comminuted carbonized plants; but better exposures are cut in the brooks, where the sandstones are sometimes quarried for rough building-stone.

Fossil plants.

Bayfield.

Afton River.

Afton River, below the railway, exposes high banks of greenish-gray and red marl and sandstone, often like Millstone Grit. Above the Indian Reserves, reddish, greenish and gray smooth shales, like those of Black River, are associated in both branches with red coarse conglomerate, and overlie Devonian quartzites; while downstream are bands of ferruginous limestone and ripple-marked sandstone. At Gorman's corner, the basal limestone, wrinkled and oolitic, is in contact with flinty rocks.

Devonian and Carboniferous.

Pomquet Island

On the west point of Pomquet Island nearest the breakwater, gray, greenish-gray and reddish, fine, micaceous sandstone dips 334° < 45°. Further north, greenish and gray arenaceous shale and sandstone show impressions of fossil plants. On the shore, westward from Bayfield wharf, the first rocks seen are gray fine sandstone and arenaceous shale, rusty in spots and blackened with carbonized plants, with reddish-gray layers and lenticular patches of gray pea-conglomerate and coarse grit. But the greater part of the shore shows only wide beaches of fine gray sand, blown and rippled, strewn with boulders. Pomquet Harbour is low on the east side, from Heatherton northward nearly to the Indian chapel, where fine, gray sandstone, rusty-weathering, and not unlike that of Port Hood, dips about 300° < 50°.

Fossils.

Pomquet Harbour.

Between Fraser's Grant and the post-road to Guysborough, the Lower Carboniferous country towards Heatherton presents many good outcrops of sandstone, shale, limestone and gypsum in the brooks; these rocks are always soft and marly, and are very different from the adjacent Devonian strata.

Gypsum.

Among the red, green and gray soft Carboniferous shale, sandstone and rusty-weathering limestone overlying the Devonian red argillites in the various branches of Black River, none present any points of interest except the limestone and a band of gray and brownish sandstone quarried at Heatherton. The coal and underclay found near the mouth of Pomquet Harbour will be described hereafter. On the road

Black River.

Sandstone quarry at Heatherton.

Coal.

from Bayfield to Heatherton the land is good, but somewhat clayey, showing occasional outcrops of reddish-gray sandstone; west of Pomquet Forks it is flat and uninteresting, with few rocks. Up Pomquet River, above the bridge at the telegraph road, ledges and cliffs of gray and reddish-gray fine soft argillaceous sandstones and flags, with green layers, rippled and wavy, are associated with red marl, and contain the "copper mine,"* worked some years ago, in a greenish-gray, nearly compact sandstone or underclay, full of plants, chiefly *Calamites* and *Cordaites*, partly converted into coal in thin layers or films, but partly, also, into gray sulphide and green carbonate of copper. Gray and red marl and sandstone, greenish and bluish-gray argillaceous shale and gray, strongly coherent shale or impure limestone, are found higher up, followed by cliffs of dark gypsum, speckled with white gypseous marl and impure limestone, red and grayish-white, crumbly, marly sandstone, cream-colored gypsum and dark, soft, earthy, strongly bituminous limestone, full of encrinites and broken shells. The beds are greatly contorted. The gypsum is shaly and conformable with the limestone, veins of selenite passing from one into the other; but, in some masses, gypsum and limestone are mixed, as if the former had been intersected, when plastic, by gypsum veins. Gypsum, gypseous marl and limestone occupy a considerable breadth in the river. At Meadow Green bridge, the lowest, or Blue Cape limestone, red crumbly shale and sandstone are well exposed and underlain higher up by red flinty Devonian rocks, the contact of which is also well seen in some of the streams near Marydale. In one of these, the limestone is bluish-gray, veined with calcspar, probably exceeds ten feet in thickness, and is interstratified with a band four or five feet thick, mixed with the red argillites. It will thus be seen that, in general character, these rocks are precisely like those assigned to this formation in previous reports on New Brunswick and Nova Scotia.

Pomquet copper mine.

Gypsum and limestone.

Fossils.

Meadow Green.

Outcrops of red sandstone and shale or marl, gypsum and limestone, in the neighborhood of St. Andrews, South River, Glenroy, and other places, require no special mention. A reported discovery of coal among these strata in a brook on the west side of South River, at John Fraser's, above the iron bridge at the head of the tide, proved, on examination, to be a bed of gray sandstone, full of large carbonized trunks of *Lepidodendron* and *Calamites*, mineralized throughout by coal and pyrites in layers.

Coal of South River of Antigonish.

A short distance out on the road from St. Andrew's to Vernal, fine, red soft sandstone and shale or marl, limestone and gypsum, are succeeded by flinty Devonian argillite and quartzite.

Contact with Devonian.

* Trans. N.S. Inst. Nat. Sc., Vol. IV., p. 75, and Vol. VI., p. 322.

The cliffs of the shore at Monk Head* show large exposures of gypsum, limestone, red marl and gray, fine, rust-spotted sandstone, with large patches of nut- and egg-conglomerate. The sandstone has been quarried for building, and was used in the abutments of the iron bridge at South River. Monk Head. Quarry.

These rocks, particularly gypsum,* are also found on Antigonish Harbour, below this bridge, as far as the mouth. An outcrop of limestone, near Taylor's road, is gray, massive, and spotted with galena. Antigonish Harbour. Galena.

Carboniferous limestone strata occur, with doubtful, variable dip, in South River, and its branches below Fraser's mills, as well as in the fields and roads about Pineville, Ashdale, and Dunmore. Along the brook on the west bank of South River, north of Fraser's mills, broken land seems to indicate the passage of the lowest limestone; and on the hill, not far to the northward, reddish-gray fine sandstone, said to be easy to work and to harden on exposure, has been quarried. North of Gillis Lake are outcrops of red and green marl, and limestone skirts the neighboring millpond on Dunmore Brook. Between Pitcher's farm and West River, red sandstone, marl and greenish-gray sandstone probably overlie the limestone. Quarry.

Reference has already been made (page 17 P) to the fossiliferous limestone which caps the syenite on Williams Point and the east side of Antigonish Harbour. This limestone is gray, massive and vesicular, resembling that of the Ohio River as well as in its relations to the immense outcrops of gypsum in the neighborhood and to the red shales and marls. The broken land about the harbour well exemplifies the term "plaster land." Limestone and gypsum.

On Right's River, near the head of Antigonish Harbour,† the limestone contains *Productus semireticulatus, P. cora, Cardinia Antigonensis* and other shells. Shells.

In the Beech Hill brooks, the frequent exposures consist of limestone and gypsum, overlain by red sandstone and marl, with dark bluish-gray papery shale, dipping usually at a low angle. Fine outcrops of Carboniferous limestone extend up the West River of Antigonish to the head of the settlement. On the road between Ashdale and West River, a bluish-gray bituminous limestone, full of shells and concretionary nodules, in layers four to six inches thick, with veins and films of calcite, is associated with reddish-gray argillaceous shale and fine sandstone. Beech Hill. Dark shales. Fossils.

On the road between Fraser's mills and Glen Alpine, greenish fine diorite and rusty amygdaloid have greatly altered the compact bluish-gray limestone of Blue Cape in its course from South River Volcanic rocks.

* Trans. N.S, Inst., Nat. Sc., Vol. IV., p. 72.
† Acadian Geology, pp. 304 and 347. Trans. N. S. Inst. Nat. Sc., Vol. IV., pp. 73 and 75.

past the head of Lochaber to Ohio. In the brook from the eastward, north of Glen Alpine post-office, the limestone is immediately underlain by red slates and sandstones of the Upper Devonian. In the brook from McMillan Lake, both above and below the mill, are red shaly sandstone and argillite, very flinty, jointed and perhaps Devonian. North and west of the mill are ledges of flinty quartz-veined sandstone; and in a brook not far south of the road, soft bluish-gray Carboniferous limestone. To the south-westward, in McGillivray Brook, Silurian rocks are overlain by Carboniferous conglomerate and limestone. One of the Ohio "limestones is of palæontological interest as containing trilobites, (*Phillipsia*)," *Spirifera*, *Productus spinosus* and other fossils.*

Devonian and Silurian rocks.

Trilobites.

Contact with Cambro-Silurian.

An abrupt change from Cambro-Silurian metamorphic slates to Carboniferous strata is seen in Hartshorn Brook, a tributary of Beaver River, the latter consisting of bright indian-red marl, with green spots, very crumbly and little more than hardened mud, associated with masses of white and gray gypsum and limestone.

Limestone quarries.

The limestone of Brierly Brook and other streams near the railway, toward James River, is from six to ten foot thick, in layers two to four feet, bluish or dark-gray, flaggy, veined and blotched with calcspar, fit for building, and everywhere quarried. It is underlain both here and in the Ohio valley by greenish nut- and egg-conglomerate, invariably stained with copper ore near the contact, and worked for copper at many points shown on the map. From McIntosh's quarry† in a brook half a mile east of Brierly Brook, the limestone used in the Antigonish cathedral was extracted. Both here and to the eastward of Murphy's mills (Trotter's factory)‡ the limestone and overlying gypsum can be readily followed in great cliffs, mounds and pits, and in almost continuous exposures of the underlying conglomerate. No special description is required of the outcrops in North River and other streams flowing into Antigonish Harbour. Those of Ogden Pond have been figured and described by Sir J. W. Dawson§ and Dr. Honeyman.||

Copper ore.

Gypsum.

Ogden Pond.

Barite.

Copper ore.

On the shore at McIsaac Point, near Morristown, gray flaggy and shaly limestone, about seven feet thick, veined with calcspar and pink and white heavy-spar, rests upon highly inclined reddish and greenish grit or conglomerate, and is overlain by a much greater thickness of brecciated limestone. South of Ballantine Cove, conglomerate, containing a small quantity of green carbonate of copper, is unconform-

* Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 74, and Vol. I., p. 114. Also Acadian Geology, p. 347.
† Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 73.
‡ Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 73.
§ Acadian Geology, p. 347.
|| Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 72, and Vol. VI., p. 313.

ably overlain by light-gray, shaly, concretionary limestone, perhaps five feet thick; succeeded by cream-colored, massive, vesicular limestone passing upward into a brecciated, more or less concretionary, impure variety, containing only a few very indistinct fossils.

Outlier west of Lochaber.—The limestone near Dan. Gillis' house, in the College grant, is of the wrinkled Blue Cape variety, veined with calcspar, and may indicate a synclinal of the lower Carboniferous among the Devonian rocks of these hills. In the immediate neighborhood are outcrops of red argillite and trap. Limestone is also found on the road, in the fields behind the schoolhouse, and near the copper mine, where a little brook runs into a cave.

Outlier at Hallowell Grant.—The limestone seen at the Big Marsh post-office and mineral spring, and again about a mile further south, comprises shaly, brecciated and impure concretionary varieties, strikingly like those of the shore, at least ten feet thick, bounded on all sides and underlain by the gray, rusty-weathering, plant-bearing, micaceous conglomerate, sandstone and gray and black shales, from which a little coal was dug in the vicinity. Mineral spring. Coal of the underlying rocks.

Outlier of Doctor's Brook.—This outcrop of gray, compact, Carboniferous limestone, which was first described by Dr. Honeyman,* seems to be less than a quarter of a mile long and seven chains wide; it overlies Upper Clinton slates in the east branch of Doctor's Brook at Arisaig, half a mile above the fork, is eight feet or more in thickness, and has been burnt for lime.

Merigomish Basin.—A section of the strata, as they appear on the shore west of McAra's Brook, will be given with the Millstone Grit. It has been already stated (page 68 P) that Devonian red slates are overlain in Knoydart Brook by coarse conglomerate, false-bedded, with bands of greenish and gray flaggy sandstone, full of rusty carbonized plants. Immediately above the bridge at the mill, these rocks are overlain by bluish-gray compact limestone, succeeded, in the rocky rapids lower down, by gray, sandy flags and false-bedded sandstones, reddish shale and sandstone with concretionary layers. Near the shore road a gray and greenish flaggy sandstone, at least eight feet thick, contains plants converted into coal and stained bright green with copper.† Knoydart Brook. Coal and copper

Limestone is seen in Bailey's Brook, at John McLean's and again in Carmichael Brook, below the old road. Broken land perhaps marks

* Journal Geol. Soc., 1864, p. 339. Trans. N. S. Inst. Nat. Sc., Vol. I., p. 116; Vol. III., p. 15; and Vol. IV., p. 53.

† Trans. N. S. Inst. Nat. Sc., Vol. V., p. 198.

its extension down this brook, and on the railway west of Avondale, beyond which it is apparently overlapped by Millstone Grit.

Basin of the East River of Pictou.—The limestone of this basin with its accompanying fossils, has been fully described by Sir J. W. Dawson,* and Dr. Honeyman†; but the relations of this and the accompanying strata to the Cambro-Silurian, Silurian and Devonian rocks of the upper part of the river, and to the Millstone Grit of the Pictou coal-field have not yet been clearly defined. The limestone is like that of Morristown and Brierly Brook, has been largely quarried and is overlain by gypsum, and by red and greenish sandstone and shale. The extent and relations of these rocks, so far as known, will be seen on the map.

Quarries.

G 2. Millstone Grit.

The possibility that certain small areas of the upper rocks in the Antigonish basin, about Tracadie and Bayfield, may be Millstone Grit, has already been stated, and also that those of the St. Mary's River basin may be partly or wholly of the same age; but the only area in which this formation clearly overlies the Carboniferous limestone and gypsiferous series, extends along Merigomish Harbour, from Lismore and Avondale south-westerly to the Pictou coal-field, being well exposed on the shore, in Bailey's Brook and in Barney's, French and Sutherland's Rivers. The following section of these and the Lower Carboniferous rocks on the shore, will serve to indicate their composition and general character.

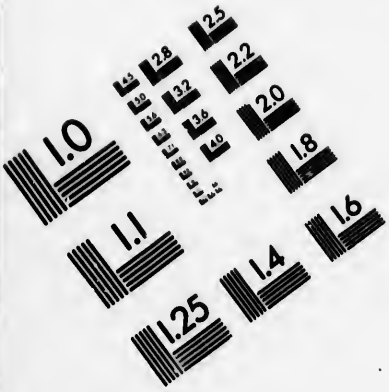
SECTION OF CARBONIFEROUS ROCKS FROM PONDS, MERIGOMISH, TO KNOYDART, ON THE SEA SHORE, IN DESCENDING ORDER.

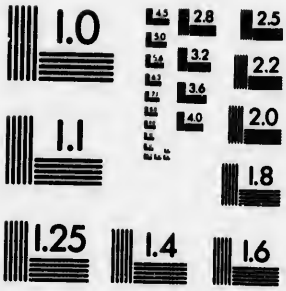
G 2. Millstone Grit.	Feet.
The Ponds. 1. Measures concealed, for thirty chains north-east from the mouth of the brook due north from Ponds post-office; dip 306° < 10° In the lower part, obscure reefs and broken banks of gray and reddish-gray fine, crumbling sandstone	115
2. Greenish-gray and rusty, flaggy and false-bedded sandstone	14
3. Reddish, fine, shaly sandstone underlain by gray and rusty false-bedded sandstone	5
4. Red and green, soft argillaceous shale with bands of reddish false-bedded sandstone with green and gray spots, underlain by gray, massive, very crumbly sandstone,	

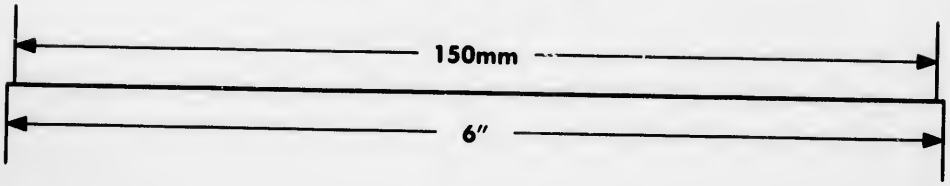
* Acadian Geology, p. 235, etc.
† Trans. N. S. Inst. Nat. Sc., Vol. V., p. 213, etc.

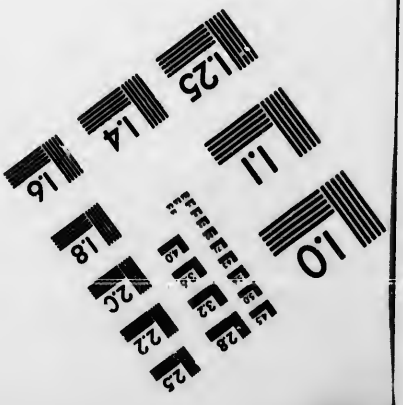
	FEET.	
containing broken carbonized plants, and coherent concretionary masses. This gray sandstone is not unlike that of Port Hood and Margaree Island (Geol. Survey Report for 1882-84, pp. 53 and 76 u).....	10	
5. Measures concealed at the mouths of two little brooks; but seen on the reefs below high-water to consist of strata similar to the above, the lower beds of which are well exposed.....	24	
6. Gray fine sandstone including a lenticular layer two inches thick of greenish-gray, calcareous conglomeratic rock, which increases further east to a foot, and is wholly concretionary, while still further east it is an underclay, showing fine *Stigmaria* converted into a mixture of coal, calcite, pyrite, blende and galena. Prostrate trees also occur in the sandstone, having the bark converted into coal, and in the bank hereabout, coal is said to have been sought. An undulation here turns the dip to 291°—300° < 15°, but it is only local although obscuring somewhat the thickness.—Mouth of a small brook.....	26	*Stigmaria.* Coal.
7. Reddish and gray and greenish shale and sandstone, with a band of gray and rusty, flaggy and false-bedded crumbly sandstone, the gray beds full of broken, carbonized plants.....	36	Fossil plants.
8. Measures concealed.....	13	
9. Red, greenish and gray sandstone underlain by red marl, with bands of red sandstone, like the rocks of Lower French River. At the mouth of Bailey's Brook.....	49	Bailey's Brook.
10. Measures concealed, but apparently red marl and sandstone seen in broken reefs at low water. Dip 304° < 10°, the shore being nearly on the strike for half-a-mile.....	20	
11. Red sandstone and marl seen on broken reefs with large gaps. The sandstone is often knobby, with small calcareous concretions, and blotched with green, but as a rule, the rocks are very crumbly and micaceous. Several thick bands of gray sandstone. Dip 302° < 15°. A headland east of two little brooks.....	120	
12. The same as 11.....	206	
13. Reddish, fine sandstone, in nearly continuous reefs. Dip 306° < 20°. Mouth of a small brook.....	99	
14. Measures concealed, but probably the same as 13.....	16	
15. Reddish and gray sandstone, with a larger proportion of gray crumbly sandstone. Patches of conglomerate in the lower part, some of the pebbles being as large as a hen's egg.....	115	
16. Measures not well seen at the mouth of Knoydart Brook.	92	Knoydart Brook.
17. Gray sandstone, more coherent than usual, containing large, spherical, concretionary masses of fine sand-		

IMAGE EVALUATION
TEST TARGET (MT-3)









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		FEET.
Grindstones.	stone, often with a botryoidal surface. Certain beds are perhaps fit for grindstone, but generally they are shaly and false-bedded. The sandstone has at its base a greenish conglomerate, in part concretionary. The thickness of the strata is here doubtful, the dip changing by a fold or unconformity to 279° < 30°....	22
	Total thickness.....	982

G 1. Carboniferous Limestone.

	18. Measures concealed.....	103
	19. Gray sandstone, of indefinite thickness, included in 18..	..
Copper ore.	20. Reddish shales and sandstones, often finely ripple-marked, containing near the base a greenish concretionary rock, full of plants which are partly carbonized, partly converted into a gray ore of copper; in some places a nearly pure concretionary limestone, and apparently an underclay like 6.....	445
	21. Red marl, with layers of reddish and greenish sandstones. To the mouth of a small brook. Dip 276° < 25°	50
	22. Red marl, with layers of reddish and greenish sandstone. The outcrops are no longer on the reefs, but in a high, rocky bank.....	10
	23. Red rocks, chiefly crumbling sandstone, with one or two unimportant layers of greenish-gray sandstone.....	417
	24. Measures concealed in a broad fishing-cove	370
	25. Red marl, with bands of reddish, greenish and gray fine sandstone. Dip. 284° < 20°	133
	26. Reddish, greenish and gray, fine sandstone, the gray full of carbonized plants and rusty spots, the red greatly predominating.....	79
	27. Red marl, with bands of reddish and greenish, ripple-marked sandstone and shale.....	148
	28. Reddish marl and sandstone, with gray and greenish layers.....	259
	29. Gray sandstone, passing at top into red. Dip 276° < 30°.	10
Limestone.	30. Red marl, with thin coherent layers of light-colored, impure limestone.....	3
Barite.	31. Gray, reddish and light-greenish limestone, for the most part compact; finely oolitic at top; blotched and veined with calcite and containing little cubes of galena, cubes and crystalline aggregations of pyrites, but no fluor-spar was seen as in similar limestones elsewhere, although heavy spar is largely mixed with the calcite. Thickness, 15–20 feet.....	17½
	32. Gray, soft, laminated limestone or marl.....	5
	33. Reddish sandstone.....	6
	34. Limestone, like 31.....	10
	35. Gray laminated limestone or marl.....	3½

	FEET.	
36. Red sandstone and marl. The continuity of the measures is broken, and it is possible that 31–35 are here repeated,	21	
37. Limestone like 31	20	
Total thickness		2110

G 1m. CARBONIFEROUS CONGLOMERATE.

38. Reddish sandstone, shale and marl, with gray and greenish bands, forming high, rocky cliffs. Dip as above	580	
39. Dark greenish and reddish white-spotted amygdaloid, veined with white and reddish calcite. Some of the amygdules are as large as cocoanuts, usually of calcspar, but also of zeolitic minerals, chalcedony, chlorite, etc. The texture of the trap is variable, and it passes into greenstone or diorite. The alteration of the adjoining beds is not noticeable	10	Amygdaloid.
40. Reddish rough conglomerate and grit, holding pebbles of a gray oolitic limestone, like 31, but otherwise all clearly derived from the Silurian and other Pre-Carboniferous strata, sometimes as large as a cocoanut, but usually much smaller	10	
41. Greenish, concretionary, nodular, impure limestone, underlain by a mass of amygdaloid	2	
42. Conglomerate, friable and reddish, like 40, cut by irregular masses of trap which does not follow the bedding as closely as before, but often cuts across it, seldom, however, altering the conglomerate more than three or four inches from the contact. At the mouth of McAra's Brook, the conglomerate and trap are greatly confused, the former apparently holding blocks of the trap. Thickness necessarily indefinite. Dip 291° < 30°	543	McAra's Brook.
		1145
Total thickness of Carboniferous rocks		4237

A large portion of the two upper groups of this section is repeated in Bailey's Brook, as follows:—

SECTION OF CARBONIFEROUS ROCKS IN BAILEY'S BROOK,

IN DESCENDING ORDER.

G 2. MILLSTONE GRIT.

	FEET.
1. Measures concealed at mouth of the brook and below 9 of section on the shore. Dip 303° < 15°	308
2. Greenish and gray flaggy sandstone, thickness undefined	..
3. Measures concealed	149
4. Reddish-gray sandstone, overlain and underlain by red marl	6

		FEET.	
	5. Measures concealed to the bridge at the main post road	41	
	6. Gray and reddish-gray shaly and flaggy sandstone.....	15	
	7. Measures concealed, but reefs of reddish and gray sandstone occasionally seen.....	160	
	8. Gray flaggy sandstone. Dip 303° < 10°.....	10	
	9. Reddish-gray, fine, flaggy sandstone, and smoothly-bedded, argillaceous shale; seen only at intervals in the brook. Dip 303° < 12°.....	130	
	10. Reddish, fine, ripple-marked sandstone and argillaceous shale, well-exposed in reefs and banks. Bridge on a good road. Dip 289° < 10°.....	26	
	11. Red rocks, chiefly soft crumbling marl, with bands of reddish and greenish-gray sandstone and shale, cut through and exposed by the brook, both immediately above the road and again a mile higher upstream ...	28	
	12. Gray shaly and flaggy sandstone.....	12	
	13. Red rocks, like 11. Dip 296° < 7°.....	50	
Fossil plants.	14. Gray rusty-weathering sandstone, full of carbonized plants, and mixed with small patches of concretionary conglomerate. Probably No. 17 of the section on the shore and also the sandstone seen at a foot-bridge, about fifty chains below the bridge near D. D. McDonald's shop, on the road between Knoydart and Avondale.....	7	
	Total thickness of Millstone Grit		942
	G 1. Carboniferous Limestone.		
	15. Reddish sandstone and marl, with greenish and gray bands, not continuously exposed in Bailey's Brook, but better seen in Vamey's Brook; the distance across the strike between 14 and 16 here and in Vamey's Brook, is not more than a mile the thickness is probably, with the prevailing low dip, less than 800 feet, indicating a considerable unconformable overlap—for there is almost certainly no fault.....	800	
Limestone and copper ore.	16. Bluish gray compact limestone; veined with calcspar, often ferruginous, and containing in one place specks of copper pyrites. In Bailey's Brook there appear to be two or more bands resting immediately on red Devonian slates, as also in Vamey's Brook; while at John McLean's, it overlies rocks, supposed by Dr. Honeyman, to be Cambro-Silurian. It is seen again in Carmichael's Brook, and again doubtfully indicated by broken land on the west side of Barney's River, near Avondale railway station, where it is apparently overlapped by the Millstone Grit.....		
			800
	Total thickness of Carboniferous.....		1742

In Barney's River, below the confluence of Gordon Brook, and in other brooks of the neighborhood, gray and greenish, brown and reddish sandstone and shale, the former sometimes quarried for building, and holding spheroidal concretions of harder, nodular sandstone and many carbonized plants, are exposed at intervals in the cliffs. Immediately above Gordon Brook are banks of gray, fine, flaggy and shaly sandstone, rusty and full of carbonized plants, which is in thick beds higher up, has been quarried, and is underlain by reddish ripple-marked argillaceous shale and crumbly false-bedded sandstone containing patches of conglomerate and concretionary limestone. Above Avondale bridge, the Carboniferous rocks are underlain by greenish flinty Medina sandstone; but at the bridge, and also in Anderson Brook, Carboniferous sandstone is in place. On the south shore of Merigomish Harbour, on all the roads in the neighborhood, in the brooks and on the railway, are frequent outcrops of these strata. Near the Presbyterian church, reddish-gray and greenish, soft, friable sandstone and arenaceous shale, with impressions of *Calamites* and other fossil plants, and concretionary masses one foot in diameter, have a north-westerly low dip.

Barney's River. Sandstone quarries. Fossil plants. Contact with Medina. Merigomish.

Near the mouth of French River, a fine grindstone grit has been largely quarried from a bed ten to fifteen feet thick, dipping $6° < 5°$; whereas, a short distance further east, the dip appears to be $111° < 7°$. Gray shaly sandstone, greenish argillaceous shale, reddish or brown, micaceous, bituminous sandstone and marl, with gray calcareous conglomerate and associated rocks, are found on the shore to the eastward. About two hundred yards east of Mitchell's wharf, a gray and reddish, flaggy and shaly limestone has been quarried and burnt, and shows on another point still further east.

Grindstones. Limestone.

In Huggan Brook, are gray and reddish, rusty-weathering, crumbly, flaggy, shaly and false-bedded sandstones, containing plants, in which traces of coal have been discovered. Near Piedmont station and on the valley road, there are outcrops of conglomerate between these finer beds and the Cambro-Silurian strata of the hill; thence the conglomerate follows the boundary towards French River.

Conglomerate.

Fine exposures of Millstone Grit occur in picturesque nearly continuous cliffs along French River, between the shore road and Glenshee. The first beds seen above the salt marshes are of red and green soft marl and fine sandstone, followed upstream by gray fine sandstone, fifteen feet thick, which has been quarried, capped by ten feet of red marl and sandstone. Higher still are reddish-gray, fine, flaggy sandstones, certain layers of which are mottled gray and dark-reddish, like those of Hawkesbury, others rusty and containing bands of dark nut-conglomerate, remarkably persistent as far as seen. Gray sandstone

French River. Quarries. Conglomerate.

is interbedded with red marl and flags, followed upstream by a wide belt of gray sandstone, then by a great thickness of red rocks, interrupted only by occasional bands of gray and greenish sandstone. Similar alternations of red strata extend for half a mile upstream; some of the beds include nodular concretions and bands of impure limestone and ironstone, and are blotched in places with calcspar, like the rocks of Afton and Pomquet Forks. The gray sandstones have the usual markings of carbonized plants. The dip is variable, and the measures are folded, an anticlinal axis apparently following the river for some distance.

Ironstone.

Beneath these red rocks is a band of red crumbly conglomerate, twenty-four feet thick, underlain by marl and by a gray conglomerate, enclosing a lenticular seam, three inches wide, of bright clean coal, seen for three feet in the river, but thinning out at both ends. Red conglomerate and marl follow. The former greatly predominates and contains pebbles, as large as cocoanuts, of red and green, mottled, fine, micaceous sandstone; reddish, impure limestone or marl, reddish-gray, fine, flinty sandstone, like that of Hawkesbury; reddish-gray, flinty, quartz-veined Devonian quartzite; whitish-gray fine sandstone; whitish quartzite veined with calcspar and ankerite, containing hæmatite; and a pebble of compact, earthy, red hæmatite as large as a hen's egg. The pebbles of mottled rock greatly predominate, and are almost certainly Lower Carboniferous, so that this conglomerate, which occupies a breadth of nearly half a mile in the river, belongs probably to the base of the Millstone Grit. It is seen to overlie metamorphic rocks, and can be traced in contact with them along the telegraph road to the westward of Glenshee.

Coal.

Pebbles of iron ore in conglomerate.

Junction of metamorphic rocks.

In the railway cuttings about Merigomish and Sutherland's River, gray and reddish flaggy sandstones with concretionary layers have a northerly dip, these layers passing into limestone of fair quality. Below the railway, on the right bank of the river, are many blocks of gray sandstone and concretionary calcareous conglomerate, and at one point, a cliff of conglomerate or breccia eight feet thick, overlies gray flaggy sandstone. On the east side of the river, about two hundred yards above the railway bridge, the dip is $338° < 47°$. At the bridge, the angle of the dip is 26°. A short distance higher, a sandstone, that has been quarried, dips $< 16°$, the red rocks above $< 55°$. Above the bridge on the telegraph road, the rocks are greatly disturbed for some distance, consisting of red shale and sandstone with gray layers, holding carbonized plants, some bands being speckled reddish and green, like the sandstones of Hawkesbury. A section of these rocks, at Ross' bridge, is given by Sir William Logan.* At the

Sutherland's River.

Fault.

Logan's section

* Geol. Survey Report for 1866-69, p. 12.

small brook from the westward, about a mile higher, they are succeeded by gray broken argillite and reddish, massive, fine, flinty sandstone followed upstream by bright-red, calcareous, coarse conglomerate, mixed with sandstone and shale, with green streaks and blotches, and cut by dark calcareous trap. All the pebbles of this conglomerate appear to be Pre-Carboniferous, it extends to the contact of the metamorphic rocks in the falls at Park's mills.

Park's mills.

The fine exposures of Millstone Grit in Pine Tree Brook and Gut have been described by Sir William Logan.* At the very head of the cove south of James Small's, conglomerate *débris* denotes the presence of the overlying Permian.

Contact with Permian.

G 4. PERMIAN.

Rocks of Newer Coal Formation, Upper Coal Formation, Upper Carboniferous, Permo-Carboniferous or Permian age are largely developed on the shore between Merigomish and Pictou Harbour, as described by Sir J. W. Dawson,† but from this series he has excluded, notwithstanding its strong general resemblance to these rocks, the New Glasgow conglomerate, which seems to be its proper and natural base, referring it instead to the "upper part of the Millstone Grit or lower part of the Middle Coal Formation," a classification followed by Sir William Logan,‡ probably on the authority of Sir J. W. Dawson, just as he places in his Devonian series in the Pictou coal-field, on the same authority,§ rocks belonging to several different periods of formation, because being outside the coal-field, they were only incidentally examined by him. Of the New Glasgow conglomerate, Sir J. W. Dawson wrote in 1845: "The coal measures of the Albion mines, on the banks of the East River of Pictou ..... are succeeded, in ascending order, by a great bed of coarse conglomerate, which, as it marks a violent interruption of the processes which had accumulated the great beds of coal, shale and ironstone beneath, and as it is succeeded by rocks of a character very different from that of those older coal measures, forms a well-marked boundary, which we may consider as the commencement of the Newer Coal Formation."‖ That the great break is also accompanied by unconformity is conclusively shown by Logan and Hartley**; and also that the line of separation between the conglom-

New Glasgow conglomerate.

Sir William Logan's and Sir J. W. Dawson's views concerning it.

Unconformity.

* Geol. Survey Report for 1866-69, p. 9.

† Acadian Geology, p. 320.

‡ Geol. Survey Report for 1866-69, pp. 13 and 65.

§ Geol. Survey Report for 1866-69, p. 7; Acadian Geology, pp. 319 and 502; Trans. N. S. Inst. Nat. Sc., Vol. III., p. 105; Canadian Naturalist, Vol. IX., 1881, p. 11; and the present report, p 33 P.

‖ Quarterly Journal of the Geological Society of London, Vol. I., p. 822. Cf. also Trans. N. S. Inst. Nat. Sc., Vol. II., p. 95.

** Geol. Survey Report for 1866-69, p. 13, line 34, and p. 66; Suppl. Acad. Geol., p. 36.

Faults do not affect the conglomerate.

erate and the coal measures is not a fault. On this assumption, there is no necessity for the explanation of the structure by the singular "Devonian thrust up" (page 65) and thinning of the conglomerate toward the dip, the faults affecting the coal measures having, perhaps, as at Springhill, been produced before the deposition of the conglomerate, which has subsequently overlapped the unconformable contact of the Millstone Grit and Pre-Carboniferous beds, another proof of which is found in the occurrence of a large patch of conglomerate resting upon the latter in McCulloch Brook, at and above the crossing of the Acadia Company's railway, but not shown on Logan's map.

McCulloch Brook.

It seems highly probable that the above is the true explanation of the structure, notwithstanding all that has been subsequently written to disprove it,* a supposition also greatly strengthened by the tracing of the belt of conglomerate eastward from the last outcrops mentioned by Logan, through Quarry and Olding Islands to Robinson or Big Island, where the rocks are admitted to be Permian. The same great physical break between the so-called Newer Carboniferous and older rocks is found in the Cumberland district, in parts of which there seems just as much reason to place the former in the Millstone Grit. The tracing of these strata eastward, to join those of Pictou Harbour, should make the unconformity still more evident and remove every doubt. The fossil plants obtained from the beds overlying the New Glasgow conglomerate have a Permian aspect,† and therefore the whole series may for the present be regarded as Permian. Nearly opposite the southwest corner of Quarry Island, on the mainland, cliffs of conglomerate, with small, lenticular bands of red sandstone, dip 318° < 9°. On the island, near this point, are good outcrops of reddish and greenish sandstone and arenaceous shale, underlain to the south-eastward by red marl, with thin bands of gray and reddish, striped, calcareous, concretionary sandstone, intermixed, in the cove to the eastward, with red pea- and nut-conglomerate. Three hundred yards from the east point of the cove is the quarry from which the island takes its name, still extensively worked for sandstone used in the manufacture of grindstones, which are dressed on the ground. The bench at present worked is fifteen feet thick, overlain by greenish argillite. On the north point, and skirting the shore from the head of the northwest cove to the low-water beach, where the island joins the mainland, is the botryoidal limestone used by Logan to determine‡ the summit of the New Glasgow conglomerate, which seems here to have lost its conglomerate character, and to be made up largely of finer sediments. The calcareous band is underlain by reddish, soft, argillaceous, shaly

Permian of Big Island.

The fossils Permian.

Quarry Island.

Grindstones.

Limestone.

* Geol. Jour., 1853; Acadian Geology, pp. 321 and 343; Supplement, pp. 34, 36 and 49.
† Suppl. Acad. Geol., p. 33.
‡ Geol. Survey Report for 1866-69, p. 14.

marl like that of Savage Point (page 96 P). Reddish fine shale, flaggy sandstone and marl, probably of this age, extend along the north shore of Indian Island for one hundred and fifty yards from the western point. At the point are similar rocks, also like those of the west end of Quarry Island, with thin green bands. Indian Island.

For two hundred and fifty yards along the south shore are reddish sandstone and marl, with patches of green marl; succeeded at six hundred and ten yards from the point by reddish and greenish-gray fine sandstone, blackened with broken carbonized plants, and containing calcareous, concretionary patches; underlain by reddish, fine sandstone and pea- and nut-conglomerate, the pebbles being obscure but apparently derived from Lower Carboniferous rocks, and the surface of the sandstone covered with numerous scales of specular iron, also present, but in less abundance, in the conglomerate. On the eastern point of the easternmost of the two little islands north of Indian Island, are large blocks of gray, impure concretionary limestone, gray and reddish sandstone, with large, hard spherical concretions. At both the east and the west ends of the western island, are similar blocks, with a large proportion of red. But no rocks are in place. Fossil plants.

On the north-east point of Olding Island, red sandstone is seen at low water; further west, gray and greenish-gray sandstone and argillaceous shale; and at the western and south-eastern points, other outcrops of sandstone. On the north side, a quarry was opened some years ago, but has been worked out; here a band of gray, impure, concretionary limestone, containing masses of the botryoidal variety, probably, indicates the upper part of the New Glasgow conglomerate. Olding Island. Quarry. Limestone.

From the last exposures of Millstone Grit at the Ponds westward to the Big Island of Merigomish, the shore is low and sandy, with broken banks. The first rocks on the north-east side of the island, west of the long beach, are gray sandstone, with a slight inclination seaward, sometimes coarse and pebbly, but with layers fit for grindstones, in thick or thin beds, crumbly, false-bedded, rusty with carbonized plants and trees, and interstratified with thin layers of greenish argillaceous shale. Where they overlie a small coal seam, these sandstones become coarse, yellowish and pyritous. The coal is from twelve to eighteen inches thick, tolerably regular as far as seen, bright and clean, but with streaks of pyrites and mineral charcoal; it rests upon a soft fire-clay at least eighteen inches thick, underlain by yellowish grit, with efflorescent iron sulphate on the surface, succeeded a short distance south by red argillaceous shale of considerable thickness, interstratified with gray thick-bedded sandstone and grit, holding a prostrate tree, two feet in diameter, mineralized with white and black calcspar. Bluish and greenish-gray, fine, shaly and flaggy sandstone, with hard Big Island of Merigomish. Grindstones. Fossil plants. Coal seam. Prostrate tree.

spheroidal and botryoidal concretionary masses, coarse, gray, crumbly, sandstone, and a calcareous, fine concretionary conglomerate, two feet thick, underlie to Merigomish Point, beyond which, for some distance south, outcrops are more obscure and seen only at low water. The thickness from the coal to this conglomerate is probably about two hundred and sixty feet. North of the base of Savage Point there is exposed a set of soft, red marls and sandstones with thin, concretionary bands of limestone and sandstone, dipping at a much higher angle than the strata north of Merigomish Point. The inner shores show

Smashem Head no sections, except at Smashem Head, where fine, gray sandstone and concretionary conglomerate or impure limestone are well exposed. In the cove west of Smashem Head a few blocks of concretionary, botryoidal limestone are found; these are more numerous on the outer shore of Glashen Point, and, as they are hardly likely to have been carried by ice, may indicate the passage of the Quarry Island calcareous band. On Glashen Point are seen, at low water, beds of gray and reddish, hard, shaly sandstone used for scythe-stones. At

Finlayson Island. the south-east corner of Finlayson Island, one of the Pig Islands, are indefinite outcrops of gray fine sandstone with spherical concretions, fossil, plants and patches of gray, impure, concretionary limestone.

East River of Pictou. The rocks overlying the New Glasgow conglomerate, on the East River of Pictou, have been fully described by Mr. Henry Poole* and Sir J. W. Dawson.† On the east side of the river, these comprise

Black shale. reddish and gray sandstone full of plants, and greenish or bluish-gray and blackish carbonaceous shale. Immediately south of the mouth of

Quarries. Smelt Brook, and, again, further south, the sandstone has been quarried. Beds, similar to these, occur further north, all dipping at a low angle; while in the cove immediately south of Ship-yard Point, bright-red and green marl rise into a crumbling cliff. Greenish-gray, rusty-weathering sandstone, full of large specks of white mica, forms part of Ship-yard Point and many of the reefs as far as the Big Gut bridge, between

Fisher's Grant. which and the ferry wharf at Fisher's Grant occur only obscure outcrops of gray and reddish, friable, nearly horizontal sandstone and grit, containing *Calamites* and other plants, and hard concretionary

Limestone. masses of calcareous breccia or conglomerate passing into nearly pure limestone.

Similar rocks extend to the mouth of Pictou Harbour and also inland, producing sandy, excellent soil.

On the west side of the East River, the first rocks seen, a considerable distance beyond the conglomerate, are dark shales and sandstones, apparently the extension of those of the east side. At the mouth of

* Trans. N. S. Inst. Nat. Sc., Vol. I., p. 36.
† Suppl. Acadian Geology, p. 35.

Middle River, in the cove south of Skinner Point, good exposures of reddish-gray and whitish fine sandstone and grit, cream-colored argillaceous shale and reddish, crumbly, arenaceous shale, dipping 74° < 14°, indicate a turn of the basin to the northward, a corresponding flexure of the underlying conglomerate bringing the latter to the shore near the loading ground at Granton. On Begg's Gut, reddish and gray shale and sandstone are overlain, in a little brook from the eastward, by twenty feet of greenish-gray and gray, free-working sandstone, in thick beds, quarried to some extent by Mr. R. E. Chambers, of Truro. Little blasting is necessary, the stone being removed by wedging. A short distance above tidewater in Begg's Brook, red and gray, fine, crumbly grit prevails. Middle River of Pictou. Sandstone quarry.

For nearly three-quarters of a mile above the loading-ground, Middle River shows no rocks; then reddish, shaly sandstone caps conglomerate in a bank fifteen feet high, the pebbles of the latter ranging in size from a cocoanut downward. Further south on a flat point, clay is obtained for brick-making; and immediately beyond, red soft grit is associated with bright-green marl, rich in carbonized plants, underlain by coarse conglomerate, with bands of reddish-gray sandstone and shale. Other exposures of reddish marl and conglomerate are found as far as the narrows, as shown on Logan's map, and above tidewater form rough reefs and high, steep banks. On the road from Alma mills, westward across Greenhill, the conglomerate is well developed, but has not been closely examined. Brick-clay. Fossil plants. Greenhill.

At the base of the sandbeach on the east side of the mouth of Pictou Harbour, are outcrops of bluish-gray fine sandstone; while up the creek beyond, to the bridge on the shore road, are cliffs of gray and greenish-gray sandstone in nearly horizontal layers, sometimes false bedded, rusty and pebbly, with upright trees and carbonized plants, streaks and blotches of coaly matter, some of which have been dug but seldom exceed an inch in thickness. Above the bridge are broken banks of similar sandstone with a northerly inclination, which is somewhat obscure, not from lack of exposures, for the cliffs are twenty feet high and the reefs numerous, but owing to the coarse, irregular beds and low angle of dip. Some of the land in the neighborhood is very rocky. Ferrous sulphate oozes from the cliffs, and the water of many of the springs is strongly astringent. Search for coal. Mineral springs

East and west of Mackenzie Head are repetitions of these rocks, with a north-westerly dip; at Roaring Bull Point the dip is north-easterly, and the cliffs show red marl and fine crumbly sandstone, some of the upper beds being very calcareous, concretionary nodular and capped by gray, crumbly, thick-bedded sandstone. Roaring Bull Point is rocky from base to "bill," fine gray sandstone with a tinge of red dipping Mackenzie Head. Roaring Bull Point.

eastward at an angle of 10°. There is little variety in the rocks to the eastward, which appear on all the headlands and in many of the coves;

Fossil plants. some parts contain more plants than others, or are coarser, or have hard concretionary masses which give rise to irregular weathering. Evans Point is very rocky and shows a band of bluish-gray, concretionary, calcareous conglomerate, underlying sandstone. The inner shores of Chance Harbour are low, and only a few outcrops of reddish and

Little Harbour. gray sandstone are found on those of Little Harbour. In the millbrook, below Stewart's mill, fine gray shaly sandstone prevails, as well as to the eastward and on the road up the millbrook. On the north side of the railway and Merigomish road at Glenfalloch a gray fine sandstone dips

Quarry. north-westward at a low angle, and has been largely quarried.

Roy Island. At the west end of Roy Island begin reefs of gray false-bedded sandstone, which extends in unbroken cliffs along the outer shore, shows little

Grindstones. variety and has been quarried for grindstones at several points. Not far west of Colquhoun Point a prostrate tree, mineralized with white

Fossil trees. and dark coaly calcspar, shows concentric, agate-like layers from the pith outward, probably due to the mode of deposition of the calcspar. In the same beds are upright trees and roots mineralized in the same manner. The sandstone which contains many hard, concretionary masses is of finer sandstone, is traversed by long joints parallel to the strike and crossed at right angles by others which give rise to fissures in the soil of the bank above. The inner or eastern shore of Colquhoun Point is inaccessible below the cliffs even at low water. Sandstone was at one time quarried on King Head. The shore to the southward is for the most part occupied by soft red and green marl and sandstone, with

Limestone. greenish concretionary layers. In a little brook north of Quarry Island are slabs of whitish-gray impure limestone about three feet thick, probably from outcrops overlying the red sandstone of the brook. It is not the botryoidal limestone, but overlies it and apparently forms part of the belt of red rocks passing through Big Island.

On the road from Quarry Island westward to the main road, reddish and gray fine sandstone and shale are underlain by coarse friable con-

Limestone and coal. glomerate, accompanied by huge blocks and outcrops of gray concretionary limestone, part of which is botryoidal, and has been burnt. The coal seam here is supposed by residents to be the same as that of Big Island, but perhaps underlies it, although this is still uncertain, pending the examination of the associated strata.

Volcanic Rocks.

These rocks occur in the region of which this report treats, in large, important areas with others of sedimentary origin, and have frequently been adverted to. They belong to several distinct periods, but it

has been often found impossible to determine what these periods were, although in some cases this can be readily done. Viewed generally, however, they may be provisionally referred to the following groups:—

1. The old crystalline series, containing all the massive rocks, and perhaps also the schists described as Pre-Cambrian. 2. Igneous rocks which, like those of Georgeville, cut the lower Cambro-Silurian conglomerates. 3. Contemporaneous volcanic rocks of the Middle and Upper Cambro-Silurian, occupying one of the two largest tracts covered by these rocks. 4. Contemporaneous rocks of Lower Devonian age, found south of Guysborough River and McPhee's mill-brook. 5. Dykes cutting Silurian, Middle and Upper Devonian rocks. 6. Contemporaneous volcanic rocks and dykes traversing the Carboniferous conglomerate and lowest bed of limestone at St. Peter's and elsewhere. Classification.

1. *Pre-Cambrian Volcanic Rocks.*—These having been fully described at page 7 P of this report, need not again be referred to.

2. *Georgeville Intrusive Rocks.*—These rocks, at their contact with the Pre-Cambrian and Cambro-Silurian, are described at page 8 P. Further east, at a small island or rock near Georgeville, is a red and cream-colored syenite or quartz-felsite, containing very little hornblende, and in places a pure quartzite, very like the flinty rock of Frenchman's Barn, cut by dykes of greenish soft trap, and sending in every direction, into the adjoining flinty argillites, veins not exceeding two inches in thickness. It is also mixed with the argillite in masses; sometimes nearly compact, but also very coarse. On the shore road, the syenitic and dioritic rocks all pass into porphyritic felsite, but generally contain a large quantity of hornblende, and also mica, and become pure hornblende-rock or a mixture of hornblende and quartz.

They come to the shore between Georgeville and Malignant Cove, where they are mixed with crystalline limestone and other rocks already described, and with a rock composed of quartz, felspar and limestone, like that of Ingonish River,* the dip being greatly disturbed and large veins of quartz being on both sides of the contact. They are here also cut by three dykes of black trap, the largest fifteen feet wide, and by veins of red compact syenite or quartz-felsite, like that described above, which is thus perhaps newer.

The syenite of James River and North River is probably younger than the above.

3. *Other Cambro-Silurian Volcanic Rocks.*—Mention has been made of the agglomerates, amygdaloids and similar rocks associated with the sediments of Doctor's Brook, Barney's River, and other places; and of the masses of syenite and diorite which break through them at

* Geol. Survey Report for 1882-83-84, p 36 R.

many points, as in the Antigonish hills and James River; but some further particulars regarding the most interesting of this series may not be out of place. The syenite which forms so large a portion of the hilly country north of the railway at James River, where intersected by this river above the railway bridge, consists of a glistening bright-red variety, with little hornblende, traversed by dykes of dark-green fine diorite, and succeeded upstream by greenish-gray siliceous slates. In the first branch from the west, these rocks are also present, as well as in the streams to the eastward.

James River.

Brierly Brook. In Brierly Brook, reddish or flesh-colored quartz-felsite, with porphyritic crystals of felspar and numerous veins of quartz, is associated with greenish and reddish massive diorite and felsite. In the extension of the Cambro-Silurian rocks westward, the volcanic portion at Barney's River and Marshy Hope need not again be adverted to.

The Arisaig Trunk road, immediately south of the Hollow, is occupied by chloritic, serpentinous and calcareous rocks, porphyritic felsite, mottled red and green amygdaloid, blackish, fine chloritic diorite, and greenish and gray, mottled, fine and coarse breccia or fragmental felsite, interstratified with Cambro-Silurian sandstone. On the old road past Donald McLellan's, greenish and mottled epidotic, soft, fragmental shale is mixed with porphyry, among Cambro-Silurian sedi-

Doctor's Brook. ments; and in the branch of Doctor's Brook east of the Trunk road, with greenish, massive, fine, calcareous diorite, gray, soft slate or amygdaloid, containing spots of clear quartz and other minerals, and cutting irregularly across red argillite in patches or following in the bedding, in both cases partaking of the lamination of the sedimentary portion. On the road through the back settlement of Arisaig and between Doctor's and McNeil's Brooks, fragmental and trappean rocks abound; and near the confluence of the east and west branches of Doctor's Brook are mixed with diorite and syenite, porphyritic felsite, and felsitic slates of great variety of color, like those of Coxheath;

McNeil's Mountain. while red syenite, associated with greenish coarse diorite, rises into the peak of McNeil's Mountain.*

In Malignant Brook, flinty rocks are cut by dykes of diorite and amygdaloid. The coarse syenite and diorite to the eastward are older, and contain large porphyritic crystals of felspar. In the little branch west of Malignant Brook, near the shore, and in the neighboring fields and woods, are large outcrops of reddish or brown amygdaloid, red syenite, and dark, fine, porphyritic diorite.

Piedmont. Among the slates and grits of the hill south of the Piedmont valley are bright-red coarse syenite and quartz-felsite, cut by irregular

* Trans. N. S. Inst. Nat. Science, Vol. IV., p. 50.

veins of quartz, and mixed with greenish-gray chloritic, calcareous diorite.

The volcanic rocks in the neighborhood of Eden Lake are perhaps partly of this age. Those of the upper part of the East River of Pictou have already been described. Eden Lake.

4. *Lower Devonian Volcanic Rocks of Guysborough.*—That some of the volcanic rocks in the Devonian belt stretching from Guysborough Harbour to South River Lake are contemporaneous, or nearly so, with the sedimentary strata of this belt, scarcely admits of doubt; but that some of them are newer is also probable. Age.

Blocks of porphyry strew the shore road immediately north of Guysborough. Guysborough.

At Bigsby Head, to the southward, a mass of blackish, greenish, reddish and bluish amygdaloid, full of veins of calcspar, and holding specular iron and epidote, is in contact with altered sandstone and conglomerate west of the head of Carding-Mill Brook, in Tovy Brook, and other streams of the neighborhood; trap and diorite are associated with purple fragmental slate and compact porphyritic felsite. Iron ore.

Toward the eastern end of Rocky Lake are reefs of pinkish and greenish, mottled hæmatitic and calcareous trap in contact with flinty, altered red slates. At the eastern end of Grant Lake are blocks of purplish felspar-porphyry, veined with quartz and spotted with chlorite and specular iron; and on the wood road from this lake to the shore, these rocks are in place. On the lake south-west of Grant Lake are lodges of greenish, pyritous, fine-grained, calcareous quartzose and chloritic diorite, in contact with light-gray argillite. On other lakes of the vicinity, at Erinville, Glencoe, North Branch Lake, McAllister and Roachvale Brooks, the trap, diorite and felsite present few points of interest.

The frequent occurrence of veins and blotches of specular iron ore in connection with volcanic rocks leads to the conclusion that this ore owes its origin to them. At the Erinville iron mine, wedges and veins of ore are found in diorite, but also brecciated with a cream-white clay-rock. Specular iron ore.

Large outcrops of crystalline diorite cross the road south of Cuddihy Lake and the path from the iron mine to the shingle-mill at Glencoe. About half-a-mile out on the road from Erinville to Giant Lake, volcanic breccia and chloritic trap occur; and a small dyke of epidotic diorite about a mile east of Giant's Lake; with others in the neighborhood of Argyle. Giant Lake.

McNaughton Brook shows several junctions of volcanic rocks with Devonian strata. These latter, below the stillwater, consist of dark bluish-gray flinty argillite, and are in contact with light-gray amygda- McNaughton Brook, South River of Antigonish.

loid, perhaps continuous with that of the road. The amygdules are principally of calcspar or of yellowish agate-like quartz, chlorite and other minerals. Lower down, greenish compact diorite and whitish-gray granular quartz-felsite intersect micaceous sandstone, coarse grit and argillite showing impressions of *Calamites*. Still lower, knobs of light-colored trap extend nearly as far as a small brook from the west; immediately above which is gray granular quartz-felsite, succeeded at and below the brook by greenish trap, which again passes into compact porphyritic felsite or quartz-felsite, and into obscure granite. Lower down, light-gray, flinty, porphyritic quartz-felsite, with small spots of bright-colored vitreous quartz scattered through its mass, cuts highly altered sandstone or quartzite, succeeded again by light greenish-gray felsite, made up of fragments two inches and more in diameter. The greenish and gray plant-bearing flags and shales occur a few yards lower at a bridge on a farm road. A short distance below, trap and quartz-felsite are again seen, also at the foot of the gorge, and again to the north-eastward of the brook, as defined on the map.

5. *Dykes in Silurian and Devonian Rocks.*—The few intrusions among Silurian sedimentary strata have been all noticed. One of the most interesting is that west of Indian Brook, near Cape George, where red crystalline syenite and greenish, fine, calcareous diorite, themselves intimately mixed, containing porphyritic and globular masses, displace and are mixed with gray quartzite, probably Silurian, like the unaltered fossiliferous rocks of the immediate vicinity, but possibly older.

Cape George.

South River Lake.

On both sides of South River Lake are large outcrops of coarse hornblendic diorite. In some of the branches of McPhee's mill-brook, diorites are associated with amygdaloid. At the head of Polson's or Copper Lake, whitish coarse quartz-felsite, a granite without mica, is abundant. On the opposite side of the lake, running 83° from the shaft-house on the hill at the mine, and also at the road, a ridge of reddish and gray trap, fine-grained and obscurely amygdaloidal lies between a belt of wet lowland on the south, and the outlet of the lake on the north. Near the outcrop of whitish marble is a ledge of rock either igneous or so metamorphosed as to be irrecognizable as sedimentary. It should be remembered that here, as in other places, the volcanic areas on the map represent rather the points where such rocks have been seen than their extent and the intricate line of their contact, which can seldom be closely indicated.

Polson's Lake copper mine.

Near the College copper mine, whitish granular diorite or granite, like that of Polson's Lake, breaks through purple argillite. In the brook running from the little lake in this vicinity are many blocks of greenish-gray, white weathering, fine amygdaloid, but none in place.

Lochaber copper mine.

On the road from Lochaber to John Carroll's, the epidotic, quartz-veined diorite, containing blotches of specular iron, is doubtfully newer than the Carboniferous limestone.

6. *Lower Carboniferous Volcanic Rocks.*—Numerous dykes cutting Carboniferous conglomerate at McAra's Brook and on Cape George peninsula, have been described in connection with that formation. At Arisaig pier, a black trap, probably an extension of that of McAra's Brook, cuts the felsites, and extending along the shore outside them is seen at other points to the eastward: it is amygdaloidal and contains green serpentinous spots. Arisaig.

A pillar-rock of greenish-black amygdaloidal, spheroidal trap occupies the short piece of rocky inaccessible shore south of Ballantine Cove. Most of the amygdules are calcspar, and a bright-red soft mineral is in the veins. The trap of the small dykes northeast of Livingstone Cove is raven-black and greenish-gray, veined with calcspar. One of these dykes, about twenty feet in width, runs 156° with a north and south, vertical obscure lamination, scarcely altering the reddish coarse Carboniferous conglomerate, which must not be confounded with the flinty conglomerate and older system of dykes on the iron bound coast further west. Pillar rock. Livingstone Cove.

Surface Geology.

The prominent mounds or accumulations of drift materials along Malignant Brook from Maryvale chapel northward, on the Ohio and other rivers, and at Antigonish, have been described by Dr. Honeyman,* who has also given many particulars concerning the flats on the banks of the rivers, the deltas at their confluence, the large tracts of fine arable land in the intervales of Beaver Meadow, South and West Rivers, Right's River, James River, Brierly Brook and the great intervale upon which the town of Antigonish is built. Less attention has naturally, however, been paid to the superficial deposits than to the more interesting and important rocks which underlie. "The geology of this county, and the physical features, or hills, lakes, rivers, uplands and intervales which largely originate from its geology, constitute Antigonish the finest agricultural county in Nova Scotia." Antigonish county.

A section of stratified sand and gravel, resting on drift in a bank on the shore a little to the eastward of Merigomish Harbour, is given by Sir J. W. Dawson.† Merigomish.

On the Canso road east of Guysborough is a great ridge of sand and Guysborough.

* Trans. N. S. Inst. Nat. Sc., Vol. I., p. 118, Vol. III., p. 321, Vol. IV., pp. 75 and 79, and Vol. VI., pp. 315 and 325.

† Acadian Geology, p. 81.

Sand and gravel-ridges and mounds.

gravel known as the Gravel Pit, and near Halfway Cove on the upper side of the road, a deep hole called the Punch Bowl. Banks twenty-five feet high line the road on the southeast side of St. Mary's River between Whidden's ferry and Glenelg; others seventy-five feet high occur at North Loehaber; and about Barney's River, curious knolls or mounds of sand and gravel are numerous, the half barren pasture-land between the river and the shore being also very pebbly. On the railway between Avondale and Piedmont, are great banks of drift gravel; and between

Hogsbacks.

the road at William Murray's and the river, two long hogsbacks. A much more prominent hogsback, crossing the road, runs into the meadow opposite Thomas Leadbetter's at the upper settlement of Barney's River. It is composed of layered sand and gravel, the former used for making mortar; is eighteen feet high on the west side of the road, but flattens out to the eastward. Near the Round Lake of Cole Harbour River, north-west of Port Felix, is another well-defined "whale's back" in a sigmoid curve; it is about half a mile long, runs a little east of north and at the northern end terminates in two branches. It is composed of sand and gravel, rising about fifteen feet or more above the

Conglomerate.

valley on either side, with a cow-path along its narrow top. In Hyde Brook, a branch of Salmon River east of Guysborough, a bright rusty conglomerate, apparently recent and composed of the pebbles of the brook somewhat strongly cemented by yellow ochre, sometimes assumes an indian-red color and may possibly be Lower Carboniferous. A mile and a half east of Sandy Cove, about six feet of rusty and dark conglomerate are seen in a little brook, the rusty cement being apparently accumulated from the sand and gravel, and the dark streaks from vegetable matter. In Delaney Brook, a similar conglomerate, horizontally bedded, contains many fragments of the dark slate found in the brook; and on the shore of Crow Harbour near John Ehler's, and again near the head of tidewater in Halfway Cove Brook, is a conglomerate, probably also derived from drift detritus.

Ice grooves.

The following is a list of the more important observations of glacial striæ in this region, some of which are on finely polished rocks beneath twenty feet or more of sand, gravel and boulders:—

Whitehaven, S. 13° E.; well marked and seen in several places.
Parker Point, S. 4° E.; rocks polished.
Steep Creek, about S. 42° E. or parallel to the Strait.
North Canso, S. 30° E.
Cape George, near the school, S. 50° E.
Greendale, S. 70° W., on rounded, upright faces.
Livingstone Cove, S. 85° W., on sloping, polished faces.
Afton road, south of Wallace Lake, S. 15° E.

Lochaber, S. 7° E., near foot of the lake.

Lynch road, S. 44° W., and another not far distant, S. 58° W.

Upper Black Brook Lake, East River St. Mary's, S. 8° W., on rounded, polished rocks covered by ten feet of gravel at the outlet of the lake.

Large blocks and boulders are seen in many places far removed from the beds from which they have been derived, often isolated on little mounds of sand and gravel. Raised beaches* fringe many of the Guysborough lakes. Tracadie Lake has one, composed of large blocks of sandstone so arranged as to resemble rough masonry, while other parts of the shore are covered with fine rippled sand. Boulders. Raised beaches.

Sand-beaches are numerous on the sea shore as shown on the map. That at the mouth of Pomquet Harbour consists entirely of sand in undulating hills and hollows, nearly barren, but with a few scattered trees and bunches of grass. Great and important changes naturally take place in the position of these easily moved materials. The mounds of the eastern beach of Roy Island, for example, shown on the Admiralty charts, have been levelled, the beach at the west end lengthened, and a patch of lowland at the northwest corner removed. The inner shore of the island is all low and much of it marshy. A breach was made in the bar by the August gale of 1873, but was again closed by the sea within two or three days, and teams cross from this so-called island to the mainland even at high tide. At the base of Colquhoun Point is a beautiful beach for bathing, and there are many others on these shores. From the eastern end of the long beach, a bank of sand fringes the woodland nearly to the entrance of Merigomish Harbour. Sand-beaches. Changes made by the sea. Roy Island.

Springs, often containing various salts in solution, rise from the ground in many parts of this district, particularly where the underlying rocks are of the Carboniferous limestone and gypsum formation. At Taylor's road and on the road from Pomquet Forks are several strong salt springs, near one of which, in the intervale of Pomquet River, is a deposit of bog manganese. At Big Marsh in Hallowell Grant is the spring from which the water came that was analyzed for Sheriff Hill by Mr. Hoffmann.† In the country about Ashdale and Dunmore are many springs. Some of the plaster pits are fed by springs; others derive their supply of water from the surface. One of these pits in the neighbourhood of Ogden Pond is said to contain snow all the year round. Mineral spring. Hallowell Grant. Plaster pits and ponds.

Near the house of Michael Gillis, Dunmore, is a sink-hole, in which, at the time of my visit, the surface of the water was forty feet below the surrounding country, and said to be very deep in the centre. The hole is about one hundred and fifty yards long and seventy-five yards

* Acadian Geology, p. 36.

† Geol. Survey Report for 1885, p. 15 M.

wide, and has water-lines at short intervals round its hopper-shaped basin. On the railway near James River, are other remarkable plaster pits and ponds of considerable size. East of Brierly Brook railway station, on the road to Antigonish is a strong, cold, saline spring, in broken plaster land.

At New Strathglass, a very strong spring gives rise to a branch of James River. It is cold, fit for drinking, and comes probably from an adjacent valley which, except in uncommonly wet weather, is dry.

Another spring below the Marsh settlement, forms a large branch of Middle Barney's River, coming out of the ground at George Cluness' house.

Dunmaglass. A mineral spring, much resorted to, occurs on Donald McEachern's land in the Hollow near Dunmaglass post-office; the water has not been analyzed.

Springs, probably of similar composition and greatly relished by cattle, are found on Barney's River at Avondale and at the mouth of Bear's Brook, oozing from Pre-Carboniferous rocks.

At the bridge near the mouth of Anderson Brook, a small brook deposits yellow ochre, no doubt derived from the sandstone of the neighborhood; and similar ferruginous springs have been already mentioned as occurring in other districts.

Sutherland's River. Immediately below Park's mills in Sutherland's River is a saline spring which deposits yellow ochre. Another occurs in the bed of the river a short distance above the mills. These and the salt springs in the neighborhood of Antigonish will be again referred to.

About one hundred and fifty yards south of the telegraph road, seventy-five yards west of the iron bridge over French River at Glenshee, is a large sink-hole on the west bank of the intervale. Beneath the sod, is a thickness of three or four feet of black mould, composed of roots **Clay and peat.** and leaves; beneath this mould, an indefinite thickness of white clay. Peat bogs are particularly numerous in the rocky country along the Atlantic coast; but no examination has yet been made of the depth and quality of the peat.

Infusorial earth and marl. Deposits of infusorial earth and marl like those found in western Nova Scotia,* occur in many lakes of this region, some of which have been described by Principal McKay, of Pictou.

A little lake on McKay Brook, St. Mary's, has been drained to turn it into hay-land, exposing a bed of shell marl.

Scenery, Climate, Timber, Productions, etc.

Messrs. Jackson and Alger say in the short sketch which accompanies their map of Nova Scotia, published in 1841, that "it possesses some

* Acadian Geology, p. 31.

of the most varied and remarkable scenery in North America,. . . diversified with beautiful lake scenery and picturesque coast views, verdant hills and valleys and many flourishing villages." Scenery.

In Haliburton's History and novels, Gesner's Geology and Industrial Resources of Nova Scotia, Dawson's Acadian Geology, and a host of other books, frequent reference is also made to the scenic attractions of the coasts and mountains of this province.* The southern coast is bleak and barren, with sluggish brooks, lakes and marshes; and is almost uninhabitable, except for the fishing and mining, although there are many excellent harbours affording picturesque views among their numerous islands and bold, rocky headlands. In the northern part, the scenery is more attractive, and we again find the "cool clear rills trickling down the glades;" the views are more picturesque, and the numerous meadows form a pleasant landscape, the land being well irrigated by brooks, and on either side of which it rises in romantic boldness to a considerable height, but seldom approaches to the altitude of mountains. Atlantic coast. Gulf shore.

The coast of Canso, Dover and the islands in the vicinity are wild and romantic, presenting to the ocean rough bold cliffs, mostly granite, the surface being either barren or supporting a few scraggy spruces, cranberries and other low-growing plants. The most northerly of the Cranberry Islands, called the Frying-Pan, is the home of innumerable sea-gulls. Extensive barrens lie between Canso and Tor Bay; but hay-marshes fringe some of the brooks, and small spots of cultivable land are found on the shore. Toward the head of New Harbour, mossy spruce land, interspersed with clumps of birch and maple, occupies the valleys and also some of the hills on which, however, much of the timber is blown down. Canso. Barrens.

The valley of New Harbour River to the head of tidewater, is very beautiful, the hills on either side being high. Above the salt water, it is wide and easy to follow. On Isaac's Harbour River, fine meadows and marshes occupy a narrow belt about the lakes, while higher up, the river flows through a well-wooded valley from which a large quantity of timber for shipbuilding has been obtained, but which is otherwise apparently unproductive. Good hardwood is found between the upper part of this river and Lawlor's Lake, and toward Country Harbour and westward, interspersed with barren tracts, which are also characteristic of the Canso peninsula, as of all the large areas where granite abounds. New and Isaac's Harbour Rivers. Ship-timber.

The scenery of the St. Mary's River at Melrose, is picturesque in its well cultivated meadows and numerous small lakes, enclosed by rough, woody hills. Many of the lakes which empty into this river are rocky and beautiful, bordered with hardwood and evergreens, inside which a Melrose. Lakes.

* Osgood's Maritime Provinces, page 334.

white line of blocks is frequently seen. Where brooks enter, however, the shores are generally low and marshy, and lagoons, difficult to cross, extend far upstream; the lakes are thus easily dammed for lumbering or other purposes, and much of the country, in their vicinity, is liable to be flooded after a heavy rainstorm. A great freshet, on September 12th, 1882, flooded all the mines near Sherbrooke, and for a time converted a great part of Goldenville into a lake.

Rivers. One of the roughest rivers in the country is the picturesque portion of the East River of St. Mary's at Rocky Mountain, where the gorges and high overhanging cliffs present during a freshet a scene of wild and terrifying grandeur.

Picturesque boulder. Sutherland's Brook is a stream of great beauty, with its foaming cascades, its pools, and woody banks. Not far above its mouth, a boulder of conglomerate forms a little island, crowned by a clump of spruces, one of them nine inches in diameter. The conglomerate is like that of Arichat; the cliffs are of gray argillite and quartzites, sometimes finely rippled.

Holy Hill. All the branches of the East River about Holy Hill, on the contrary, wind sluggishly among alders and marshes in half barren land, with little fall and few rock outcrops.

South River Lake and Lochaber are singularly beautiful. Of the latter, the late Honorable Joseph Howe thus speaks in his poem *Acadia:*

> Winding in graceful folds, 'twixt hills that rise
> On either side, the fair Lochaber lies."

McPhee's mill-brook. On the brooks flowing into this lake, and on several branches of South River, scenes of rare beauty are afforded, one of the most remarkable of which is the rocky gorge above the lower dam in McPhee's mill-brook.

Pomquet and Tracadie. The brooks of the well settled districts of Pomquet and Tracadie, are, as a rule, tame and uninteresting, exceptions being found, however, in certain picturesquely rocky portions of the Monastery Brook, and of Tracadie, Pomquet, Black and Afton Rivers.

Ohio Mountains Brooks flow from the Ohio Mountains, where they rise from springs and small marshes, as gentle, often steep, but never dangerous mountain-streams, in whose sheltered gorges ferns are green till the middle of November. The land at the head of St. Joseph Lake is hilly, and broken by limestone and plaster which form pits, ridges and little knolls. Callahan Brook, with its picturesque, rocky walls of red syenite and slate, its falls and deep, narrow gorge has been already described. Many of these brooks and lakes abound in trout, which

Callahan Brook

Trout.

differ greatly in size and color, even in waters no great distance apart, as for example in the two Black Brook lakes, in the uppermost of which the fish are of a fine red color, whereas, in the lower, they are black—a circumstance perhaps due to the color of the shores and bottom which are largely composed of red syenite at the upper lake, but at the lower of black slate.

Antigonish hills and valley.

The Sugar-loaf at Antigonish, and the hills on the Gulf shore, command fine and extensive views of the surrounding country and to seaward. Arisaig Brook, the lower part of Doctor's Brook and its east branch run in deep and beautiful valleys, like some of the Mabou rivers, as shown in Mr. Weston's Arisaig photographs. But there is in the scenery of this district no more striking feature than the Hollow or "Bruin's Highway," a pass or gateway extending along the northern boundary of the Cambro-Silurian rocks from McNeil's Brook to Bailey's Brook, nowhere wide and comparatively level, although the hills, particularly on the south, are high.*

The Hollow.

Marshy Hope.

The scenery of Marshy Hope valley resembles that of certain Cape Breton glens; but the outlines are usually tamer and less attractive. James River, Brierly Brook and other streams of the neighborhood afford wild and beautiful views, like those of Margaree. Brierly Brook flows with two fine falls of ten feet each, through a narrow gorge with high perpendicular walls. The celebrated falls of James River are best seen from above on the left bank, for from below they can be seen only in part. "Green quartzite forms an elevated peak which rises abruptly above the falls. The water flows in great volume over precipitous rocks, and from a height of about one hundred feet, into a capacious basin, the whole forming a scene of impressive grandeur." †

James River falls.

Cave.

A cave, one hundred feet long and six feet wide, in the limestone of McLellan Brook is quaintly described by Gesner.‡ A small stream of pure water runs along the floor, and rude overhanging masses of rock form the walls and roof.

Falls of Sutherland's River.

A succession of fine falls occur in the gorge of Sutherland's River at Park's mills, among cliffs rising to a height of more than fifty feet. The lowest falls over two steps of one and two feet, into a deep, rock-bound pool, while above there are two cascades, aggregating twenty feet, which cut through the rocks in three separate gorges.

Sunnybrae.

"The beautiful valleys and hills which surround the thriving village of Sunnybrae, on the East River of Pictou, render it worthy of its name, and one of the most picturesque spots in Pictou county."

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* Trans. N. S. Inst. Nat. Sc., Vol. IV., pp. 51 and 57.
† Dr. Honeyman in Trans. N. S. Inst. Nat. Sc., Vol. I., p. 110.
‡ Geology of Nova Scotia, p. 135.

Soils.

Reference has been made in this report to the character of the soils yielded by the various underlying rocks, and to their capacity for producing grain and other crops. The land underlain by Pre-Cambrian felsites and schists is generally more or less sterile; that of the Cambro-Silurian districts is hilly and rough, but productive. The Silurian soils are fairly good, but too clayey; the Lower Devonian and Carboniferous conglomerate are often rocky and barren; whilst the

Upper Devonian.

Upper Devonian soils are said to be, in some cases, superior to those of the Carboniferous limestone, the highest red beds being very productive, as shown by the thriving farms at Beauly, Lochaber, South River, Vernal, Marydale and elsewhere.

Carboniferous limestone.

The soil derived from the Carboniferous limestone is rich, loamy and calcareous in the neighborhood of limestone; but the clay-land derived from shales, as at Tracadie and Heatherton, although free from stones, is wet and less productive than the more stony land of the rear. Between Pitcher's Farm and West River, only a few inches of soil cover a shaly rock; consequently the land is bad and in great part still under forest, although comparatively level. Considerable tracts of barren occur on the peninsula north of Antigonish, underlain by Carboniferous conglomerate and associated rocks, but with few other exceptions, all the land in this county is fit for cultivation. But between the East and West Rivers of St. Mary's, nearly all the country underlain by this formation and by Devonian rocks, is irreclaimably

St. Mary's barrens.

barren, dry and rocky, covered with blocks of whitish flinty sandstone and grit. In part, this barrenness is no doubt due to bush fires which have destroyed much valuable timber; but the gray sandstones do not seem to possess the substance necessary for a luxuriant growth of vegetation, so that the injury done by the fire is not repaired, the forest being replaced by shrubs and mosses, or the bare surface of the rock left without even a covering of moss. The mossy spruce- and tamarac-land, the pools and mossy marshes bordered by scraggy spruce, the sluggish brooks, lakes and other uninteresting characteristics of this district have been frequently adverted to.

Wild flowers.

But whether "waste or woodland, hill or plain," the wild flowers are there, hidden away among the trees, making bright the open barrens by their charming variety of color and form, trailing in the streams or rising from the water of marshes and ponds. A pretty little flower the water Lobelia (*Lobelia Dortmanna*)* was found growing in the upper Black Brook Lake; a Purple Fringed-Orchis (*Habenaria fimbriata*), and white water-lilies (*Nymphæa odorata*) are seen in some of the brooks; cranberries abound in the marshy lakes. In Gunn's Lake, the marshland is golden with the fragrant and beautiful little Hood-shaped

* Determined by Professor Macoun.

Bladder-wort (*Utricularia cornuta*), associated with fly-catching plants. The so-called lily of the valley (*Maianthemum Canadense*) is also abundant in moist woods. In the bed of a sluggish brook, flowing from marshes at John Chisholm's, near the head of McPhee's mill-brook, are large numbers of the white water-crowfoot (*Ranunculus aquatilis*, var.) On some of the streams of Antigonish, as for example Graham Brook, the ferns sometimes attain a height of seven or eight feet. Interesting collections of the plants of this region, made by Messrs. Faribault and Robert, have been examined by Professor Macoun.

Seasons. The seasons do not differ materially from those of the country north and east of the Strait of Canso. That of 1886 was very early, the mayflower (*Epigæa*) being in bloom on April 15th, and the white water-lily (*Nymphæa odorata*) on July 10th; whereas the latter was not in flower on Flynn and Gavin Lakes till August 8th in 1884.

Raspberries and blueberries were ripe at Guysborough Intervale on August 8th, 1884, and an extraodinary crop of wild strawberries was ripe at the College on July 10th, 1885, the dewberry having preceded them several days.

Wheat. The crops are similar to those of Cape Breton, the land in the northern part of the mainland being, however, better settled and in a higher state of cultivation. Much interesting and valuable information about the climate, resources, scenery and population is contained in Haliburton's History of Nova Scotia. Wheat ripens on Roy Island, Big Island and along the greater part of the Gulf shore, but not always in the interior. A large quantity of ton timber is shipped to England chiefly from Guysborough Harbour, but the woods of the greater portion of the country are small, and barely supply the local demand for lumber. The animals are the same as in Cape Breton. Moose and bears were once common on the barrens of St. Mary's, the former are now scarce, although still occasionally killed.

Population. The population of Guysborough county is 17,808,* of Scotch, English, Irish, French and German descent, with 900 Africans; 1601 are fishermen, and 1568 farmers, with a floating mining population. Antigonish county has a population of 18,060, of which two-thirds are of Scotch descent, the remainder French, Irish and English chiefly, with a few Africans; 3256 being engaged in farming, 43 in fishing. Of the 35,535 inhabitants of Pictou county, six-sevenths are of Scotch descent, the remainder chiefly English and Irish; farmers, 4806; fishermen, 15; but many of the farmers fish also.

Produce of Guysborough. In Guysborough, the number of acres under cultivation for grain, is 682; for roots, 1,996; for hay, 15,881. The annual yield of wheat is 6,529 bushels; of barley, 4,152: of oats, 42,988; buckwheat, 11,720;

*Census of 1881.

potatoes, 191,259; turnips, 12,016; of other roots, 2,062; and of hay, 20,512 tons. Butter, cheese, wool, cloth, cattle, sheep, pigs, horses, and maple sugar are also produced, but very few apples or other fruits. The value of the fur procured is $1,565. Pine,—square and in logs,—oak, tamarac, birch and maple are exported, and also masts, spars, staves, tan-bark and cordwood. Much ship timber is still taken out of the forests.

Of cod, there are taken 30,943 quintals; 9,369 of hake, haddock, and pollock; of herring, 17,276 barrels; of gaspereaux, 1,293; of mackerel, 13,117; besides halibut, salmon, eels and trout; 13,874 gallons of fish-oil are produced; and 520,405 pounds of canned lobsters.

Antigonish. The number of acres under cultivation in Antigonish is 3,640 for grain; 3,363 for roots; 36,141 for hay. The yield of wheat is 41,687 bushels; 10,811 of barley; 153,675 of oats; 1,244 of peas and beans; 15,228 of buckwheat; potatoes, 319,946; turnips, 26,400; other roots, 1871; 41,164 tons of hay. Butter, cheese, cloth, a little fruit and maple sugar, horses, cattle, sheep, and pigs are also exported. The value of the furs is $356. The same woods are exported as from Guysborough and Pictou, with the exception of tamarac and oak.

Of cod there are taken 2,087 quintals; of hake, haddock and pollock, 815; 999 barrels of herrings; 100 of gaspereaux; 3,684 of mackerel; besides salmon, eels, trout and oysters, and there are 970 gallons of fish oil made.

Pictou. In Pictou county 11,647 acres are under cultivation for grain; for roots, 4,182; for hay, 39,913. The yield of wheat is 114,741 bushels; of barley, 14,459; oats, 345,591; buckwheat, 29,059; peas and beans, 2,362; potatoes, 486,444; turnips, 71,775; other roots, 5,086: hay, 45,715 tons. Butter, cheese, cloth, wool, cattle, sheep, pigs, and horses are also exported; apples, grapes, plums and other fruits grown in large quantity. The furs are valued at $657. The woods exported are the same as those from Antigonish.

Pictou county furnishes the market with 1,440 quintals of cod; 16 of haddock, etc., 1,287 barrels of herring; 109 of gaspereaux; 398 of mackerel, together with salmon, shad, eels and trout; 196 barrels of oysters; 524 gallons of fish-oil and 394,300 pounds of canned lobsters.

Economic Minerals.

The occurrence of various useful minerals and metallic ores has been already referred to, and will be more fully discussed in the following pages. These minerals are well illustrated by the collections in the museum of the Geological Survey at Ottawa, and in the provincial museum at Halifax.

Coal.—The small pipes and seams of coal in the sandstones of the East and West Rivers of St. Mary's, at French River, South River and elsewhere, are of no economic value, and need not be enumerated; nor will the vain search for coal at various points, as at Kerrowgare and Arisaig, in black Silurian slates, be again referred to. Coal.

The discovery of a seam of coal, eight inches thick, at Pomquet Harbour, and of pieces of coal and the remains of vegetables on the North River of Antigonish, was noticed by Gesner* in 1836; and Haliburton adds, that limestone is found about a mile to the westward of the former. Of late years, several pits have been sunk at Peter Dion's, where the coal dips N. 24° W. $< 20°$, associated with crumbly gray sandstone and greenish and gray argillaceous shale, and underlain by underclay full of *Stigmaria.* The coal seen in pieces on the shore, is in part bright and good, but in part very pyritous. A boring in the water not far from the bank, is said to have cut: rock, 5 feet; coal, 2 feet; resting on rock not bored. Pomquet.

No seams of workable coal appear to have been found on the peninsula north of Antigonish, the black shales there exposed having apparently been mistaken for coal,† into which they pass at several points; but from many of the openings not a trace of good coal has been obtained. Hallowell Grant

Mr. Campbell ‡ has clearly shown that these oil coals and shales underlie the Carboniferous limestone at Big Marsh; he divides them into two groups, the lower seventy or eighty feet in thickness, including twenty feet of good oil shale, five feet of which are curly cannel, rich in oil; the upper, 150 feet thick, in immediate contact with the limestone, containing a large percentage of oil. The pits dug in search of coal in and about Big Marsh, are shown on the map. The black shales are associated with light-gray micaceous shale and sandstone, full of impressions of broken plants. In the report of the Commissioner of Mines for 1868, page 21, a return is made of $682.50 expenditure for preparatory work in driving a tunnel into the face of a hill for the purpose of cutting the seam of coal. An additional expenditure is returned of $590 next year, but the presence of faults near the crop of the seam is said to have impeded progress. In 1870 considerable difficulty is said again to have been experienced in consequence of the disturbed state of the strata, a series of faults having thrown the seam out of its regular position, and necessitated much extra work in drifting.§ At two of the pits, on the Beaver road, a black, very bituminous shale passes into gray, rusty, crumbly shale, glistening with mica and containing obscure plants. Coal has Coal below the Carboniferous limestone.

* Geology of Nova Scotia, p. 142.
† Acadian Geology, p. 349; Trans. N. S. Nat. Sc., Vol. VI., p. 70; Gilpin's Mines of Nova Scotia, p. 14.
‡ How's Mineralogy, pp. 28 and 34.
§ Rutherford's Report.

Ogden Pond. also been sought in the black, bituminous, carbonaceous shale near Ogden Pond. On Graham Brook, pits have been dug in a coaly crumbling rock with steel-gray, nodular, ferruginous, argillaceous shale, which contains plants, and which is associated with conglomerate, and underlies a gray limestone. On Huggan mill-brook, near

Piedmont. Cumming's furniture factory, at Piedmont, several pits have been dug in search of coal, in gray and greenish-gray shaly sandstone, of Millstone Grit age, full of carbonized plants and associated with reddish-gray striped sandstone, which has been quarried for building. Streaks of coal, six inches in thickness, found, it is said, in these rocks, seem to be only carbonized tree trunks.

Lower South River. The so-called coal mine of Lower South River is described on page 82 P; and the Permian coal seam of Big Island, on page 95 P. The borings

Merigomish. made some years ago in the small seams of East River, north of the Pictou coal-field are described by Mr. Henry Poole.* In the report of the Commissioner of Mines for 1873, page 15, it is stated that a bore-

Pictou Harbour hole was put down 500 feet at Sutherland's Point, north of New Glasgow, which reached shales very similar in appearance to those of the coal-bearing basin to the south but which were more probably those of Mr. Poole's section. In 1874, the bore-hole was extended to a depth of 734 feet, when mottled marls were struck. Another boring, 534 feet deep was made at Hardwood Hill, the measures passed through being fire-clay and freestone.

Antigonish. *Vivianite.*—This beautiful blue phosphate of iron is reported by Professor How† in small quantity near the surface at Antigonish.‡

Bog Iron Ore.—Bog ores are found in several places in small quantity. A specimen from Antigonish county analyzed by Dr. How,§ contained "45 per cent. metallic iron with 18.30 water, about 7 of clay, 5 per cent. organic matter, and a decided but not unusually large amount of

French River. phosphoric acid." A specimen from a small deposit near French River yielded to Mr. Gilpin || 46.56 per cent. metallic iron, 11.60 water; manganese 5.89, clay 15.43, with traces of sulphur and phosphoric acid.

Clay-Ironstone. Beds of clay-ironstone, from six inches to four feet in thickness, are noticed by Mr. Gilpin¶ as numerous among the Carboniferous strata of French River; and an analysis of one of them gave: metallic iron, 25.16 per cent., clay 61.52 per cent. and traces of

Polson's Lake. sulphur and phosphoric acid. The spathic ores of Polson's Lake, are

* Trans. N. S. Inst. Nat. Sc., Vol. I., p. 36.
† Mineralogy of Nova Scotia, p. 109.
‡ Trans. N. S. Inst. Nat. Sc., Vol. VI., p. 325.
§ Mineralogy of Nova Scotia, p. 102.
|| Nova Scotia Mines. p 64.
¶ Nova Scotia Mines, p. 64.

described at page 119, that of Sutherland's River in the Geological Survey Reports for 1866-69, p. 441, and for 1873-74, p. 238. Sutherland's River.

Brown Hæmatite.—An analysis of a specimen of ore from Lochaber, collected by Dr. Honeyman, yielded* nearly 48 per cent. metallic iron, water 11.12, sesquioxide of manganese 4.73; siliceous gangue 13.86, and traces of phosphoric acid, lime and magnesia. Carbonate of iron, micaceous iron ore and copper ore are stated by Dr. Honeyman to be also widely but thinly distributed among the Devonian Slates, from which this specimen was obtained. Lochaber.

The iron ores of the East River of Pictou have been described by Gesner,† Dawson,‡ How,‖ Hartley,§ Honeyman,¶ Poole,** Gilpin,†† Harrington,‡‡ and others, but will not be here referred to, since the region in which they occur has not yet been thoroughly examined. East River of Pictou.

Red Hæmatite and Specular Ore.—The wide range and distribution of these valuable ores of iron in the counties of Guysborough, Antigonish and Pictou, in beds, veins, strings, blotches, films, and specks, in all the rocks from the highest to the lowest, has been frequently pointed out. Some of the outcrops would seem to indicate the presence of large bodies of ore, but none of them are now vigorously worked.

At Bigsby Head, east of Guysborough, a vein of specular ore runs 244° among trap and purplish felsite. Guysborough.

A most promising deposit of specular iron has been worked near Erinville by the Crane Iron Company, of Philadelphia, under the management of Mr. T. M. Williams, of Mine Hill, New Jersey, to whom I am indebted for many of the following particulars:—To test the ore, a shaft was sunk fifty feet, from the bottom of which a drift was extended twenty-five feet through the ore to a wall. Another tunnel was driven sixty feet north-east in the ore, and a third south-east thirty-five feet, also in hæmatite; while in an open cutting, another band was found to extend twelve feet in a south-easterly direction. On the top of the back or ten feet vein, are masses of quartz, full of long, narrow crystals, crystalline fragments of the ore, and a little iron Erinville.

* How's Mineralogy of Nova Scotia, p. 99.

† Geology and Mineralogy of Nova Scotia, p. 59; Industrial Resources of Nova Scotia, p. 258.

‡ Acadian Geology, p. 591; Supplement, p. 94; Canadian Naturalist, Vol. VII., p. 137, and Vol. IX., No. 6; Report of the Pictou Coal and Iron Co., 1875; Report of the American Association, 1879.

‖ Mineralogy of Nova Scotia, p. 97.

§ Geol. Survey Report for 1866-69, p. 182.

¶ Trans. N. S. Inst. Nat. Sc., Vol. II., Part 4, p. 67; Vol. III., p. 171; Vol. V., p. 204.

** Reports of Commissioner of Mines for 1872, p. 36; for 1874, p. 49; 1875, p. 61; 1876, p. 57; and 1877, p. 43.

†† Nova Scotia Mines, p. 64.

‡‡ Geol. Survey Report for 1873-74, pp. 214, 223, 229, and 259.

pyrites. Other openings have been made about one hundred yards, 232° from the main shaft, in all of which more or less ore was cut. The walls of the veins seem to be in every case composed of greenish, dioritic, felspathic, trappean and brecciated rock; but, at the time of my visit, Sept. 30th, 1882, they were not well exposed, and no work has been done since. About three thousand tons had been extracted at a cost of fifty cents per ton, the cost of hauling to a shipping place at Guysborough being $1.50, and the price at the time $7 to $8 per ton in the American market, where it was used for lining puddling furnaces.

At another opening, on Thomas Kent's claim, about a mile to the westward, specular ore has been found in wedges and veins, brecciated with cream-white claystone and quartz, in blotches and veins, with crystals of pyrites, in two pits not far apart, near one of which is a strong, ferruginous spring. A vein, six or eight inches thick, occurs in compact, greenish-gray soft rock, probably an altered argillite, but without apparent bedding. In the neighborhood are great outcrops of dark-gray trap in contact with conglomerate, the ore being scattered through all these rocks.

Guysborough River.

In Guysborough River, immediately east of Mink and Atwater Brooks, is another deposit of specular iron, which has been mined in a flinty, quartzo-felspathic rock, containing large crystals of calcspar. The ore forms a sort of breccia with a ferruginous calcspar, and is also veined with it, being itself a vein six feet wide, which runs 65°, but is not well exposed. Some parts contain a large percentage of iron pyrites, and very little of it is quite free from this impurity. No undoubted volcanic rock is seen, the grayish-white claystone being probably a mixture from the vein.

Giant Lake.

Iron ore is said to have been found at Angus McIsaac's, Giant Lake, but nothing is yet known about it.

South River.

Near South River and Vernal, the Devonian slates and sandstones contain traces of specular iron ore. In a pit west of the Vernal road, the quartz-veins, which penetrate a flinty quartzite, are associated with veins of ore, seldom exceeding a quarter of an inch in thickness, but very numerous, reticulating in the cracks of the quartzite, sometimes without the quartz.

Caledonia Mills

At Duncan McDonald's, Caledonia Mills, a shaft was sunk through compact sandstone, spotted with a considerable quantity of iron ore, which is also present as films in the joints, and associated with a breccia composed of specular iron, red hæmatite and spots of felsite.

South River Lake.

In a small brook on the west side of South River Lake, dark-gray, coherent, argillaceous sandstone is cut by a vein of quartz, six inches thick, holding half specular iron. It runs 4° and is traceable for some distance in the bedding. Other small and unimportant deposits of this neighborhood and Lochaber are indicated on the map.

In a small brook which flows from the back settlement of Arisaig to the confluence of the east and west branches of Doctor's Brook at John and Andrew McDonald's, red hæmatite, six feet thick in a north and south direction, shows itself in the bank among outcrops of fragmentary rocks and slates; but whether as a vein or bed was not determined. The ore is in part excellent, but somewhat variable in composition. About fifty yards upstream from this outrop is another, said to be twelve feet thick, and smaller bands are stated to occur lower down. Other important deposits have been discovered between the back settlement and Doctor's Brook: one of these shows eight feet of good, coarsely oolitic hæmatite in a light-colored siliceous rock; another, six feet of ore among red slates. The numerous similar deposits of this neighborhood, perhaps, owe their origin to the proximity of syenite, diorite, and other igneous rocks.* On the new road from Doctor's Brook to Pleasant Valley, below the bridge on the brook, a band of rock, six feet wide, in a north and south direction is strongly impregnated with and passes into pure hæmatite. Near this and, perhaps, continuous with it, is the so-called twenty-four feet bed, in a greenish flinty sandstone. Measured from north to south, the breadth of ore-bearing rock is forty-one feet, the more northerly small vein being, however, separated from the other by about twelve feet of greenish-gray, banded, flinty quartzite, dipping 331° < 63°, in layers one to eighteen inches thick, and in the thick bed are several of these bands, more or less lenticular, and, therefore, differing in thickness in different parts of the cutting. At one point, the hæmatite is said to have measured twenty-four feet of solid ore; but where best seen, the thickest layer does not exceed six feet, while to the eastward, all, except this and an eighteen inch band near it, may be said to be quite cut out or replaced by quartzite. The ore is oolitic and good, like that found elsewhere in the neighborhood; near it are reddish and mottled fragmentary rocks diorite, with veins of epidote, red concretionary, hæmatitic slate, and other similar strata.

Doctor's Brook.

To the north-westward, a shaft twenty-five feet deep was sunk, some years ago, in trap showing traces of specular iron. In the small brook, which crosses the shore road east of McNeil's Brook, are two large outcrops of red hæmatite, about eighty-eight yards apart. The upper one shows about ten feet of pure hæmatite; the lower 15 feet, with "horses" of greenish flinty rock.

McNeil's Brook

Immediately west of McNeil's Brook, near Angus Campbell's, is a bed of oolitic hæmatite, three feet wide, opened for twelve feet east and west, and separated by about forty-five feet of Cambro-Silurian slate, from another large indefinite band to the northward.

*Trans. N. S. Inst. Nat. Sc., Vol. IV., p.. 53.

Gulf road. West of the Gulf road, on the line between Angus McGillivray (Andrew's son) and Ranald McDonald, is an outcrop of fine red hæmatite, six feet thick in an east and west direction. Greenish diorite is in the vicinity, and the detritus indicates also the proximity of rusty-weathering, soft Cambro-Silurian slate.

Arisaig. The bed of hæmatite interstratified with the Silurian rocks of Arisaig is described at pages 44 and 48 P. It is probably that of which an analysis is given by Mr. Poole,* containing 52.34 per cent. metallic iron.

The Webster iron ore is a very siliceous, red hæmatite of varying richness, apparently a contact deposit between Silurian and Cambro-Silurian strata, like the Lower Carboniferous ores of Cape Breton.

Marshy Hope. At Marshy Hope, a small quantity of specular iron is found in connection with trap and Cambro-Silurian rocks, on the north side of and close to the railway, west of the Bear's Brook.

Avondale. Nearly opposite the post-office at Avondale is a red siliceous rock, not actually seen in place, but evidently underlying, which passes into an iron ore, apparently not rich enough to pay for working. It may indicate a patch of Devonian rock here, but is perhaps Lower Carboniferous.

French River. On the slope of a hill on the west side of a tributary of the East branch of French River that crosses William Irving's land twenty-eight chains south of the telegraph road, two miles west of Kenzieville, (Barney's River) is an outcrop of iron ore that may prove of importance. It lies at the contact of the Medina and Cambro-Silurian strata, and seems to be a mixture of trap and grit, passing in places into oolitic hæmatite of fair quality.

Bog Manganese.—The earthy and bog ores of manganese, largely used for paints, are found in small quantity as nodules and earthy beds in the soil in many places, as, for example, on the road to Goshen from the foot of Lochaber; on the telegraph road near Afton, where porous, rusty-weathering rock occurs in a swamp and stinking-pool; in Pomquet River, below John Chisholm's house; in Sutherland's Brook, immediately above the East River of St. Mary's; and on the hill south of the railway, west of Piedmont station.

Pyrolusite.—Large pieces of this ore of manganese are said to be found in the drift on the hill, four hundred yards south-east of Callahan's house, near the head of the Ohio settlement. It is also found, associated with iron ore, at the East River of Pictou.*

Copper Ore.—Ores of copper are widely diffused among all the geological formations in this region, but although large sums of money

* Report of Commissioner of Mines for 1876, p. 60.
† Gesner's Geology, p. 63; Geol. Survey Report for 1873-74, p. 230.

have been spent in developing some of the more promising deposits, none of these have yet realized the expectations of the explorers.

The occurrence of copper pyrites in specks in dark slate, associated with the trap and syenite of McAllister's Brook, near Guysborough, was pointed out on page 53 P. In the northwest branch of Salmon River,* about a mile above Erinville, an indefinite quartz-vein was mined twenty or more years ago for copper. A tunnel was driven a few feet into the west bank of the river, and a shaft sunk forty feet to meet it; but the vein was not cut in the shaft. It contains copper and iron pyrites and is associated with bluish-gray very coherent slates. A minute quantity of copper ore occurs in the flinty Devonian quartzite of the Mink Brook, a tributary of the Guysborough River.

McAllister's Brook.

Erinville.

Mink Brook.

On Polson's or Copper Lake, east of Lochaber, fragments of copper and iron pyrites, sometimes three to five feet in diameter, in an impure brown hæmatite, are found in the surface gravel,† derived from veins near the junction of Devonian and igneous rocks. "Spasmodic efforts were for nearly forty years made to find the vein from which the boulders came. . . . At last, in 1875, a vein containing copper pyrites was discovered,"§ six feet wide, dipping north with the containing slates, and consisting chiefly of spathose ore, spotted with copper pyrites. In 1876 this vein was opened by a shaft twenty-five feet deep, "the mineral matter at the point opened being chiefly spathic iron ore, yielding 35.5 per cent. of metallic iron; it is spotted with iron pyrites. In 1879 two shafts were sunk about sixty feet, but work was then suspended. At a distance of one hundred and fifty feet along the vein, where the cover is reduced from twenty to five feet in thickness, another opening was made, and the width of the vein there determined to be eleven feet. The percentage of copper ore is said to have also largely increased." Fragments of the associated Devonian dark slates are enclosed in the vein-stone, and in places a crystalline rock is attached to a breccia and quartz occasionally mixed with the spathic iron. The land rises steeply from the road to the mine, and near the road, traces of specular iron have been found in spathose veins traversing greenish-gray and purplish argillite.

Polson's Lake.

Two specimens of ore from this mine were examined by Dr. Harrington.‖ The first taken from a considerable depth was found to consist of a mixture of copper pyrites, spathic iron ore and a little iron pyrites, containing 11.70 per cent. of copper, but no silver. "The spathic iron ore is pale brownish-gray in color, coarsely crystalline,

* How's Mineralogy of Nova Scotia, page 72.

† How's Mineralogy of Nova Scotia, p. 67; Dawson's Acadian Geology, p. 592; Supplement, p. 95; Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 77.

§ Poole, Report of Commissioner of Mines for Nova Scotia for 1875, p. 64, and for 1876, p. 62.

‖ Geol. Survey Report for 1876-77, p. 476.

and has a specific gravity of 3.61. It was found to contain 73.68 per cent. of carbonate of iron, or 35.573 per cent. of metallic iron."

"The second specimen was from the surface, and consisted of copper pyrites, pale iron pyrites, hydrated peroxide of iron, and some rock matter. It was found to contain 5.67 per cent. of copper." Further particulars concerning this mine, and that on the west side of Lochaber, will be found at pages 59 and 102 P.

Lochaber.

On the College lands, about two miles west of the foot of Lochaber, a shaft, said to be 85 feet deep, was sunk in 1876 in greenish epidotic, serpentinous diorite traversed by veins of quartz in which, as well as in joints in the diorite, occur large blotches of specular iron and copper pyrites.

Iron pyrites is sparingly present, and spathic iron is mixed with quartz as the vein-stone in one or two places. Some of the blocks from the veins are three feet thick, of quartz and diorite mixed; in them are vugs containing long crystals of quartz and beautiful leafy aggregations of specular ore. In many of the neighboring pits, purple Devonian argillite has been cut. The relations of the various rocks could not be made out at the time of my visit, work having been long suspended at the mines; but Mr. Gilpin* states that: "the deposits form a series of veins, cutting at oblique angles black and red shales and quartzites, and thrown for a short distance 30° out of an east and west course by a dyke, apparently containing talc and serpentine.

"The first vein met going east is about two feet wide. I have no details of its contents. The second vein, twenty feet distant, has been proved to a depth of eighty-five feet; it varies in width from five feet six inches to six feet three inches, and holds about 20 per cent. of copper pyrites, evenly distributed in talcose slate, greenstone and quartz, and micaceous iron ore. The third vein, 216 feet distant, is from one foot six inches to two feet wide, and holds copper pyrites, with erubescite in bands, with quartz and talcose greenstone. The fourth vein, 130 feet distant, is about five feet wide, and carries about 10 per cent. of rich ore, with much quartz. The fifth and sixth veins are respectively fifty and one hundred and fifty feet further east; they are about each three feet wide. . . . In these last, the micaceous ore has been to some extent replaced by carbonate of iron. . . . The sixth vein is gradually returning to its east and west course; and, at a further distance of three hundred yards, it has been opened again and proved to be four feet six inches wide; and, nearly half a mile to the east, on the strike of the vein, two small veins have been found, holding very good ore, and large boulders, proving the passage of the larger veins."

*Nova Scotia Mines, p. 78, and Quarterly Journal Geol. Soc., Vol. XXXIII., p. 751.

"The quality of the Lochaber ore is unusually good; the chief variety met is copper pyrites, with a small admixture of carbonate of copper and erubescite. An average of the large veins, gave on analysis by Dr. How, of Windsor:

Metallic copper	19.21
Metallic iron	25.31
Sulphur	22.65
Carbonate of lime	5.15
Oxygen, etc.	4.67
Gangue	23.01
	100.00

An analysis of the pyrites from the second vein gave the writer:

Copper	29.00
Iron	29 70
Sulphur	31.50
Silica	3.40
Moisture	.20
Carbonate of iron	6.20
	100.00

"A sample from the third vein gave, at Swansea, 31.25 of metallic copper."

"An assay of seven cwt., at Swansea, gave 19.87 per cent. of copper."* In 1877† forty tons of ore were collected from the pits "and from the level, driven on the three parallel narrow breaks called the fourth vein above. The breaks carry small bunches of solid ore, and were driven on in hopes of striking a main vein. On the brook side, half a mile away, a tunnel driven into the hill cut a small vein, showing copper ore, and a large vein, composed chiefly of spathic iron ore, similar to the vein in which copper pyrites has lately been found in quantity at Polson's Lake."

The copper ore in the Lower Carboniferous rocks of Pomquet Forks is described on page 82 P of this report; that of Knoydart Brook at page 85 P. The latter was mined in 1884 by Mr. Hartley, of New Glasgow, and is said to contain traces of silver and gold. Pomquet Forks. Knoydart.

At Brierly Brook, on the Ohio River, and near Beaver Meadows, the ore found at the contact of the Carboniferous limestone and conglomerate has been mined to a small extent at various times, during the last twenty years, good specimens of yellow and purple copper pyrites being obtained at many points.§ The position of the principal pits is Brierly Brook and Ohio.

* Poole, Report of Commr. of Mines for 1876, p. 62.
† Report of Commr. of Mines, p. 48.
§ Geol. Survey Reports for 1876-77, p. 450; and for 1882-83-84, p. 94 H.

marked on the map. Near the head of the Ohio settlement, several openings have been made in the felsites which underlie the Carboniferous limestone. The principal of these is in a finely mottled felsite-breccia, with a broken, softer portion, containing large blotches of broadly crystalline calcspar, mixed with streaks of yellow and gray copper ore, blende and galena. The rock has no regular strike or jointing, but is greatly broken, and the whole of the vein and ore materials may have been infiltrated after the containing rocks were fractured. The ore yields* 1,120 lbs. of copper, 6⅔ dwts. of gold, and 3 oz. of silver to the ton.

Arisaig. Behind and to the westward of Arisaig chapel, and also at the pier, several openings have been made on very small irregular veins, in which specks of iron and copper pyrites and galena were observed.

Garden of Eden. In the mill-brook that crosses the St. Mary's road above Eden Lake, an excavation was made some years ago, about 110 yards above the bridge, in an irregular vein of calcspar, five feet thick, containing specks of copper pyrites. On the east side were soft, shaly, fragmental rocks; on the west, a little pearly mica schist and greenish mixed argillite, perhaps also veinstone. Higher up the brook, are cliffs of fragmental rock, succeeded by greenish soft Middle Cambro-Silurian argillite. Other similar deposits are stated by Mr. Gilpin* to occur in the neighborhood.

Galena—The occurrence in the Carboniferous limestone of specks and crystals of galena, of no economic value, is so common as to attract little attention, although it has sometimes led to the unprofitable expenditure of money in the hope that these traces might lead to richer deposits. "Fragments of *Calamites*, with the tissue infiltrated with galena and iron pyrites, are found on the outcropping of a sand-
Arisaig. stone bed near Arisaig."‡ Lead ore is said to occur also in Salmon
Salmon River. River near Guysborough.‖

Gold.—The gold mines of the Atlantic coast will be found described in Mr. Faribault's report. Search has been made among the hills, to the northward, for the precious metals, as in Right's River, North River, Bailey's Brook, Georgeville, South River, Malignant Cove and many other places, but without success.

Limestone.—The numerous quarries from which limestone for burning and building has been obtained in the Lower Carboniferous basins

* Gilpin, Report of Commr. of Mines for 1884, p. 23, and for 1885, p. 34.
† Mines of Nova Scotia, page 78.
‡ Poole, Report of Commissioner of Mines for 1873, p. 35.
‖ Gesner's Geology, p. 64.

are shown on the map, and many of them, as at Brierly Brook, Dunmore, Ashdale, St. Andrew's, and other places, have been incidentally described in the course of this report (pp. 79 P *et seq.*). The gray limestone of the monastery at Tracadie has been largely quarried for both these purposes. Near Black River it contains veins of white calcspar, with ferruginous streaks and crystals of purple fluorspar. In Limestone Brook, at Fraser's Mills, in contact with red Devonian slates, is a light and dark-gray limestone, of good quality, like that of Blue Cape, which has been quarried for seventy years. Veins of calcspar, spotted with fluorspar, are so numerous as to form a mottled breccia, with which a little conglomerate is sometimes mixed. The limestone follows the brook on the strike in high cliffs and knolls. The dark bluish-gray, strongly bituminous Carboniferous limestone of upper Ohio, can easily be traced along its contact with the felsites. It is covered with soft, rich, black mould, is always greatly fissured, and brooks sometimes run into the fissures and are lost. The blacker portions are broadly crystalline.

Tracadie monastery. Fluorspar. Caves.

An analysis of a sample from a bed of limestone, " 15 feet thick, which is extensively quarried at Springville to supply lime for the local demand yielded:—*

East River of Pictou.

Carbonate of lime	96.26
Carbonate of magnesia	2.33
Oxide of manganese	.55
Oxide of iron	.57
Alumina	.10
Sulphur	.02
Phosphoric acid	.03
Silica	1.99
Moisture	.17
	102.02

Gypsum.—The immense beds of white, gray, red and variegated gypsum, associated with the Carboniferous limestone at Antigonish Harbour, and other places, have been already noticed. Formerly it was shipped from Antigonish to other Canadian ports, the shipments in 1877 being 703 tons, but of late years none has been exported.† The compact, white variety, called alabaster, and the transparent pure variety called selenite are abundant.

Alabaster and selenite.

Phosphate of Lime.—The black phosphatic nodules, so abundant in the Silurian rocks of Arisaig, have been described by Mr. Weston‡ but are of no economic value.

Phosphatic nodules.

* Poole, Report of Commissioner of Mines for 1875, p. 69.

† How's Mineralogy, p. 136; Gilpin's Nova Scotia Mines, p. 93; Acadian Geology, p. 347; Trans. N. S. Inst. Nat. Sc., Vol. IV., p. 72.

‡ Geol. Survey Report for 1876-77, p. 434.

Antigonish.

Salt.—Salt springs and ponds are found everywhere in the neighborhood of the gypsum, as at Pomquet, and South Rivers, Brierly Brook, Addington Forks, and other places. Salt was made many years ago from the salt pond near the town of Antigonish. In May, 1866, a company called the Nova Scotia Salt Works and Exploration Company, was incorporated under the management of Mr. Josiah Deacon, to conduct boring operations to discover the source of the brine.* The first boring was sunk on Town Point, near the mouth of the harbour, a six-inch borehole, lined with iron tubing, being driven through a considerable thickness of soil and clay, then through a thick band of gypsum into sandstones, without finding any indication of brine; so that further operations in this locality were abandoned.

Encouraged by indications of salt water and salt on the surface, where the railway station now stands, a second borehole was put down here; and a nine-inch cast-iron pipe sunk through sixteen feet of gravel, full of weak surface brine. The auger then passed through red, blue and brown marl, with thin bands of fibrous gypsum; then through several layers of magnesian sandstone, striking a bed of gypsum 141 feet from the surface.

After penetrating 18 feet into the gypsum, there was a flow of pure, strong, limpid brine from a cleft, which flowed nearly to the surface, could only be lowered a few feet by pumping, and discharged a large volume of sulphuretted hydrogen gas. A steam engine was "erected for pumping, and furnaces, tanks and evaporating pans of large dimensions, constructed for the production of salt. After the manufacture of a considerable quantity of salt, the strength of the brine became very much reduced." Another borehole was accordingly put through "clays to a depth of 650 feet, but finding no indications of brine, that of the other boring being too weak for use, and the working capital exhausted, the work was abandoned."

Hallowell Grant.

St. Andrew's.

Sutherland's River.

Mineral Springs.—Mr. Adams' analysis of the water from the spring at Big Marsh, Hallowell Grant is given in the Geol. Survey Report for 1885, page 15 M. Near St. Andrew's, in the neighborhood of outcrops of bluish-gray massive limestone and gypsum, is the "rotten spring," of blackish mineral water, resorted to by rheumatics and other invalids. The water from the brine spring in Sutherland's River, above Parks mills,† is also highly esteemed for a variety of diseases.

Tracadie.

Clays, fit for the manufacture of bricks, occur at many localities. At the Tracadie monastery, bricks of good quality have been made for local

* Gesner's Geology, page 92; How's Mineralogy of Nova Scotia, p. 145; Trans. Nat. So,. Vol. IV., p. 74; Acadian Geology, p. 350; Report of Commissioner of Mines for 1874, p. 58.
† How's Mineralogy, p. 144.

use. Several brick-yards are in active operation near Antigonish, and also about three miles from the town on the Sherbrooke post road, and in the intervale of West River. On the right bank of South River, a short distance above McEachern's bridge, near St. Andrew's, is a large quantity of rusty-white clay, which would make good bricks. Higher up South River in a small brook from the eastward at Cummings' bridge, a red, oily, fine clay is used for paint; and higher still, a white similar paint-clay. Antigonish. Paint.

On the road between the Avondale post-office and school, about 150 yards west of the main road, is a seam of bright-red, heavy clay, resembling putty, used for paint; and a short distance northward, a thin band of tough, blue clay. The brick-clay of the Middle River of Pictou has already been mentioned. Avondale. Middle River.

The annual make of brick in Nova Scotia was estimated by Mr. Gilpin, at 10,000,000 for 1879; and the selling price in Halifax at $8.00 per 1000. In 1850, How gives 2,845,000, and in 1860, 7,659,000, as the annual production. Pictou coal-field.

Fireclay.— "40,000 bricks were made in 1879,* from a bed of fire-clay, four feet thick, overlying the McGregor seam. The clay was considered by Mr. Jammo, at that time manager of the Londonderry iron mines, to be the best plastic clay he had ever used for lining blast and puddling furnaces. "According to Mr. Haliburton, the clays of this district have been pronounced by parties in Staffordshire unsurpassed by any in England."†

Building Stones.—The use of the various bands of Carboniferous limestone and sandstone and of Permian sandstone for building purposes, has been before referred to. Some of the sandstones of the West River of St. Mary's, below Wallace bridge, are suitable for flags and grindstones. St. Mary's.

In the Monastery Brook, Tracadie, a flaggy micaceous, Lower Carboniferous sandstone has been quarried for local use; and near Monk's Head and other localities, rough building stone has also been obtained from the same formation. A gray sandstone, quarried at Heatherton, was used principally in the construction of railway culverts and bridges. In certain localities, as at Ogden Brook, the rough gray sandstone, associated with Carboniferous conglomerate has also been quarried for local use. In Barney's and French Rivers, freestone and grindstone have been obtained from the Millstone Grit. But by far the largest part of the stone exported comes from the quarries between Pictou Harbour and Big Island, Merigomish. The yield from these quarries in 1877, was 1500 tons, valued at $7,500. In 1885, Antigonish exported thirty-six tons of building-stone, valued at $144. Tracadie. Heatherton. Barney's and French Rivers. Pictou Harbour Merigomish and Antigonish

* Report of Commissioner of Mines, p. 15.
† How's Mineralogy, p. 167.

Merigomish. *Grindstones.*—In addition to excellent building stone, the quarries last mentioned furnish a large quantity of grindstones. The yield of the Merigomish quarries in 1877 was 382 tons, valued at $4,764. They are nearly all situated in the Permian area, and the principal quarries, already described, are on Pictou Harbour, McKenzie Point, Roaring Bull Point, Quarry Island, Big and Roy Islands. Many interesting particulars concerning these quarries are given in the catalogue of the Indian and Colonial Exhibition, and also in the report by Mr. Coste on the Mining Industries of the Dominion, Part S.

Scythe-stones.—On the point of Big Island west of Smashem Head, a reddish, hard, shaly sandstone has been locally used for sharpening scythes and for other similar purposes, for which it is said to be well adapted.

South River. *Marble.*—The crystalline limestone of Hattie's millstream on the west side of South River Lake, may be from a large, homogeneous vein. It is white, finely crystalline, pure and good, like the finer varieties of Marble Mountain and George River.* The mixed, impure crystalline limestone of Livingstone Brook, is probably a vein. The Georgeville. large mass of the shore at Georgeville is described on page 8 P.

East River of Pictou. Professor How† describes a greenish colored marble from the East River of Pictou, and a gray, patterned, concretionary variety from Fraser's Mountain. Fraser's Mountain, which exhibits in a polished specimen "concentric waved bands in separate sets whose outlines somewhat resemble expanded flowers, . . . it would make fine inlaid work." The quantity is said to be considerable, but not all equally beautiful. The so-called Brown's Mountain. marble worked on Brown's Mountain, is a gray and reddish, pink-weathering grit and syenite, jointed and full of quartz-veins.

Syenite, Porphyry, etc.—Many varieties of these rocks fit for ornamental work have been met with, but none utilized.

Barytes.—This mineral is frequently found in association with veins of calcspar in Carboniferous limestone, as at Hallowell Grant; it is‡ mixed with red oxide of iron at Frenchman's Barn, and accompanies the iron ores of the East River of Pictou, in small tabular plates.§

Graphite.—Several pits have been sunk on Salmon River, above the Tor Bay road near Guysborough, in a black shale, probably Devonian, and near the contact of the gold-bearing series, which contains a considerable quantity of graphite.

* Geol. Survey Reports for 1875-76, p. 382: for 1876-77, p. 456: and for 1877-78, p. 30 P.
† Mineralogy of Nova Scotia, p. 158.
‡ Trans. N. S. Inst. Nat. Sc. Vol. III., p. 233; How's Mineralogy, p. 161.
§ Gesner's Mineralogy, page 63.

Infusorial Earth.—"Many of the lakes of Nova Scotia contain large deposits abounding in remains which consist of the siliceous skeletons of upwards of sixty species of diatomaceae, and of the siliceous spicules of at least seven species of fresh-water sponges. The deposits from different lakes are generally marked by a difference in the species present or in their relative proportion. In lakes which are not agitated by large streams bearing earthy sediments during times of freshets, the deposits consist generally of a light slimy brownish mud, sometimes of a depth beyond twenty feet, into which a pole can be easily driven by the hand. This mud, when treated so as to eliminate the carbonaceous vegetable matter, leaves a variable percentage of exquisitely sculptured diatom cells and various forms of sponge spicules. In some places, this percentage is very high and the deposit correspondingly whiter and firmer, in some cases consisting nearly of the pure siliceous valves and spicules. The diatomaceae grow not only in the waters of these lakes but in the streams flowing into them, so that these deposits are not all developed *in situ*. The sponges, on the other hand, affect the stiller waters of the lake. They attach themselves to and grow upon portions of submerged wood or stone, or even on sand, sometimes forming extensive incrustations several inches in thickness, some species extensively lobed and even branching. The sponge-flesh, dying away each winter, innumerable microscopic spicula, which formed its skeleton, are thus scattered in the waters, so that in some localities, the sponge spicules form a greater proportion of the deposits than the valves of the diatomaceæ."

"Some of these deposits may prove to be of industrial importance, the material being regarded as capable of use as polishing powder for various purposes, and in the manufacture of dynamite."* Industrial uses.

The lakes mentioned by Mr. McKay as containing these deposits are: Ainslie in Cape Breton; Lochaber in Antigonish; Mackay, Black Brook, Eden, Grant, McLean, Calder, Forbes, Ben and Toney Lakes in Pictou County; Mackintosh, Earltown and Gulley Lakes in Colchester; the lakes which supply the city of Halifax with water, Grand and Dartmouth Lakes in Halifax county, and Kempt Lake in King's county. Localities.

About four tons of this material were shipped in 1886, from a small deposit in a marsh at Alexander Sutherland's (Sergeant), Upper Barney's River. The extent of the deposit is not known; the marsh is fifty yards wide, of indefinite length; the layer of infusorial earth two feet thick immediately under the sod. Barney's River.

At Englishtown, St. Ann's, Cape Breton, a deposit of this earth, said to be of excellent quality, has been somewhat largely dug by Mr. J. Fraser Torrance, from a small lake behind the village. Cape Breton.

* Principal A. H. McKay in the Report of the British Association for 1884, p. 742.

Roy Island. Avondale. East River of Pictou.

Sand.—Good sand is found on many of the sea beaches and among the drift. A considerable quantity of fine sand from the beach of Roy Island has been used at Acadia coal mines. North of Avondale post-office, a deposit of sand, said to be suitable for moulding, is found close to the road to Bailey's Brook. It is also abundant on the East River of Pictou,* the best known deposit being near the mouth of McLellan's Brook. In 1876 Antigonish sent 227 tons of sand, valued at $1 a ton, to Prince Edward Island.†

Guysborough River.

Slate.—On the north branch of Guysborough River, above the Afton road, is a quarry of dark bluish-gray Devonian argillite, evenly bedded but having also an oblique imperfect slaty cleavage. The shales do not always break out smoothly, and the adherence of the different layers to one another is very strong. In Shaw's and Aikens Brooks, similar slates have been quarried, but no satisfactory roofing slate seems to have been discovered.

Pencil Stone.—Clay-slate, useful for making slate pencils, is found in abundance, according to Dr. Honeyman, among the Silurian and Cambro-Silurian soft argillites of Antigonish and Pictou counties.

Arisaig.

Dysyntribite.—Associated with the felsites of Frenchman's Barn and Arisaig pier, is a soft unctuous rock, of yellow, orange, red, green, gray and other finely mottled colors, belonging to the agalmatolite, parophite and dysyntribite group of minerals,‡ said by Dr. Honeyman to be twelve feet thick, traceable for a great distance, but passing on the strike from a massive rock into slates. It is susceptible of a high polish, but broken by cleavage joints, and tarnishes easily; has been quarried to some extent as an ornamental stone, and might also probably be used for anti-friction purposes and pottery making.

Rock crystal.

Garnet.—Dr. Honeyman mentions§ garnets as occurring at Polson's Lake. Crystals of quartz, of great beauty, are often found in veins among the Devonian slates.

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* Trans. N. S. Inst. Nat. Sc., Vol IV., p. 145.
† Report of Commissioner of Mines for 1876, p. 64.
‡ Geol. of Can., 1863, p. 484; Trans. N. S. Inst. Nat. Sc., Vol. III., p. 233, and Vol. VI., p. 320.
§ Trans. N. S. Inst. Nat. Sc., Vol. I., p. 110.

REPORT

ON THE

LOWER CAMBRIAN ROCKS

OF

GUYSBOROUGH AND HALIFAX COUNTIES,

NOVA SCOTIA.

By E. R. FARIBAULT, C.E.

Introduction.

This report, and the maps which accompany it, comprise the result of investigations made, since the fall of 1882, among the gold-bearing rocks of the Atlantic coast of Nova Scotia, in southern Guysborough and eastern Halifax counties.

Acknowledgments.

I wish to offer my thanks to the many persons to whom we are indebted for services rendered in the performance of this work, and more especially to the following: Thos. Millward, of Stormont; K. S. Sweet and J. L. Smith, of Country Harbour Cross-roads; Thos. O'Neil, of Salmon River Lake; J. C. Flick, of Holland's Harbour; Dr. A. F. Falconer, James McDaniel, Thos. Campbell, Jas. H. McDonald and Alex. McDonald, of Sherbrooke; James A. Fraser, M.P.P., Alex. McDonald and John Williams, of Goldenville; H. Elliott and Alex. McDonald, of Stillwater; Alex. McKenzie, C.E., and J. Stewart, of Melrose; W. T. Smith, R. Findlay and A. Chisholm, of Caledonia; John Nelson, of Trafalgar; J. Hemloe, of Little Liscomb; Thos. Creighton, of Liscomb Mill; John Malay, of Ecum Secum; John Fraser and McMann Brothers, of Moser's River; E. Malaye and Ed. Archibald, of Salmon River Mine; Jas. McG. Cruikshank and J. F. McKenzie, of East Sheet Harbour; J. A. McDaniel, of Sunnybrae; Henry McLean, of Hopewell; W. J. Chisholm, Edwin Gilpin and James H. Austen, of Halifax; F. N. Gisborne, Ottawa.

Character of the country.

The whole of the country under consideration is low, the hills seldom rising more than five hundred feet above the level of the sea.

The granite hill east of Donahue Lake, 725 feet high, and the Bull-ridge east of Stillwater, are the most prominent elevations of the district. A decided and uninterrupted ridge follows the northern boundary of these rocks from Cape Canso to Trafalgar and beyond, indicating the axis of the principal granite masses. The rivers and larger streams of the district taking their rise from this ridge, flow southward into the Atlantic.

The Country Harbour and St. Mary's Rivers, however, rise further north in the Devonian formation, and intersect the ridge at right angles in gorges with high, steep sides. The valleys of the other large streams are also often deep and narrow, and present very little intervale; the rocks being hard and compact, produce only light soils, but are remarkable for the numerous lakes, ponds, lagoons, still-waters and swamps upon them. More than five hundred lakes have been surveyed.

Extensive fires, at different times, have destroyed the forests along the shore, and in many places to a great distance inland, increasing the original barrenness of the surface. Large dense forests, affording good ship-timber, are still to be found on the headwaters of the rivers of New Harbour, Isaac's Harbour, Indian Harbour, Liscomb, Ecum Secum, Moser's, Quaddy, Salmon and Sheet Harbour, and lumbering is still carried on extensively on those of Sheet Harbour, Moser's and Liscomb.

Forests.

Except in the St. Mary's and Country Harbour valleys, the interior of the country is uninhabited, being for the most part unsuitable for agriculture; and along the shore most of the inhabitants are engaged in fishing.

Cultivable land

Fine tracts of woodland, fit for agriculture, occur, however, on Moser's, Ecum Secum and Indian Harbour Rivers, where the detritus of the black slates, which attain here their greatest width, yields a deeper and more productive soil than the granite and quartzite.

Harbours.

The sea-shore is intersected by numerous deep, narrow harbours, bays, coves and creeks, which afford good shelter for fishing vessels.

The principal harbours of refuge for large vessels are Whitehaven, Country, St. Mary's River, Liscomb, Mary-Joseph, Beaver and Sheet; of these, Whitehaven* and Liscomb, together with Halifax, are regarded as the best harbours along the Atlantic coast of Nova Scotia, being never obstructed by drift ice.

* Haliburton's History of Nova Scotia, Vol. I., p. 103.

Area of the Gold-Bearing Rocks.

The gold-bearing rocks of Nova Scotia cover nearly one-half the superficies of the province, that is, according to various authorities, from 6000 to 7000 square miles.* Of this area, which stretches along the Atlantic coast from Canso to Yarmouth, rocks supposed to be of Lower Cambrian age occupy about one-half, and granite the remainder. The eastern part only, as far as Sheet Harbour, has been surveyed and mapped, and is here reported upon. Chedabucto Bay forms the northern boundary to the mouth of Salmon River, where it leaves the shore, and keeps immediately south of the river as far as Ogden, thence along the old Bantry road to the outlet of Hurley Lake, beyond which it runs in a southerly course, striking Country Harbour River one mile and a quarter below the Cross-roads. From this point, the line runs a few degrees north of west to Trafalgar, keeping south of the Country Harbour road, Melrose and the West River of St. Mary's. On the south, these rocks extend to the Atlantic Ocean, and form the numerous outlying rocks, reefs and islands so dangerous to navigation on this coast. Extent.

Classification of the Rocks.

The rocks in the region described in this report, may be classed as follows:—

Gr. Granite (porphyritic and gneissic.)

C. Lower Cambrian, { Lower or quartzite group, / Upper or graphitic and ferruginous slate group.

Gr.—Granite.

Masses and dykes of granite intersect the Lower Cambrian strata in many places from Cape Canso to St. Mary's River, and also immediately

* In the Geological Survey Report for 1870-71, page 268, the area of the gold-bearing rocks of the Atlantic coast of Nova Scotia was described by me as follows:—

"The extent of the Atlantic coast series of stratified gold-bearing slate and quartzite, has been variously estimated at from 5,000 to 7,000 square miles. My observations during the past summer induce me to think that this estimate is very considerably too large. The mistake has probably arisen from defective information respecting the area occupied by the granitic rocks; which, as I have already pointed out, is very largely in excess of that assigned to it on published geological maps, from which the computations referred to have probably been made. The area represented on Sir W. E. Logan's large map of Canada as occupied by strata of Lower Silurian age on the Atlantic sea-board of Nova Scotia is about 5,400 square miles, and of this probably fully more than 1,400 square miles are occupied by granitoid rocks. Exclusive of Cape Breton Island, 3,500 square miles would, therefore, probably represent the total extent of the area over which the stratified slaty and quartzose auriferous rocks are distributed."

This closely corresponds with the estimate now given by Mr. Faribault.—Alfred R. C. Selwyn.

Superficial extent.

south of the West River of St. Mary's, from Cochran's Hill to Trafalgar, occupying approximately 235 square miles, or about one-fifth of the whole area examined. The granite constitutes a prominent ridge marking the line of greatest disturbance of the district. It occurs in five separate and distinct areas. The first extends from

Subdivisions.

Cape Canso to Whitehaven, the second from Cole Harbour River to New Harbour River, the third from Ogden to Sherbrooke, the fourth from Cochran's Hill to the Cameron Settlement, and the fifth from the Cameron Settlement to beyond Trafalgar. Within each area there are several masses and dykes of granite, which will be referred to further on.

Characters of the granite.

The granite varies very much in composition and texture, according to its position, whether in the large masses or in more or less close proximity to the surrounding sedimentary rocks. In the large masses, it is generally whitish or reddish, composed of white or pink felspar, white, colourless or smoky quartz, and white silvery mica, all uniformly distributed in a fine and compact or crystalline admixture. In the centre of these masses, the rock often assumes a porphyritic structure forming a beautiful light-gray granite, with a finely crystalline paste of uniform texture, containing large, scattered crystals of felspar, averaging half an inch, but often attaining one inch and a half in length, uniformly distributed through the mass. Very good

Exposures.

exposures of this granite may be seen on the road between Crow Harbour and Cole Harbour, also one mile up the Basin and Eastern Brooks between Tor Bay and New Harbour, in the southern part of the granite mass east of Sherbrooke, and south of Trafalgar on the south branch of the West River of St. Mary's.

Schist.

At the edges of large masses, the granite is found frequently to pass gradually into a foliated schistose rock, which, losing its crystalline texture, itself passes insensibly into the altered sedimentary rocks. This alteration is shown to great advantage at a twelve-feet fall on the Patterson brook of New Harbour River, and at the Glenelg bridge, on the East River of St. Mary's.

Dykes.

Dykes and veins of granite are often seen cutting Lower Cambrian strata in the vicinity of the large masses, but also in many instances far from such masses. They are generally of a very coarse and irregular texture, the felspar and quartz often attaining two feet in diameter, while the mica is in large scales, forming perfect hexagonal crystals.

Such dykes cross the Whitehaven road a quarter of a mile south of its junction with the Canso road, and are also seen in a barren, half a mile south-west of Desert Lake.

The small veins, on the contrary, are generally finely crystalline; as they thin out, the mica and even the felspar disappears gradually and they become simple quartz veins. Veins.

Good examples of such quartz veins are to be seen at the dyke crossing the Whitehaven road, at Cochran's Hill, a little distance south of the Crow's Nest gold mine, and also a few hundred yards up Churn Brook and the Mitchell mill-brook of the West River of St. Mary's.

Description of the Granite Areas.

1. *Cape Canso Granite Area.*—The most easterly of the five areas is occupied by three distinct masses, with dykes and veins, generally following the strike of the surrounding altered rocks, but also intersecting them so promiscuously as to form a network of veins, which often extend from one mass to another.

The most northerly of these masses may be described in some detail, for it is nearly all covered by barrens where the denuded rocks are well displayed, and is crossed by roads which make every part easily accessible. It does not exceed a mile and a half in width, and stretches from the Cranberry Islands in a westerly direction for twelve miles, taking in the southern part of Georges, Piscatiqui and Durell Islands and Canso, whence it follows Chedabucto Bay to one mile west of Fogherty Point. Lazy, Black, Fogherty and a few other points are, however, occupied by altered Lower Cambrian rocks, and no granite is seen at Fox Bay for a distance of three-quarters of a mile, where Indian Cove has, apparently, been cut out through an otherwise continuous mass of coarse whitish or reddish-grey granite. This variety also constitutes the dykes and veins so numerous at the contact of the main granite masses with the stratified rocks, and is again found on the old shore road to Canso, east of Tor Bay, penetrated by numerous patches and veins of quartz. First mass. Canso.

On the Canso road, between Wilkins Lake and Three-mile Lake, and both west and south of the latter, coarse gray granite traversed in every direction by veins of white, smoky and gray quartz, varying in thickness from eight feet down to a few inches, is mixed with altered gneissic and quartzo-felspathic rocks. The outer part is largely composed of a coarse gneissic variety which in many places gives good examples of the gradual passage of granite into gneiss. Quartz-veins.

On Reynolds Brook, above the Canso road, at the contact east of a small pond, the quartzo-felspathic rock is crystalline, even at a distance of two hundred yards from its junction with the granite; and the degree of crystallization is but slightly increased till within a few feet of the contact where the coarse gneiss is distinguishable from the granite

Gneiss running into granite.

only by its foliated, undulating structure. This contact is everywhere very irregular and presents no clear line of demarcation, the foliation insensibly dying away, and small patches and tongues of granite running, generally in an easterly and westerly direction, in the surrounding quartzo-felspathic rocks. The gradation, indeed, is so regular that it appears as if, during the process of folding, the component minerals of the Lower Cambrian strata had been, under enormous pressure, and owing to the presence of water or vapors, fused and mixed with those of the plastic granitic magma squeezed into the crevices. At the contact observed on Long Lake north of Hazel Hill post-office, and at that on Wilkins Lake south of the Canso road, the granite is also associated with gneissic granite, perhaps in larger quantity than on Reynolds Brook.

Along the shore of Fox Bay, west of Indian Cove and along the south side of Tickle Channel, numerous dykes and veins of granite, sometimes foliated, associated with quartz patches, and often of a dark red colour, pass from the main mass into the quartzites and black slates which do not appear to have been more altered at the immediate contact than they usually are in this district at some distance from it.

An isolated dyke crosses the Whitehaven road, half a mile south of its junction with the Canso road, and extends for at least one mile and a half: it is mostly composed of reddish-gray very coarse granite or pegmatite, having many veins and blotches of white quartz, often very irregular but generally running like the dyke in an easterly and westerly direction. Passing from the dyke into the surrounding country-rock are many small veins of granite which likewise follow its strike, and in thinning out, often lose their mica and felspar and become quartz-veins. In the mine worked by Mr. John Pillsbury in the rear of John Reynolds' at the eastern end of this dyke, quartz-veins of this character are cut through, which pass into coarse granite and carry iron pyrites, yellow and horse-flesh copper ore, mispickel and a greenish clay.

Mine on the Canso road.

The two other masses in this first area lie more to the south on the Atlantic coast. The smaller does not exceed two miles in width and five miles in length; it extends from the North-West Arm of Whitehaven eastward along the north side of the North-East Arm to the Dover, Young and Wilkins Lakes of Dover Bay. The other mass, and by far the largest of the three, extends from Cape Canso Island along the Atlantic coast to the Flying Point of Whitehaven, a distance of fifteen miles, varying in width between three and six miles, including the numerous islands on this shore and running north as far as Glasgow Harbour, Hazel Lake, McKenzie Brook, the head of Dover Bay and Marshall Cove.

Second mass.

Third mass.

Many narrow belts, dykes and veins of granite are associated with the rocks between the two granite masses, sometimes connecting them: these are difficult to trace in detail, and those marked on the map as crossing Wilkins, Charles, Young and Dover Lakes, and the North-East Arm, are, therefore, indefinite; but it will be seen that they have, as usual, the tendency to follow the strike of the stratified rocks, although in many places they are also much intermixed with them.

Whitehaven. On the north side of the North-East Arm, a contact between slate and granite was observed, the latter being fine-grained and in places almost a pure quartzite, but succeeded by the common light-gray granite of the country which extends as far as the North-West Arm. The slate for two inches from the junction is converted into a granitoid rock composed almost wholly of crystals of andalusite; at three inches the rock might properly be called a fine mica-schist, beyond which the strata are concealed.

Period of foliation. In the country between Dover Bay and Whitehaven are found many small lenticular patches of gneiss, running east and west, or north-east and south-west, parallel to the strike of the quartzite and slate further north; this would seem to prove that the gneiss was foliated at the same time that the latter were folded.

The granite country between Cape Canso and Whitehaven is all barren, and the rock more exposed than in any other part of the district. Huge erratic blocks of granite are found on the polished surfaces of the highest elevations, while the depressions are filled with smaller, angular blocks, which give the country a rough and rugged appearance.

2. *Tor Bay Granite Area.*—Further west is a second area, which differs from the first in that besides the ordinary light-gray or reddish-gray variety, it contains a large quantity of porphyritic granite. It lies north-west of Tor Bay, extends twenty miles west to New Harbour River, and is occupied by three separate masses of granite. Porphyritic granite.

First mass. The easternmost extends from a quarter to one mile north of the shore of Tor Bay to within half a mile of Crow Harbour, and from Cole Harbour River to Halfway Cove Lakes.

Crow Harbour. A very interesting contact of gneiss and granite was observed on the edge of this mass, half a mile south of Lamb's Point, west of Crow Harbour. The two rocks are mixed along the contact through a width of more than a hundred yards, layers of gneiss striking east and west in the granite, which holds also wedges of gneiss, sometimes six feet long and nine inches wide. At one place, granite dykes cross the bedding of the gneiss, which is of comparatively fine texture, full of mica, and contains lenticular veins of clear vitreous quartz, on the Quartz veins.

Staurolite. surface of which are fine crystals of black hornblende and compound crystals of staurolite. A small belt of granite, twelve feet wide, runs in the bedding of the gneiss N. 58° W.; and in a direction parallel to the main belt, and near its edge, there are small connecting tongues and lenticular veins often passing into quartz.

Granite dykes passing into quartz.

A spur, running from the main mass to the eastward for three-quarters of a mile, crosses the north-east branch of Larry's River, about half a mile above the fork. It does not exceed a quarter of a mile in width, and is entirely composed of coarse gneissic granite, roughly foliated, and altering the neighbouring mica-schist and slate. On the eastern shore of Crow Harbour, a dyke of reddish fine granite, with obscure lines of stratification and foliation, runs in the bedding of the laminated whin or quartzite, which here occupies the shore. This dyke is probably connected with the first granite mass, although over a mile distant from it.

Second mass. The second mass of the Tor Bay area, to the west of the first, is bounded on the south by the Halfway Cove, Bonnet and Donahue Lakes, and extends north to Chedabucto Bay, where it is exposed along

Halfway Cove. the shore from Halfway Cove westward for one mile and a quarter. It presents at its western end the most prominent elevation of the district, and rises east of Donahue Lake about 725 feet above the level of the sea. The shore of Chedabucto Bay is very rough, rocky and indented for the first three-quarters of a mile west of Halfway Cove, and, as well as the Canso road, which is close by, consists of granite, often coarse.

Further west, in different places on the shore, the granite, which is sometimes reddish-gray, breaks through altered slates or felsites, which in one place appear to underlie it, and are altered into compact, dark bluish-gray felspathic rocks, like the Coxheath * laminated felsites.

A little distance further is an obscure granite, blotched with quartz and epidote, in the midst of greenish-gray compact rocks, closely followed by very coherent felsite, obscurely gneissic, like the rocks of Capelin Cove,† and apparently sedimentary. A quarter of a mile up Halfway Cove Brook, the mica-schists dip N. 46° W. off a face of gray granite, which follows the brook, and is also well exposed 700 yards further west, where it crosses a small tributary, and cuts off the slate. Up this brook, there is a beautiful white variety of granite, of uniform compact texture, composed of grains somewhat smaller than peas.

Donahue Lake. Donahue Lake, one of the largest lakes of the district, is only half a mile wide, but over three miles long, studded with several small

* Geol. Survey Report for 1875-76, p. 373.
† Geol. Survey Report for 1877-78, p. 9 F.

islands, and full of fine trout. The eastern side, with its rough white granite cliffs, contrasts strongly with the beautiful deep-green hardwoods bordering its low, undulating western shore. The granite barrens between this lake and the Sandy Cove Lakes display rocky surfaces, without a trace of vegetation, upon which large rectangular slabs of granite, detached from the solid mass, lie conspicuously around. At one place, long, parallel white bands, from one inch down, and one to three feet apart, composed essentially of crystalline felspar, run N. 54° W. in the granite, and are traceable for twenty-five yards along the strike. At the northern end of Donahue Lake, mica-schist and slate are seen to dip south-east against the granite at an angle varying between 70° and 70°.

Scenery. Barrens.

North-west of this mass, along the shore from Sandy Cove westward, and up the south side of Salmon River, beyond the bridge on the Tor Bay road, are several narrow belts and dykes of obscure granite, intermixed with slate and quartzite. The granite varies much in composition and texture, and differs from that of all the other masses of this district.

Sandy Cove. Salmon River.

On the shore, half a mile east of Sandy Cove, gray and whitish-gray granite lies in lenticular masses in the bedding of the quartzite, and encloses also blocks of it, having, apparently, like the quartz-veins, being formed along the lines of least resistance in the strata. In places, indeed, the two are associated, and one belt of granite, about a foot wide, contains an inch of quartz on each side. Some seventy yards further east, are curious vein-like masses of granite, precisely like quartz-veins, and giving the impression that they have originated in the same way. The strong probability is that some of these at least have never been connected with any large mass. A few yards further east, a granite vein is replaced or continued by one of quartz, which again on its strike contains patches of granite. These bands are never more than three or four feet wide, but appear to continue westward, crossing the Canso road a quarter of a mile east of Sandy Cove Brook, and ending within a quarter of a mile of Delaney Brook, and at the same distance south of the road. The granite is here rather a compact quartz-felsite, with a porous, quartzose, weathered surface, like pumice-stone; sometimes, apparently, a breccia and full of epidote.

Granite vein.

Similar rocks on the shore at the mouth of Delaney Brook belong to a belt which, running westward, crosses Hyde Brook just above the road and thence follows the south bank of Salmon River to a mile and a half or more above the Tor Bay road.

On Hyde Brook, the rocks are rusty-weathering, pyritous, dirty granite, the constituents of which are not well mixed, and fine-grained, dark diorite. This belt averages a quarter of a mile in width,

Diorite.

and forms part of the escarpment of the northern boundary of Lower Cambrian rocks.

Third mass. Tor Bay and New Harbour.

The third mass lies immediately south of the last and extends from near Gamman Basin westward along the eastern side of New Harbour River to half a mile above the Third Fork, having a length of twelve miles with a breadth of five. Its country is broken, rocky and barren, and often rendered almost impenetrable by wind-fall, intermixed with scrubby, second-growth black spruce. The northern boundary leaves the Tor Bay road opposite Square Lake, running westward and crossing the New Harbour road one mile south of the Junction, and Loon Lake Brook, three-quarters of a mile south of Loon Lake. Besides the ordinary light gray and reddish granite, the porphyritic variety is found in many places, especially up the Eastern Brook of New Harbour, where specimens show large crystals of felspar, beautifully scattered through the mass. An irregular belt of Lower Cambrian rocks, little more than a quarter of a mile wide, runs up Patterson Brook, in the very midst of this granite mass, as far as Canter and Sangster Lakes, a distance of over three miles. The rocks of this belt strike east and west; they are evidently cut by the granite and greatly altered. From the western end also, long dykes run westward and cross New Harbour River above the First and Third Forks. One of these dykes crosses the brook from Ocean Lake half a mile below the outlet, in a direction parallel to the strike of the associated quartzites.

Dykes.

The granite is here very fine and hornblendic. Other dykes cross the eastern branch of the Third Fork a quarter and half a mile further up. One of them, of gray granite, two feet wide, runs in the bedding of greatly altered slate which is full of staurolite crystals near the contact, and cut by many irregular veins of quartz.

Extent.

3. *Country Harbour Granite Area.*—This area is some three miles west of the last and extends from Ogden to Sherbrooke, a distance of twenty-two miles. It is occupied by five separate principal masses and a few smaller ones.

Five masses.

First mass.

The first, and by far the largest, has a surface of thirty-four square miles, and is about twelve miles long. On the north side it is in contact with the Lower Devonian for two miles, from Ogden north-westward along the Guysborough road. Leaving the Lower Devonian, the granite is overlain by the Carboniferous, the contact running south-west along the old Bantry road to within a mile of Country Harbour Cross Roads. A narrow band of whin is left, however, between the granite and the Carboniferous south of Hurley Lake, for a distance of three miles. The southern boundary along the Lower Cambrian rocks is very irregular, coming near the Country Harbour road at the lower

Ogden.

bridge on the river, and also further down at Johnson Brook, where it adjoins the Country Harbour gold-district; while in other places it is over a mile and a half from the road. The line of contact further east crosses Howlett's Brook one mile up the stream, the headwaters of Stewart Mill-brook three-quarters of a mile above the lake, and thence runs to the foot of the Big Still-water. At the east end, the mass divides into two prongs separated by a tongue of Lower Cambrian rocks, one mile and a half wide, running westward between them for some six miles. Country Harbour gold-district.

On the line of contact in Lawlor's Brook, one hundred yards above the mill-dam, irregular dykes of light-gray fine granite break across the bedding, but also run parallel with it for many yards. The associated rocks are much altered, but the lines of contact are quite definite, and there is, apparently, no passage of one into the other as was observed in some parts of the masses to the eastward. About two hundred yards further up, the prevailing granite is white, with streaks of a fine red variety, chiefly composed of compact crystalline quartz and felspar, with a few large spots of mica. This red granite appears to form a large part of the eastern end of this mass. It was observed on the Salmon River road at a small brook near the Ogden schoolhouse, where it passes into a beautiful deep-red, finely crystalline quartz-felsite or syenite; and also, one mile and a quarter further west, at a ten-feet fall of a small brook, south of the old Bantry road. Red granite.

Foliated, coarse gneissic granite appears to occupy much of the country west and north of the Big Still-water of Isaac's Harbour River. It was seen up a small brook a few hundred yards west, at the line of contact a quarter of a mile up the east branch, and half a mile up the west branch. On the headwaters of the east branch of Stewart Mill-brook, numerous blocks of gneiss are found with huge blocks of granite; and there may possibly be small isolated patches of gneiss *in situ*, in the vicinity, although the blocks may have been drifted from further north. In some of these blocks, the plates of mica are one inch square, the crystals of felspar much larger, while the quartz is in masses or veins several feet wide. It is near the quartz veins that the coarse aggregations always seem to occur. Isaac's Harbour River.

A quarter of a mile south of this mass of granite is another, stretching eastward in a narrow belt from the Country Harbour road opposite Green Point for about four miles to beyond Stewart's. At the head of the third small brook below Howlett's Brook, a dyke of gray granite, nine inches wide and apparently connected with this mass which is close by, was observed running east and west in the bedding of altered whin or fine gneissic rock, from which it is clearly distinct, there being no passage of one into the other. A little to the south of this last mass Second mass. Country Harbour Narrows.

are two others of small extent: one of these only a few hundred yards wide, crosses the brook a quarter of a mile below the schoolhouse; the other, three-quarters of a mile further down; both are of a gray, massive granite.

Third mass.

The three other granite masses belonging to this third area are found between the Country Harbour and St. Mary's Rivers. The most northerly, only three-quarters of a mile wide, and two miles long, extends from the vicinity of the shore and opposite the Narrows, westward to the head of the south branch of the West Brook of Country Harbour River. The granite, generally coarse, contains large masses and veins of white quartz. An exposure of gray granite, apparently of small extent, was seen on Hudson Brook, half a mile north of this mass.

Fourth mass.

The fourth mass is narrow, lenticular and irregular, over nine miles long, stretching from the Country Harbour River, about two miles below Fenton's Brook, as far as the north side of Lake Brûlé, where it attains a width of one mile, and then branches off. One branch, running a little north of west, takes in the upper part of Head Lake of Indian River, and narrows, two miles further west, into a dyke not over forty yards wide, composed of pegmatite, the component minerals of which are very irregularly mixed and coarse; the quartz and felspar in places often exceeding the size of a man's head, while the mica is in scales over six inches in diameter. This dyke projects conspicuously above the level surface of the barren, and is capped by light-gray gneiss, in layers between three and six inches thick, alternately composed of crystalline quartzite and quartz-felsite and fine gneissic granite, evidently the "whin" rocks altered and upheaved by the granite. One mile north of this dyke are auriferous measures which were worked to some extent several years ago, but are now wholly abandoned.

Conspicuous dykes capped by gneiss.

Old Country Harbour gold-mines.

The other prong runs from Lake Brûlé, a little south of west, and, after crossing Indian River about a mile below the Head Lake, widens out to one mile and a quarter at the Bull-ridge, and extends along the north side of Archibald Lake and a little beyond.

Fenton's Brook

The eastern end of this mass consists principally of several dykes of light-gray fine granite which run along the shore of Country Harbour as far as Fenton's Brook. The contact on this brook is one of the most interesting in the district. Granite, gneissic granite, fine gneiss, andalusite pyritous slate, with numerous quartz masses and veins in succession cross the brook, and are closely associated and intermixed, the granite occurring either along or across the bedding.

The barren at the head of Fenton's Brook is in places paved with granite, out of which the other constituents have weathered, leaving the quartz on the surface, whence it can be taken in handfuls. The

Bull-ridge, a high, bare escarpment of whitish coarse granite, running east and west, overlooks the surrounding country. Seen from its summit, the barren extending southward to the Atlantic coast, presents a most dreary and desolate view. Bull-ridge.

A few dykes occur also further south, along the west side of Country Harbour.

A four-inch vein of granite crosses Armstrong Brook, below the hay-marshes at its head; and, judging from the number of blocks of granite met with a great part of the way downstream, it is probable that other masses cross the brook. Reddish-gray coarse granite, with black mica and flesh-colored felspar, runs along the bedding of highly altered and tilted rocks for about half a mile on the shore of Country Harbour immediately south of Armstrong Brook. Red granite. At the northern end of Mount Misery, a narrow dyke of reddish-gray granite with very little silvery mica, runs in a southerly direction and slightly across the bedding of highly metamorphosed rocks; it appears to be a prolongation of the last-mentioned small mass. It is of uniform width, not exceeding four inches. Mount Misery. Gray coarse granite also crosses Stewart Lake Brook a few hundred yards up, and there are, no doubt, several other small masses between Squint and Armstrong Brooks, judging from the great alteration and disturbance of the rocks.

The fifth and last mass comprised in the Country Harbour granite area is that of Sherbrooke, interesting in itself, but much more so on account of its relation to the Sherbrooke or Goldenville mining district. Fifth mass. Sherbrooke. It lies one-half to three-quarters of a mile west of the Sherbrooke road, extends northward to the foot of the highest of the upper Indian Harbour Lakes and to the road to the marshes of Archibald Brook, eastward to the foot of the lowest of the upper Indian Harbour Lakes, where it runs along A. Jordan's Brook, and southward to within half a mile of Mitchell Lake Brook, near the black slate belt. The Indian Harbour Lakes lie within this mass in a narrow valley, between bold cliffs three to four hundred feet high. Indian Harbour Lakes. The granite forming these cliffs often splits into rectangular slabs, the predominant joints running in an easterly and westerly direction. It is thus easily removed for building, in blocks of all dimensions; it has been quarried to a small extent east of the highest lake, and used in the construction of the piers and abutments of the iron bridges of the district, and also for other purposes. Quarry. Two or three hundred yards west of this lake, and a little north of the granite quarry, a contact was observed on the face of a cliff, where the granite runs between beds of quartzite, while at the base it overlies and cuts the quartzite, dipping to the north at an angle of 70°. The granite is porphyritic and generally whitish-gray, but for the first two or three feet from the contact it takes a red colour,

due to the large proportion of red felspar, becomes coarser and has larger scales of mica, the quartzite or whin being much altered.

Descriptions by Dawson and Hind.

This contact appears to be that figured and described by Sir J. W. Dawson in his Supplement to Acadian Geology, page 84. About forty yards north of it, a two-inch vein of fine granite, with very little mica, intersects the quartzite at an angle of 35°.

Bold cliffs of gray coarse granite border the eastern side of the Sherbrooke Lakes, on which interesting contacts have been described by Professor H. Y. Hind.*

Wine Harbour gold-district.

About a mile east of the post-office at St. Mary's Bay, the surface of the hill is covered with large rectangular blocks of granite, probably derived from an underlying mass of small extent, the nearest to the Wine Harbour gold-mining district, which is three miles and a half distant.

Dykes, long and numerous.

Melrose.

4. *Granite Area of West River, St. Mary's.*—This area is entirely occupied by dykes and long narrow bands of granite, extending along the northern escarpment of the Lower Cambrian rocks, from Melrose to the Cameron settlement. The country in the vicinity of Cochran's Hill, Rocky Brook, Waternish and Melrose is crossed by many dykes, those that have been seen and marked on the map certainly forming but a small part of the large number existing. Their relation to the surrounding rocks is nearly the same in every case. In width they vary from ten feet downward, and in many cases exceed a mile in length, following the bedding, but, like the auriferous quartz-veins of this district, often passing from one plane of bedding to another, which they again leave further on for a third, or thin out. In other cases,

Veins.

little fissure veins leave the main dyke to cross the bedding, but are generally short. Granite veins, crossing the auriferous measures at

Cochran's Hill and Crow's Nest gold-district.

Cochran's Hill, and the dyke to the south of the Crow's Nest, afford good examples of such contacts.† At the latter, the slate is, at the junction of the granite, altered into perfectly crystalline schist, largely composed of beautiful crystals, over an inch in diameter, which proved, on examination by Mr. Hoffmann, to be staurolite. The granite of the wide veins is coarse, while that of the smaller veins is often very fine, with little mica, and passing into quartz-felsite or quartzite.

Other veins of granite were also seen, one crossing the Rocky Brook at a ten-feet fall two miles due east of Cochran's Hill gold-mine; another, in a bold cliff on the east side of St. Mary's River, three-quarters of a mile above the Waternish post-office; and another, crossing the

* Sherbrooke Gold District; Journal of the Geological Society of London, Vol. XXVI., pp. 468-479; "Report on a Gneissic Series underlying the Gold-bearing Rocks of Nova Scotia," Halifax, N.S., 1870.

† Supplement to Acadian Geology, pp. 84 and 85.

road on the west side of the river, a quarter of a mile below the Crow's Nest.

Two prominent bands of granite run approximately parallel with the Lower Cambrian strata along their northern escarpment. The eastern band begins one mile and a half east of Melrose, where it is overlain by Carboniferous rocks, and runs a few degrees south of west for a distance of more than twelve miles, crossing the Sherbrooke road one mile and a half below Melrose and the East and West Rivers of St. Mary's, at the Glenelg bridges, approaching the river at Smithfield silver mine, crossing Churn Brook and the road to Smith's bog, half a mile up, passing on the north side of Cranberry Lake, striking McDonald Mill-brook one mile and a half up, and ending at the upper lake of Francis Gut Brook. The eastern part, as far as Glenelg bridge, is seldom over one hundred yards wide; from this point it gradually widens, and at the McDonald Mill-brook, exceeds three-quarters of a mile in width. Where it crosses a small branch of McKeen Brook, one mile and a half east of Melrose, immediately below the Guysborough road, the granite passes into a dark-green or reddish, coarse felspathic and hornblendic fragmentary rock, which continues down the brook for some hundred yards. Twenty yards further, begins coarse, friable Carboniferous sandstone. Immediately above the road is a bluish-black, crumbly, plastic slate, apparently crushed by a fault. From this point, as far west as Glenelg, the dyke is composed of dark-gray, fine granitoid gneiss, with little or no mica, resembling that of Sandy Cove Brook. The western end is also largely composed of granitoid gneiss, generally coarser, and of a light-reddish and whitish-gray color, but also of true granite. On the Churn Brook, at the edge of the band, granitoid gneiss is apparently bedded between layers of altered quartzite; and about half a mile higher up is a small dyke of similar gneiss.

Prominent bands of granite.

Contact with Carboniferous at Melrose.

Silver-mine.

The other band begins three-quarters of a mile north of the western end of the last, or half a mile south of Hattie's bridge, and runs almost due west, with the Carboniferous on its north and the Lower Cambrian on its south side. For four miles it has a regular width of one-eighth of a mile, and runs along the road south of the river as far as Mitchell's Mill-brook; after which it is, for over two miles, overlain by Carboniferous conglomerate largely composed of its detritus, but appears again in a dyke, one or two hundred feet wide, crossing Chisholm Brook and the road to Big Liscombe Lake, half a mile south of the river, and extends seemingly three miles further west, up to the Trafalgar granite area. This band is composed of granitoid gneiss similar to that of the western part of the last band.

Hattie's bridge.

5. *Trafalgar Granite Area.*—Of this extensive area, only the eastern portion has been examined. It is bounded on the south-east by the Second Rocky, Bruin, Hungry and Big Liscomb Lakes; on the east, by Big and Little Liscomb and Chisholm Lakes; while the northern boundary from Chisholm Lake follows the south side of the West River road as far as Dorman Brook, where it passes a quarter of a mile south of it; crosses the south branch of the West River one mile above the bridge, and the Musquodoboit road three-quarters of a mile west of Porcupine Lake; it keeps a little north of Hattie's Lake, but was not followed further west.

Big Liscomb Lakes.

Distinct varieties of granite.

The granite of the eastern end of this mass is mostly whitish-gray, coarse and porphyritic; while that to the westward of the south branch is of finer grain, foliated and porphyritic, generally holding black mica, which gives it a dark-gray color. This area and that of the West River of St. Mary's require to be examined more minutely, and their description must therefore be deferred to another occasion.

The mode of occurrence of the granite in these two masses appears to differ from that of the three eastern areas.

C. Lower Cambrian Rocks.

Fossils discovered by Dr. Selwyn.

No fossils have been found in any of the gold-bearing strata, except the *Eophyton* discovered by Dr. Selwyn at the Ovens, and other forms now regarded as of inorganic origin. Of their age, Dr. Selwyn thus speaks: * "The geological position and the age of these rocks has been fully discussed by Dr. Dawson, and by other of the authors whose observations I have alluded to, and all are agreed that they probably belong to the Lower Silurian period. My first impression of them, formed after personal examination last summer, and based on mineralogical and stratigraphical considerations only, was that they represented the groups known in Britain as the Harlech grit or quartzite and the Lingula-flag series."

Age.

Since then, Sir J. W. Dawson,† Dr. Honeyman,‡ Professor Hind, and others have adopted and maintained the same views regarding the age of these rocks. Mr. Alexander Murray § compares them with the auriferous strata of his Intermediate series of Newfoundland, as follows:

Corresponding rocks in Newfoundland.

"The resemblance in general character of the strata with their included auriferous quartz-veins in Newfoundland to those of Nova Scotia, must strike anyone who has visited the two countries with the purpose of studying their geological features; and I venture to say

* Geol. Survey Report for 1870-71, p. 269.
† Supplement to Acadian Geology, p. 81.
‡ Trans. N. S. Inst. Nat. Sc., Vol. VI., p. 52.
§ Geological Survey of Newfoundland, 1880, p. 535.

that the description given of the latter country by Dr. J. W. Dawson, might, in many respects, equally apply to the former; although according to that author, the auriferous country of Nova Scotia is supposed to be of Lower Silurian age; while that of Newfoundland is undoubtedly unconformably below the Primordial."

In 1878, Sir J. W. Dawson, adopting Dr. Selwyn's views of 1870,* places them below the Acadian series of St. John, New Brunswick, as corresponding to the Longmynd series, Harlech grit and Llanberis slate of England. They certainly, in many respects, resemble the Cambrian rocks of the Eastern Townships described by Dr. Ells.† Like them they are auriferous and cut by masses of granite which alter the slates into staurolite and andalusite schists and the "whin" or quartzite into gneiss; all are very much twisted and wrinkled. Some analogy may also be found between these rocks and those of the Lake of the Woods, described by Mr. A. C. Lawson.‡ Comparison with the rocks in the provinces of Quebec and Ontario.

Nothing more definite can be said at present as to the exact horizon of these rocks, but we may hope that, as in England, further examination will lead to the discovery of fossils, by which this question can be decided; for, it must be remembered that in the greater part of the country examined so far, granite masses and dykes have altered the strata to such a degree as to destroy all traces of organic remains. The gold-bearing rocks are represented in this district by measures over 15,000 feet in thickness, presenting only a few varieties of quartzite, mica slate, or graphitic clay-slate; the quartzite contributing three-fourths of the whole. These rocks, always greatly altered, are metamorphosed to a much higher degree wherever they are cut by masses of granite, and in Canso and Tor Bay districts for example, have been rendered thoroughly crystalline, the quartzite generally passing into fine gneissic rock, the mica-slates into mica and andalusite or staurolite schists and the bluish-black clay-slates into twisted, dark, compact siliceous staurolite or andalusite slates. No limestones have so far been discovered in these strata. Thickness. nite. No limestone.

Mr. J. Campbell § has divided these Lower Cambrian rocks into two groups, a lower or "quartzite group" and an upper or "lower clay-slate group." This division appears to be natural and will here be adopted, the name of the upper group being, however, changed to a more characteristic one, thus: Campbell's subdivisions.

1. Lower or Quartzite Group.
2. Upper or Graphitic and Ferruginous Slate Group.

* Supplement to Acadian Geology, p. 92.
† Geol. Survey Report for 1886, Part J.
‡ Geol. Survey Report, for 1885, Part C C.
§ Nova Scotia Gold-Fields, 1863.

C 1. Lower or Quartzite Group.

Thickness of the quartzite group.

This group, which is over 11,000 feet thick, is mostly composed of the dark-gray, reddish or greenish quartzose rock called by the miners "whin," a term used in Scotland for an igneous rock resembling trap or basalt. This Nova Scotia whin is a compact or granular quartz-rock or quartzite, containing minute scales of mica uniformly distributed in a direction parallel to the bedding and to the cleavage; but when they do not correspond, presenting upon a fresh fracture, a very characteristic glittering surface. When the mica attains a large proportion, the quartzite becomes gneissic and can be split into large thin slabs, as often occurs in the vicinity of granite. It frequently shows rusty stains

Pyrites.

in small streaks, also parallel to the bedding or cleavage, and due to the arsenical and iron pyrites with which the rock is always highly charged. Certain thick beds of coarse quartzite contain large cubes of iron pyrites often over an inch in diameter. This coarser rock is generally found in beds several feet thick; but the average thickness of the beds of quartzite is usually not more than two feet, while some of the slaty and fine granular varieties are in beds between one and four inches thick.

Slate.

Interstratified with the quartzite are numerous bands of slate, usually less than a foot, but sometimes seventy-five feet thick; the principal varieties of slate are light-gray glistening mica-slate, almost wholly composed of mica; dark-bluish, papery, shining, fine micaceous slate; dull-gray, dirty, rusty, arenaceous, earthy slate; greenish, soft, unctuous slate with little mica; and bluish-black or dark bluish-gray compact siliceous slate, generally metalliferous and holding arsenical

Auriferous veins.

and iron pyrites in crystals or nodular masses, principally in the vicinity of auriferous quartz-veins, with which they are often associated.

Conglomerate.

To this group belongs also a very flinty, compact conglomerate, six or seven hundred feet below the summit of the group, noticed in two places; and an auriferous or barren quartz, forming numerous veins apparently interbedded.

The base of the quartzite group is characterized by the occurrence of coarse quartzite and grit in thick beds which, at the mouth of the St. Mary's River, appear to be underlain by bluish-black and greenish siliceous slate holding small crystals of andalusite or staurolite.

The thin bands of slate are more numerous and of greater thickness at the middle of the group, where they are associated with auriferous quartz-veins.

C 2. Upper or Graphitic and Ferruginous Slate Group.

The black slate group is separated from the quartzite group by a few layers of greenish, soft, smooth slate which becomes darker as it

approaches it and insensibly passes into it. This upper group has a thickness of over 4,000 feet, and is wholly composed of bluish-black, ferruginous and graphitic slates, easily distinguished from and unlike any others in the province, having a very characteristic fibrous-texture. Certain flinty layers are full of arsenical and iron pyrites distributed through the mass in small, perfect crystals. In the vicinity of masses of granite, these slates are wrinkled and full of beautiful pearly crystals of andalusite and staurolite, sometimes an inch and a half long, and one eighth of an inch in diameter, but sometimes short and stout. Small crystals of red garnet are also often found near the contact. Thickness of the upper group. Andalusite, staurolite and garnet.

General Structure of the Lower Cambrian Rocks.

These rocks have been greatly disturbed from their original horizontality as sedimentary rocks by a powerful but uniform pressure from the south, which has folded them into a series of sharp parallel undulations. But by denudation they have been so worn dow that the crowns of the anticlinals have been cut off, leaving the upturned edges of the strata. The rocks generally dip at an angle varying between 75° and 90°, seldom lower than 45°, and the strata are often overturned. In the more altered portion, the planes of bedding are not easily distinguishable from those of the slaty cleavage, which are often much more distinct than the former. The course of the undulations is about east and west (astronomical). Between Canso and New Harbour River, the strike is S. 76° W. and N. 76° E., and between New Harbour and Sheet Harbour Rivers, S. 84° W. and N. 84° E. The folds are thus roughly parallel to the northern boundary of these rocks, and as the sea-shore runs about south-west, they are obliquely cut along the Atlantic shore, where good sections are displayed. Their breadth increases from Cape Canso westward, and at Sheet Harbour River, it attains thirty-two miles. Folding. Cleavage. Extent.

No less than eleven principal anticlinals and as many synclinals have been defined between the islands off Sheet Harbour and Caledonia. The gold-mining districts are all situated on these anticlinals, so that their accurate location is of great practical value towards the discovery of new gold-fields. They have been followed eastward as far as Country Harbour, where a great fault, running north-west up the harbour, apparently cuts them and shoves the rocks on the east side about four miles north. Their relation on the opposite sides of the harbour, however, has not yet been studied sufficiently to ascertain the nature or even the positive existence of the fault. Gold-districts on the anticlinals. Faults.

East of Country Harbour, and in many parts of the interior between this and Cape Canso, the anticlinals cannot be mapped with as much

accuracy as to the westward and along the shore, the dislocations caused by masses of granite having disturbed the regularity of the folds which require to be studied with more detail. An extensive fault probably follows the northern boundary of the Lower Cambrian rocks from Chedabucto Bay to beyond Trafalgar. The reasons for this conclusion are the remarkably straight course of the boundary line between these two points, the unbroken escarpment on the south side and the occurrence, near Melrose and other places along its direction, of crushed black slates and quartzites with slickensided surfaces, deeply striated and coated with red hæmatite. Its straight course is interrupted, however, near Country Harbour Cross-roads by a subsequent line of faulting which crosses the other, and has caused on its east side a shove to the north, of three or four miles, corresponding with the Country Harbour fault just mentioned.

Many other faults of more or less extent, have been noticed in different places, and these form no doubt but a very small proportion of the large number to be expected in such a disturbed district, especially in the vicinity of granite masses.

Surface Distribution of the Lower Cambrian Rocks.

It will be found convenient, for several reasons, to sub-divide the region between Cape Canso and Sheet Harbour River into four districts, as follows:

1. Chedabucto Bay District.
2. Isaac's Harbour District.
3. Indian River District.
4. Liscomb, Moser's and Salmon Rivers District.

Area.

1. *Chedabucto Bay District.*—This district has an area of about 275 square miles, and lies south of Chedabucto Bay, from Cape Canso to New Harbour River. The Cape Canso and Tor Bay granite areas, described before, pages 133 and 135 P, are included in and occupy about half of this district, the remainder being covered with flinty, quartzose schistose and gneissic rocks.

Granite.

Some authorities have supposed these to be older than the gold-bearing rocks, but upon examination, it is clearly seen that they are the continuation of the Lower Cambrian rocks of the western districts, which have become thoroughly crystalline, more especially when in close contact with the granite.

A glance at the map will show this continuity of the strata. Two synclinals, crossing the New Harbour River above the Third Fork and exhibiting bluish-black graphitic slates with all the characteristics

Black slate.

of the upper group, have been traced eastward beyond the head of the North-west Arm. These slates change greatly as they approach the granite, but always keep their characteristic bluish-black color, and woody, fibrous texture. At the immediate contact, however, they become so crystalline that the rock is almost wholly composed of crystals of staurolite and andalusite, associated with others of garnet, hornblende, tourmaline, chlorite, etc. The quartzite group brought up by anticlinals can also be traced from the head of the New Harbour River eastward as far as Cape Canso. The gradual passage of the quartzite and associated bands of slates into flinty quartzose micaceous rocks, fine gneisses, gray mica-schists and pearly slates, is also well marked. Contact of slate and granite.

No less than seven anticlinals and synclinals are found between the Eastern Head of New Harbour and Salmon River, running a few degrees north of east, and bringing successively to the surface the quartzite and graphitic slate groups, in belts, which have been separated and are shown on the map, so that little need be said here concerning their distribution. It may be remarked, however, that, although these belts have in many cases been replaced by the different masses of granite, as a rule, the disturbance is less than might, perhaps, be expected. Anticlinals.

The strata sometimes dip away from masses of granite of the Tor Bay area, but more frequently maintain their normal strike up to them on one side and resume it again on the other. The granite, indeed, has not merely pushed aside the strata in making its way through them, but actually occupies the place of so much quartzite and slate, which have disappeared, as if cut off or lifted up by the granite and subsequently worn away. In this district, a larger area is covered with the upper slate group than in any of the others. Large area of slate.

The structure of the wide belt of bluish-black graphitic slate of this age, at Whitehaven, between Marshall Cove and the mouth of the Wash Brook, and stretching eastward to Larry's River, has not yet been clearly made out. Two bands, over a quarter of a mile wide, of pearly, glistening siliceous rock, full of stout, short crystals of andalusite, occur in this belt, separated on both sides from the black slate by a few hundred yards of quartzite and gray slate, resembling rocks of the quartzite group, while the andalusite rock is unlike any other in the district. One band extends westward from the Spear Lake, crosses the Whitehaven road at its junction with the Port Felix road, passes at the head of Port Felix Cove, a little above the school-house, is shown at the outer part of the western point of English Cove, and along Charlo's Cove, and extends perhaps to Larry's River, half a mile above the chapel, where much *débris* is seen. The other appears at Poulet Point, and further north, along the shores of Whitehaven and Whitehaven.

Rocks higher than the black slate group.

Port Felix. They seem to come in on two of the three synclinal axes in the black slates, and thus most probably overlie them; in which case we have here a group of rocks newer than the graphitic slate, which it would be interesting to compare with the upper divisions of the Cambrian of the Eastern Townships.

New Harbour fault.

A close examination of the quartzites on both sides of New Harbour Cove indicates a fault running along the harbour. The well defined anticlinal and synclinal on the east side are repeated on the west side, but are here about a quarter of a mile further south, and have also changed considerably in direction, the result of a displacement of about a quarter of a mile to the north on the east side of the line of faulting. The rocks on both sides are crossed by numerous veins of quartz running north and south across the strike.

Quartz veins.

The belt of bluish-black slate which crosses New Harbour River at the mouth of Patterson Brook, appears also to have been subjected to a break of about the same amount, but nothing very definite can be said about it. This fault probably extends north-westward along New Harbour River, the boundary of the granite, and thence in a northerly direction to the Salmon River fault, thus dividing the Chedabucto and Isaac's Harbour districts. This supposition is strengthened by the remarkable straightness of the lower part of New Harbour River, which nearly coincides with the boundary of the granite; but the direction of the part running north, from a little above the Third Fork, is very indefinite. A broad synclinal probably passes near the east end of Loon Lake and runs north to Salmon River, toward which the axes of the synclinals and anticlinals dip on both sides. This would account for the many belts of bluish-black slate branching off in that vicinity, and for the thinning of the whin belts from both sides.

Area.

2. *Isaac's Harbour District.*—This district extends from the line of fault at New Harbour River to Country Harbour, and from Salmon River to the sea-shore. In the northern portion are many masses of granite, in the neighborhood of which the stratified rocks assume, like those of the first district, a schistose or gneissoid character. Blocks of quartzite and granite are very abundant, but outcrops are rare; this fact, together with the total absence of the bluish-black slate, makes it impossible to ascertain the structure.

Granite.

Black slate.

The southern part of the district is crossed by two bands of bluish-black slate. One of these, already referred to, crosses the New Harbour River, but apparently runs no further west than the south end of Ocean Lake. The other crosses Isaac's Harbour, a few hundred yards above the post-offices on the east and west sides, in a deep, sharp synclinal, which extends due west as far as Country Harbour, and prob-

ably not more than two miles and a half east of Isaac's Harbour. But the synclinal axis still continues its course eastward, passing immediately south of Sponagle and Barss Lakes to New Harbour Cove, where it has been already mentioned.

About a mile south of this axis, an anticlinal runs parallel with it as far as Country Harbour in one direction, and New Harbour in the other. It passes immediately south of the main shore of Coddles Harbour, where the strata are beautifully exposed and dip N. 17° E. < 45°–55°; but further east, the angle gradually decreases, and, within three-quarters of a mile of New Harbour Head, the rocks are seen dipping both ways, and the axis itself dips a little south of east at an angle of 20°. The same also occurs on the New Harbour end of the anticlinal. Coddles Harbour anticlinal.

The auriferous measures worked on the east and west sides of Isaac's Harbour lie on both sides of this anticlinal. Isaac's Harbour gold-mines.

3. *Indian River District.*—This district includes the Lower Cambrian rocks between Country Harbour and St. Mary's River, and is mostly drained by Indian River and the Indian Harbour chain of lakes. The strata along the west side of Country Harbour are well exposed, and belong to the lower group. The structure is sufficiently clear, as may be seen on the map, where the anticlinal and synclinal axes are indicated. The section on this side, however, does not, as already stated, seem to correspond with that on the east side, but is obscure, for want of good outcrops. The question of the existence of a fault in the harbour must be determined by more detailed examinations on the east side, although the small dykes of granite running parallel with the harbour, between Squint's Brook and Armstrong Creek, the many lines of dislocation of the highly altered strata, also following the harbour between Mount Misery and a point three-quarters of a mile above the mouth of Armstrong Brook, and the numerous slickensided surfaces, are strong proofs of its existence. Moreover, no sign of the Isaac's Harbour bluish-black slate is seen on the west side, the nearest belt being on Fisherman's Harbour, more than four miles south, and the nearest synclinal one mile and a half south, that is, a quarter of a mile below Lucas Beach, exposing none of the upper slate group. There is nothing to show which of these two axes is the continuation of the synclinal of Isaac's Harbour, except that the sharpness and structure of the synclinal of Fisherman's Harbour, together with its bluish-black slate, make it resemble more closely the latter. The northern part of this district, like the preceding, is cut by numerous masses and dykes of granite which have metamorphosed the surrounding rocks for a width of one mile or more. Extent. Folds. Faults. Granite.

Auriferous belt

The auriferous belt brought up by the most northerly anticlinal of the district, and running from Cochran's Hill to the Narrows of Country Harbour, is disturbed by many dykes and veins of granite, already described, and has numerous true quartz-veins intercalated. The auriferous measures up Johnson's Brook, on the east side of Country Harbour, are apparently the same rocks, but run in a direction different from that of any other strata of this region, their general orientation being N. 20° W. along the western face of a mass of granite. This belt is undoubtedly the continuation of that of Cochran's Hill, faulted either by the Country Harbour fault or by some local dislocation produced by the upheaval of the granite.

Johnson's Brook.

Cochran's Hill.

Black slate.

Between a mile and a mile and a quarter south of this Cochran's Hill belt, a band of graphitic slate is left undenuded along the axis of a synclinal. It is seen at Waternish, and extends westward beyond the St. Mary's River, the southern edge of the band crossing the Sherbrooke road at the bridge over Cochran's Hill Brook which exposes a section of the whole band. It extends north on the brook to a forty-feet fall, which makes a width of nearly half a mile. From this brook it apparently runs due east, being seen from a quarter to three-quarters of a mile north of the Bull-ridge; but it seems to extend no further, no trace of it being seen below the Head Lake. The irregularity in the strike and dip of the rocks here, clearly shows that they have been greatly disturbed by the adjacent granite and that the lower group has been brought up along the synclinal axis in its course eastward. No indication of the upper group is then seen till Country Harbour, in the vicinity of Charles Hind's farm opposite Stormont post-office. At Cochran's Hill, the strata on the north side of the synclinal, present an overturned dip to the north, varying between 60° and 85°, as far as the auriferous belt which is here about one mile below the lowest bed of the graphitic slate group. At Country Harbour, the dips seem to average 45° on both sides of the synclinal, but the outcrops are obscure.

Waternish synclinal.

Lower group.

The lower group occupies all that portion of the district lying between the Waternish band of slate and the next, which is about two miles below Sherbrooke. It is folded in at least two principal anticlinal curves and one synclinal, the position and course of which, although not always well defined, have been mapped as accurately as possible. The most northerly of the anticlinals is about three miles south of the Waternish slate belt, but the intervening strata are no doubt affected by other folds of less magnitude, as is also the case along Country Harbour, where an anticlinal and a synclinal are met with within a quarter of a mile of each other. This first anticlinal crosses Stillwater about half a mile below the school-house, thence follows the west branch of Archibald Brook, and probably strikes the west

Folds.

Stillwater anticlinal.

side of Country Harbour half a mile above Mount Misery. The strata on both sides of this axis generally dip at an angle varying between 70° and the vertical, except above Falconer's Lake, where the angles are as low as 45°.

A few auriferous quartz-veins have been prospected in the vicinity of the anticlinal on Alexander McDonald's farm. Although greatly altered, the strata are not near any masses of granite, but are no doubt associated with dykes or veins, only one of which, however, has been observed at the outlet of Archibald Lake. Many blocks of granite occur in the vicinity of this axis, a little below the second fork of Indian River, perhaps derived from a neighboring dyke or small mass. From a mile to two miles south of this anticlinal the strata are affected by a minor fold, extending no great distance to the eastward of St. Mary's River, but forming to the westward two of the principal axes of the next district.

Sherbrooke synclinal.

The next principal plication is the Sherbrooke synclinal, about three miles south of the Stillwater anticlinal, a well defined and comparatively broad synclinal bringing to the surface the upper strata of the lower group. It crosses the Sherbrooke road 1,000 feet above the English church, and is well seen on the north-west side of the track to Indian Harbour Lakes, as a semi-elliptical basin, the longer axis of which runs south of west across the river, where its prolongation is also one of the principal synclinals of the next district. To the eastward, its strata come in contact with the Sherbrooke granite, and may be said to dip away from it, although some of the contacts, when examined minutely, show clearly that they are cut by the granite, as if the latter had partly pushed upward the strata of the synclinal and partly cut through them. The synclinal, on the opposite side of this granite mass, apparently resumes its course eastward, and extends to Country Harbour, a quarter of a mile below Lucas Beach, where it is also very broad. The strata, quite horizontal at the axis, dip to the north at an angle gradually increasing from 10° to 70°, while on the south side the dip increases to 62°, and averages about 35°. No sign of the graphitic slate was seen in this synclinal, but it evidently displays the very top of the lower group, as may be seen by comparing its section along the western side of Country Harbour with that of the synclinal of Fisherman's Harbour.

Lucas Beach.

Goldenville anticlinal.

About one mile and a half south of the last axis comes the Goldenville anticlinal. The part of this axis west of the Sherbrooke granite, to a little beyond Goldenville, has been well described by Professor Hind in his report on the Sherbrooke gold district.*

Hind's description.

The strata on the point of land south of Mill Cove are seen, on the

*Journal of the Geological Society of London, Vol. XXVI., pp. 469-479.

face of a small cliff, to lie quite horizontal; in proceeding north, they dip to the north at a low angle gradually increasing to 50° on the Sherbrooke main street, where the Goldenville road leaves it, and then decreasing to the last synclinal. Less than a hundred yards to the south of the cliff, on the other hand, the strata suddenly dip perpendicularly, and are even overturned to the north 70° between this point and the St. Mary's Bay synclinal, two miles further down. The granite mass has here also pushed up the strata considerably, giving a western dip to the anticlinal axis. The rocks are found to continue their course on the opposite side, and still form an anticlinal, running eastward along the West Branch of Indian River and Squint's Brook, and coming to the shore of Country Harbour, a quarter of a mile below the mouth of this brook. Here, as at Sherbrooke, the steep side of the axis is on the south, where the angle of dip averages 84°, while the north side is more gently inclined. Many quartz-veins, one foot thick and less, run along the anticlinal, about one hundred yards south of the first fork of Indian River; they will be again referred to

Influence of the granite.

Squint's Brook.

Quartz-veins.

St. Mary's Bay synclinal.

The next fold is nearly two miles south of the Goldenville anticlinal and presents the deepest and most persistent synclinal axis of the region. It offers a very good section of the graphitic slate group, for nearly three-quarters of a mile on both sides of the St. Mary's River from the mouth of Mitchell Lake Brook to about two hundred yards below the school-house. The band of slate runs due east along Mitchell Lake Brook, takes in the southern part of the lake, and extends to within a short distance of the lower Indian Harbour Lake, where it is cut by a fault, but, about half a mile further north, shows again on both sides of the lake, still running east and west. This fault, as already mentioned, seems to run from Indian Harbour, a short distance below the beach, north-westerly to the Sherbrooke granite, and most probably from the northern side of this mass to Melrose; for the strata have been greatly disturbed immediately east of the St. Mary's River, and have all received a twist which may be accompanied by a fault The total shove here on the east, including the twisting, is one-half or three-quarters of a mile to the north, or about the same as that of Indian Harbour, and there is good reason to believe that it is also due to the upthrow of the Sherbrooke granite. The width of the slate band on Indian Harbour Lake is very little over a quarter of a mile; it crosses the lake about half a mile above the beach, and runs a few degrees north of east to Indian River, which it crosses from a quarter of a mile to one mile north of the shore road, thence running due east in a low, swampy depression, to Fisherman's Harbour. The northern edge of the band is, at low tide, well exposed on the north shore of the harbour, where the bluish-black splintery slate,

Black slate.

Fault.

Indian Harbour

Fisherman's Harbour.

dipping south at an angle of 75° to 85°, is followed by layers of greenish argillaceous slate, succeeded by a few thin layers of quartzite and gray slate, and for nearly a mile up the east side of Country Harbour Head, by a good, uninterrupted section of the quartzite group which shows many intercalated veins of quartz. The southern edge of the band of slate undoubtedly keeps along the south side of the harbour, but no outcrops have been noticed here. The rocks on both sides of this synclinal, dip at angles varying between 80° and 90° and are even overturned.

Country Harbour Head.

Good section of the quartzite group.

About one mile and a half south of the St. Mary's Bay synclinal is the Wine Harbour anticlinal axis. It crosses the St. Mary's River half a mile below Pride's ferry, passes eastward to the foot of Cooper's Lake, and comes to the sea-shore a little above Rude Point, where the strata are well exposed and the fold well defined. As at Goldenville, the strata on the south side of the axis dip at a very high angle, while on the north, the angle of dip, quite small near the fold, gradually increases to over 80° on approaching the last synclinal. The Wine Harbour auriferous district extends immediately south of this line of folding. The anticlinal is also seen further west on the sea-shore, halfway between Port Hilford and Holland's Harbour, but is here over three-quarters of a mile north of its course at Wine Harbour, this difference representing the extent of the shove it has received from the Indian Harbour fault, and proving that the line of fault lies between the shores of Indian Harbour. Eastward, the Indian Harbour anticlinal keeps along the northern shore of Holland's Harbour, and passes somewhere near the post-office at Port Beckerton and a little north of the southern extremity of Barachois Head.

Wine Harbour anticlinal.

Fault.

The next and last fold of this district is about one mile and a quarter south of the Wine Harbour anticlinal. It crosses the St. Mary's River near the Sonora church, and runs to the sea-shore immediately south of Wine Head, a distance of a little over four miles. On the west side of the river it presents a large exposure of bluish-black slate, and a band of this slate certainly keeps along this axis as far as Wine Head, although only a few blocks and débris of the slates are seen all along and a small exposure near the head; for the thickness of the strata, measured between the Wine Harbour anticlinal and the lower beds of the bluish-black slate group of the St. Mary's Bay synclinal, being very little over a mile, and that between the strata of the same anticlinal and the Sonora synclinal being greater, a certain thickness of the bluish-black slate must represent the difference.

Sonora synclinal.

Black slate.

4. *Liscomb, Moser's, and Salmon Rivers District.*—This district lies west of that last described and includes the Lower Cambrian rocks

Extent. between the St. Mary's and Sheet Harbour Rivers. Its length between these two rivers is thirty miles, and the breadth at its widest part, thirty-two miles between the islands off Sheet Harbour and Caledonia. The general direction of strike of the rocks is S. 80° W. and N. 80° E. and in no case does it vary more than 10° on either side of this course.

Granite. The two bands composing the granite area of the West River of St. Mary's in the northern part of this district and that of Trafalgar, which forms, however, its western limit at the Liscomb Lakes, are the only masses of granite which occur; and the few much-altered rocks are altogether confined to their neighborhood, with the exception of those

Salmon River mine. near the Salmon River mine. These consist of a silvery-gray staurolite-gneiss found in blocks along the river a little above the crusher, undoubtedly derived from the country rock in the proximity of some mass or dyke of granite which does not, perhaps, quite reach the surface. The beautiful aggregations of transparent crystals of quartz often found

Faults. in the thick leads of this mine with calcite, galena, pyrites and other minerals, must also be due to the same mass. Many small local faults have been noticed in various places, but none of such extent as to affect the general structure of the strata as in the districts just described, and this is no doubt due to the scarcity of granite masses or their non-appearance at the surface.

Flexures. Deep synclinals and lofty anticlinals here succeed one another very regularly; so that whenever a band of the characteristic graphitic slate occurs along a synclinal, it is always found on the opposite side of the following anticlinal at the same distance (reduced according to the angle of dip). The folding process seems to have been slow and uniform and to have occurred when these rocks were still plastic, otherwise they would have been greatly faulted.

Eleven anticlinals. Eleven principal anticlinals and as many synclinals have been traced between Beaver Island, off Beaver Harbour, and Caledonia; four of them are the continuation of those in the Indian River district. Some have been accurately defined and mapped, but others, especially the anticlinals, require careful re-examination on account of their close relation with the gold mines.

For this reason it will be better to simply enumerate them and to defer for the present, a fuller and more accurate description.

Beginning with the most northerly, the eleven anticlinals and synclinals alternate as follows:—

1st. Synclinal: runs from Fraser Brook about 2,000 feet above West River to McQuarrie's Mill-brook, half a mile above the same river, and is overlain at both ends by Carboniferous strata.

1st. Anticlinal: Cochran's Hill auriferous belt; passing westward by the north end of Kelly's Lake.

2nd. Synclinal: not traced.

2nd. Anticlinal: follows Little Liscomb River from Methiff's Brook to its source, but was not traced east or west of this river.

3rd. Synclinal: Waternish synclinal; extends to Rocky Lake of Crooked Brook and beyond.

3rd. Anticlinal: not traced, but passes a mile south of the confluence of Big Brook and Liscomb River.

4th. Synclinal: not traced, but seen at the confluence of Crooked Brook and Liscomb River, and below Moose-bog Camp.

4th. Anticlinal: passes near the Dreadnaught dam and at the cofluence of Black Brook and Liscomb River, where it shows leads said to be auriferous.

5th. Synclinal: Sherbrooke synclinal; extends to the Long Lake of Moser's River and beyond.

5th. Anticlinal: Goldenville anticlinal; passes at the Rainbow, Moser's River, on its course westward.

6th. Synclinal: St. Mary's Bay synclinal; crosses Shoaly and Cross Lakes of Salmon River.

6th. Anticlinal: Wine Harbour anticlinal; runs out somewhere above the Stillwater of Liscomb River.

7th. Synclinal: Sonora synclinal; also runs out near the head of the Stillwater of Liscomb River.

7th. Anticlinal: from Barachois Point, passes a quarter of a mile above Wilson's Fall on Moser's River.

8th. Synclinal: Spar Lake synclinal; begins half a mile north of Liscomb Mill, and extends westward, passing one mile above Salmon River mine.

8th. Anticlinal: Salmon River mine anticlinal; extends westward, but runs out to the eastward near Liscomb River.
Brook.

9th. Synclinal: Liscomb Harbour synclinal; from Liscomb Island to Sheet Harbour and beyond.

9th. Anticlinal: Ecum Secum anticlinal; leaves the sea-shore near Lang Pond beach, and passes at Ecum Secum mine, r short distance north of Moosehead and Harrigan Cove mines, crossing Salmon River a quarter of a mile above the bridge at Moorehead and Harrigan Cove mine.

10th. Synclinal: begins along the sea-shore between Barren Island and Smith Point, and passes westward at Beaver Harbour.

10th. Anticlinal: from Tuffin Island runs westward between Back Cove and Beaver Harbour.

11th. Synclinal: begina north of Bird Islands (?) and passes along Sober Island Passage.

11th. Anticlinal: also begins north of Bird Islands (?) and passes between Horse Island and Sutherland's Island.

Of these, seven anticlinals and six synclinals run through the district from one end to the other; the others either begin or end in it. The third, fourth, fifth, sixth, seventh eighth and ninth synclinals display the upper graphitic slate along their course. Black slate.

North and south folds merely local.

It may further be remarked that there appears to be no proper north and south anticlinal or synclinal crossing this district all the way from one side to the other; but there are many local ones, sometimes of great extent. One broad synclinal, running approximately north and south, occurs west of the Sherbrooke gold-district, and is described by Professor Hind in his report on the district, already quoted. The axis does not appear to extend far north of this district, and most probably runs west of south to the sea-shore between Bird Islands and Halibut Islands; but whether it is uninterrupted between these two points, has not yet been ascertained. A cross anticlinal may also run between the village of Sherbrooke and Barren Island, and another between Salmon River mine and Sober Island, but nothing positive can be said about them at present.

General Structure of the Gold Districts.

List of reports on the gold-bearing rocks.

Several of the principal gold-districts of the province have been studied minutely and reported upon by different authorities, and more especially by Dr. A. R. C. Selwyn, Dr. T. Sterry Hunt, Dr. B. Silliman, Prof. H. Youle Hind, and Messrs. John Campbell, Henry Poole, A. Heatherington, H. S. Poole, and Edwin Gilpin.

The following list of reports and pamphlets relating to the Lower Cambrian rocks and the gold-districts, given in chronological order, may be of use to those interested in the study of them.

Gesner: Remarks on the Geology and Mineralogy of Nova Scotia, 1336; The Industrial Resources of Nova Scotia, 1849; Gold-fields of Nova Scotia, 1862; Gold and its Separation from other Minerals, 1863, Trans. N. S. Inst. Nat. Sc., Vol. I., part 1, page 54.

Dawson: Metamorphic and Metalliferous Rocks of the Atlantic Coast of Nova Scotia, 1850, in the Journal of the Geological Society of London, Vol. VI., pp. 347-364; On the Recent Discoveries of Gold in Nova Scotia, 1861, in the Canadian Naturalist, Vol. VI., p. 417; Acadian Geology, 1855, second edition, 1868, and supplement, 1878.

Marsh: The Gold of Nova Scotia, 1861, Amer. Jour. of Science and Arts, Vol. XXXII.

Honeyman: Geology of the Gold-fields of N. S., 1862, Quarterly Jour. Geol. Soc. Vol. XVIII., p. 342; Report on Gay's River Gold-fields, 1866, Trans. N. S. Inst. of Nat. Sc., Vol. II., Part 1, p. 76; Micro-Polariscopic Investigation of the Crystalline Rocks of the Gold-bearing series of Yarmouth, N. S., 1882, ditto, Vol. VI., p. 7; Geology of Halifax and Colchester Counties, 1883, do p. 52. Other Notes by the same author are scattered through the Trans. N. S. Inst. of Nat. Sc.

Annual Reports of the Dept. of Mines of Nova Scotia, 1862-1886.

Poole: Report on the Western Gold District of N. S.

Campbell: Nova Scotia Gold-fields, with section, 1863; Report on the Chebucto Gold Mining Co. of Waverly Gold District, 1864; Report on the Indian Path Gold Mine of Lunenburg District, with plan, 1869.

Silliman: A Report on the New York and Nova Scotia Gold Mining Co. of Tangier District, with plan; Report on the Atlantic Gold Mining Co., also of Tangier District, with plan; Report on the Oldham and Boston Gold Mining Co. of Oldham District; the three printed separately in 1864, with a general Introduction on the Gold Region of N. S.; Barrel Quartz of N.S., 1864, Silliman's Jour. 2nd series, Vol. XXXVIII., page 104.

Hartt: Gold of N. S. of Pre-Carboniferous age, 1864, Can. Nat., new series, Vol. I., p. 459.

Perley: Gold Mines and Gold Mining in N. S., 1865, Can. Nat., new series, Vol. II., p. 198.

Belt: The Glacial Period in North America (Gold in the drift of Nova Scotia), 1866, Trans. N. S. Inst. of Nat. Sc., Vol. I., part III., p. 91.

Hamilton: The Auriferous Deposits of N. S., 1866, Trans. of N. S. Inst. Nat. Sc., Vol. I., p. 43.

Hunt: Gold Region of Nova Scotia, 1368, Report of Geol. Survey of Canada; On the Geology of Eastern New England and N. S., 1870, Amer. Jour. Sc. (2), L., pages 87 and 133.

Bell, Barnes and Heatherington: Report on the Eureka Gold Mining Co., with a plan of the Wine Harbour Gold District, 1868.

Hind: Report on the Waverly Gold District with maps and sections, 1869; Report on the Eureka Gold Mining Co. of Wine Harbour, 1869; Nova Scotia Gold Districts, 1869, Trans. N. S. Inst. of Nat. Sc. Vol. II., Part III., page 102; Report on the Sherbrooke Gold District, with maps and sections, together with papers on the Gneisses of Nova Scotia, and on Gold Mining in N. S.; printed in a pamphlet in 1870, and given in abstract in the Jour. Geol. Soc. of London, Vol. XXVI., pp. 468-479; Preliminary Report on the Gneissic series underlying the Gold-bearing Rocks of N. S., 1870; Report on the Strawberry Hill, Burlington and Mooseland Mines of Tangier District, 1870; Gold Mining and its Prospects in Nova Scotia, embodying results of Geological Surveys of the Districts of Waverly and Sherbrooke, 1870; Report on Mount Uniacke, Oldham and Renfrew Mining Districts, with plans and sections, 1872; Report on the Indian Path Gold Mine of Lunenburg District, 1873.

How: Mineralogy of Nova Scotia, 1869.

Selwyn: Notes and Observations on the Gold-fields of Quebec and Nova Scotia; Report of Geological Survey of Canada, 1870-71, p. 252.

Heatherington: Practical Guide to the Gold Mines of Nova Scotia, 1869; Mining Industries of Nova Scotia, 1874.

Descriptive Catalogues of Economic Minerals of Canada, 1876, pp. 43–44; 1886, pp. 63–65.

Gilpin: Mines and Mineral Lands of Nova Scotia, 1880; The Gold-fields of Nova Scotia, with a map, 1882, Trans. North of England Inst. of Mining Engineers; The Nova Scotia Gold Mines, with a map, 1886, Trans. of the American Inst. of Mining Engineers.

H. S. Poole: Report of Department of Mines, N. S., 1873–1879; Jour. of Geol. Soc. of London, Vol. XXVI., pp. 307–313.

Gold-mines in operation.

There are ten gold mining localities in the region examined between Cape Canso and Sheet Harbour River. Mining operations are at present carried on in the six following: Darr's Hill or Salmon River, Golden-

Salmon River mine.

ville, Cochran's Hill, Narrows of Country Harbour, Isaac's Harbour and Wine Harbour. In some of these, several mines are or have been worked to some extent. The Dufferin Gold Mining Company of Salmon River is stated in the annual report of the Department of Mines of Nova Scotia for 1886, to have "proved to be the most permanent of the gold mining corporations of the province." During the past year, the returns show that 11,628 tons of quartz yielded 6,509 ounces of gold.

Old mines.

being a total to date of 24,556 ounces from 44,881 tons of quartz.

Several years ago work was done to some extent in the four other districts of Old Country Harbour, Ecum Secum, Moosehead and Harrigan Cove, but it has not been resumed.

Auriferous veins not worked.

Many quartz-leads found outside these districts contain also visible gold, but have not yet been worked. Among these are the veins passing a little to the south of the first fork of Indian River; those on Alex. McDonald's farm at Stillwater; those on the west side of Goldenville Lake, and on the portage road on the west side of Liscomb River, a little distance above the mill; the vein crossing the east branch of Liscomb River, a little below the embouchure of the Black Brook; those of the Gold-mine Brook, and that on the east branch of Rabbit-plain Brook. Some of these leads may yet prove rich.

No minute surveys or detailed examinations of the above mentioned gold districts have been made, but a few remarks relating to their general structure may, however, be given.

The auriferous veins near the antiolinal axes.

In examining the map, it will be found that all the gold mines are on, or in close proximity to, the anticlinal axes, and this is also true of the auriferous leads above mentioned.

Distance of the gold belts from the black slate.

The vertical distance of the different gold belts of this region, from the base of the upper graphitic slate, is shown in the following list:—

Name of the belt.	*N. or S. dip and angle of the rocks.*	*Vertical distance to the upper slate band.* FEET.
Consolidated Gold Mining Co. of Isaac's Harbour District	S. < 60°	4,000
Gallagher Gold Mining Co.	N. < 63°	4,000
Victoria Gold Mining Co.	N. < 78°	2,800
Star Gold Mining Co.	N. < 65°	4,620
Wine Harbour Gold District	S. < 75°–85°	4,620
Sherbrooke " "	N. < 45°; S. < 90°	8,000
Cochran's Hill Gold Mine	N. < 80°	4,620
Crow's Nest " "	N. < 87°	6,600
Ecum Secum " "	N. < 70°; S. <50°	5,940
Moosehead " "	S. < 55°	(?)
Harrigan Cove " "	S. < 65°	(?)
Salmon River or Darr's Hill Mine	N. < 80°; S. < 65°	2,800

It will be seen from this table that all the gold belts occur at a distance below the base of the graphitic slate, varying between 2,800 and 8,000 feet. Should this hold true of the gold belts west of this region, we shall have a thickness of 5,200 feet of productive gold measures out of the total 15,000 feet of the Lower Cambrian, or about one-third. From observations made by Poole, Campbell, Hind and others, such is most probably the case, but nothing positive can be asserted till the general structure of the rest of the Lower Cambrian of the Atlantic coast has been thoroughly made out. Many intercalated quartz-veins are also found in the lower portion of the quartzite group, and in the upper graphitic slate group, not in such large numbers, however, as at the horizon of the auriferous measures; few, moreover, contain gold, and only in very small quantity. Barren quartz-veins.

Three-quarters of a mile west of the junction, a few quartz-veins, cutting slightly across altered black slates of the upper group, were found to contain traces of gold. Half a mile west of Moser's River, above the saw-mill, a vein of rusty quartz, four feet thick, apparently following the strike of the upper graphitic slate, was opened, but found very poor in gold. It may, therefore, be concluded that the upper part of the series also carries gold, but in very small quantity; but no instances are known in which the lower portion of the quartzite group contains auriferous quartz-veins. Auriferous veins in the black slate.

Admitting that the horizon of the gold is a little above the middle of the quartzite group, the auriferous measures could certainly be found at the surface, only along the anticlinals by which they have been brought up and where their edges may have been exposed by denudation. Horizon of the gold.

It has been advocated by Campbell, Hind and others that the gold districts occurred at the intersection of broad north and south upheavals, with the sharp east and west anticlinals. Such is certainly the case with the Sherbrooke and Ecum Secum districts, and perhaps also with that of Salmon River, while the Wine Harbour gold district is rather on a north and south depression, and the others do not seem to be connected with the intersection of an anticlinal with either upheaval or depression; therefore, nothing very definite can be said about them. North and south upheavals.

The origin, mode of occurrence, and extension of the auriferous lodes have been discussed by Dr. Selwyn, in his report for 1870-71, already referred to. Origin of the veins.

Economic Minerals other than Gold.

The Lower Cambrian of the Atlantic coast contains, besides gold, few minerals which can be regarded as of economic value.

Silver.—Argentiferous galena is found in small quantity in many auriferous quartz-veins, especially when these are in close proximity to granite masses, as at Goldenville, Crow's Nest and Salmon River; and the gold usually contains a small percentage of silver. But the only place where galena was found in large quantity is at Smithfield, on the south bank of the West River of St. Mary's, two miles west of Glenelg, where it occurs in small veins cutting the narrow belt of quartzite left between the granite of the south-side of the river and the overlying Carboniferous conglomerate. Mr. Henry S. Poole* gives the following results of two analyses of this ore:—

Smithfield.

Poole's analyses.

	No. 1	No. 2
Lead	86·12	86·02
†Silver	·044	·049
Iron	·07	·02
Copper	·03	·03
Zinc	absent.	absent.
Arsenic	mere traces.	mere traces.
Antimony	mere traces.	mere traces.
Sulphur	13·32	13·30
Lime	trace.	trace.
Magnesia	trace.	·18
Silica (sand)	·426	·402
Moisture	trace.	trace.
	100·00	100·00
†Equal to per ton	15·75 oz.	17·75 oz.

Mr. Howard Clark prospected this locality some years ago, and took out several tons of the ore; but nothing has been done since 1884. In various places along the northern boundary of the Lower Cambrian rocks between Melrose and Smithfield, the crushed slate already referred to has also been mined, but only minute traces of galena have so far been discovered

Copper Ore.—Copper pyrites is generally found associated with arsenical pyrites and other minerals in the auriferous lodes as, for example, on the south side of the Canso road, half a mile east of its junction with the Whitehaven road, on the farm of Mr. John Reynolds. Here it occurs in a vein composed of quartz and granite and already mentioned in the description of the first granite area. Both the quartz and granite, which are intimately mixed, contain yellow and horse-flesh copper ore, iron-pyrites, mispickel and green clay. It was opened in 1881 and 1882 by means of cross trenches, but abandoned.

Canso.

* Report of the Department of Mines of Nova Scotia for 1875, p. 63.

Arsenical Pyrites.—Massive and crystalline arsenical pyrites is often associated with quartz in wide veins near the granite masses. On the north side of the Sherbrooke district, a vein four or five feet wide, Sherbrooke. mostly composed of massive mispickel, contains also, no doubt, a large quantity of gold.

Iron Ore.—Some of the layers of the upper graphitic slate contain a considerable quantity of magnetite and hæmatite. I was informed by a land surveyor that, while engaged in surveying some lines at the Liscomb River. head of the Slate Rock Brook on the east branch of Liscomb River, exactly where the upper slate band crosses the brook, he found the magnetic needle of his compass greatly affected. The rocks of this band were also noticed to be in that vicinity particularly charged with iron ore.

Building-stone, Bricks, etc.—The adaptability of the granite for building purposes has already been mentioned. The fine red granite at the Red granite. Ogden school-house, as well as some fine-grained, reddish-gray and gray varieties, are susceptible of a beautiful polish. The Whitehaven granite has also been used for millstones, and several ship-loads were, Millstones. some years ago, taken for this purpose from Millstone Island.

Some of the bluish-black layers of the upper graphitic slate, are Whetstones. known to make excellent whetstones, and a quantity of this slate from St. Mary's Bay, one mile and a half below Sherbrooke, sent to the United States, is said to have been well appreciated.

At Stillwater, good sand, and clay suitable for brick-making, occur Bricks. along the banks of the river, but the demand here is so limited that very few bricks have been made.