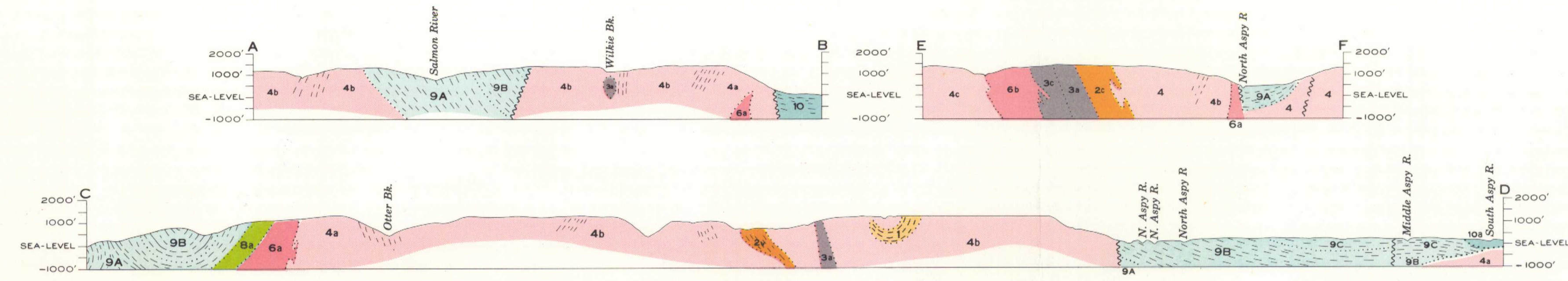
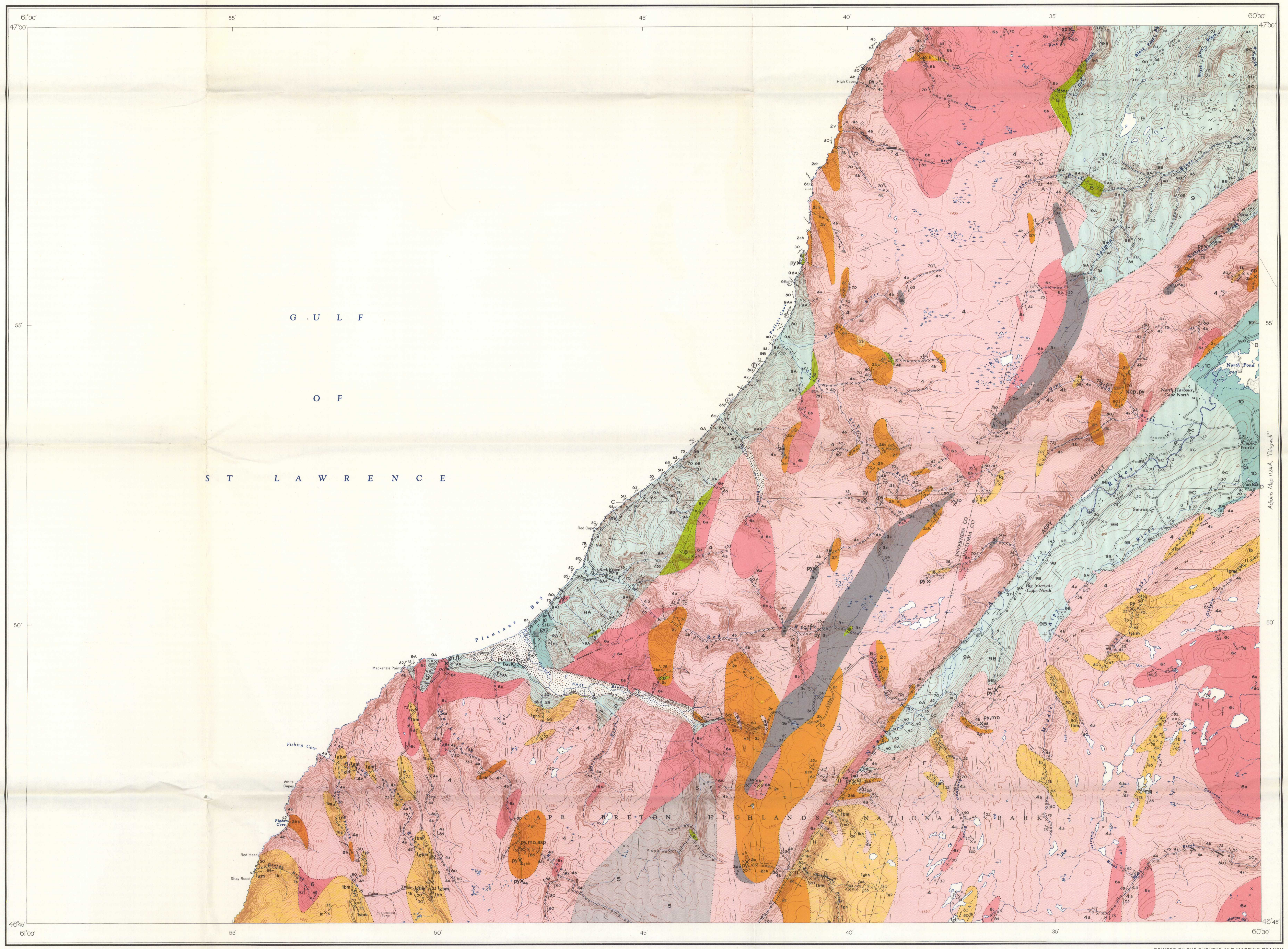
GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS



Sections along lines A-B, C-D, and E-F

SHEET 11 K/15



LEGEND

PALÆOZOIC

MISSISSIPPIAN

WINDSOR GROUP

10 — *Limestone, red and grey limy siltstone, gypsum;* 10a, *thinly laminated limestone*

HORTON GROUP

9 — *Pale red sandstone, siltstone, and conglomerate; minor grey sandstone and siltstone (chiefly 9A)*
9C, *Upper Unit: red arkosic sandstone, siltstone, and conglomerate; minor grey sandstone and siltstone; rare beds of limestone and limestone conglomerate*
9B, *Middle Unit: grey micaceous sandstone, siltstone and conglomerate; minor limestone, and limy siltstone and limestone conglomerate; rare beds of red sandstone and conglomerate;*
9Ba, *sheared micaceous conglomerate, graphitic shale and schist; minor limestone*
9A, *Lower Unit: red arkosic sandstone, conglomerate, and siltstone; minor grey sandstone and conglomerate;* 9Aa, *facies containing abundant detrital fragments of rhyolite porphyry*

DEVONIAN OR EARLIER

8 — *Rhyolite porphyry;* 8a, *flow-layered aphanitic rhyolite;* 8b, *facies with intercalated pale red sandstone, siltstone, and conglomerate*

7 — *Diabasic gabbro dykes*

6 — 6a, *granite;* 6b *syenite; minor syenodiorite;* 6c, *granodiorite*

5 — *Coarse-grained porphyroblastic granite*

4 — *Composite gneiss and hybrid rocks:* 4a, *granitic rocks with unit 1;* 4b, *granitic rocks with unit 2;* 4c, *granitic rocks with unit 3*

PRECAMBRIAN (?)

3 — 3a, *meta-anorthosite;* 3b, *meta-gabbro;* 3c, *meta-diorite*

GEORGE RIVER GROUP (?) (1,2)

1, 2 — 1. *Mainly quartz-feldspar schists and gneisses with:* 1m, *muscovite;* 1b, *biotite;* 1c, *chlorite;* 1g, *garnet;* 1h, *hornblende;* 1s, *staurolite; also* 1q, *minor quartzite and feldspathic quartzite;* 1l, *crystalline limestone and calcareous metasedimentary rocks*
2. *Mainly basic schists and gneisses with:* 2b, *biotite;* 2c, *chlorite;* 2h, *hornblende;* 2g, *garnet; also* 2v, *minor massive basic metavolcanic rocks*

Fluviatile sand and gravel
Bedding (horizontal, inclined, overturned, upper side of bed unknown)
Foliation and schistosity (inclined, vertical)
Lineation (plunge known)
Fault (defined, approximate, assumed, solid circle indicates downthrow side)
Anticline (approximate)
Syncline (approximate)
Topographic linears
Gypsum outcrop
Sink-hole . . . S.H.
Fossil locality . . . Ⓕ
Mineral occurrence . . . cp ×

MINERAL SYMBOLS

Arsenopyrite	asp	*Gypsum*	gyp
Chalcopyrite	cp	*Molybdenite*	mo
Fluorite	fl	*Pyrite*	py
Galena	gn	*Sphalerite*	sp

Geology by E. R. W. Neale, 1954-1955

Base-map compiled and drawn by the Surveys and Mapping Branch

Air photographs covering this map-area may be obtained through the National Air Photographic Library, Topographical Survey, Ottawa, Ontario

Approximate magnetic declination 25° 54′ West, decreasing 2.8′ annually

DESCRIPTIVE NOTES

This area constitutes the northern part of a deeply dissected, uplifted peneplain known as the Cape Breton Highlands. Remnants of this flat-topped upland include swampy areas and sparsely wooded barrens that range from 1,400 to 1,500 feet in elevation. They are underlain chiefly by resistant crystalline rocks. Narrow lowland areas, underlain by easily eroded sedimentary rocks and partly bounded by steep fault-line scarps, extend into the upland along the valleys of Grande Anse and North Aspy Rivers.

Striæ in adjacent map-areas suggest that Pleistocene ice-movement was eastward. A thin veneer of coarse, stony, glacial till covers much of the upland area and apparently once filled or partly filled the river valleys. Most of the major streams have carved through this till and flow in large part over bedrock. However, the steep valley sides are largely covered with glacial debris and many of the minor tributaries flow entirely through drift. Many of the ungraded junctions of tributaries with trunk streams are caused by dams of drift. Proglacial meltwater streams locally reworked the till cover of the upland, as testified by stratified sand and silts exposed at elevation 1.250 feet on the Cabot Trail, 0.6 mile north of Fishing Cove River bridge. Lenses of stratified drift also occur within till along the south side of Grande Anse River valley. Along parts of their lower reaches, the Red, Grande Anse, and North Aspy Rivers have carved terraces in fluviatile sand and gravel which was deposited during an aggrading stage in their history. This aggradation was probably related to a period of relatively higher sea-level. Tilted, wave-cut rock benches, locally overlain by stratified fluviatile deposits, and small sea caves along the coast north of Pollett Cove are up to 35 feet above present high-tide level. They were formed during a period of relatively higher sea-level and, hence, testify to post-glacial uplift. Faulting related to post-glacial uplift has caused minor displacements both in bedrock and in the overlying fluviatile deposits.

The oldest rocks are chiefly schists and gneisses (1, 2) which occur as 'islands' in a dominantly granitic terrane. Light grey, quartz-feldspar schists and gneisses (1) with various accessory minerals have been derived largely from shales and sandstones. Stretched, quartzose pebbles were noted in a few outcrops of muscovite-biotite-quartz-feldspar gneiss. Crystalline limestone (1l) associated with these rocks varies from a fine-grained, well-bedded variety best exposed on Big Southwest Brook, to a coarse-grained, flow-folded variety that outcrops along South Aspy River and Glasgow Brook. The latter locally contains up to 50% lime-silicate minerals, chiefly diopside and tremolite, and is associated with fine-grained calcic hornfels. The plagioclase in the schists and gneisses is commonly intermediate to calcic oligoclase which, together with other aspects of their mineral assemblages, suggests that the schists and gneisses belong within the almandine-amphibolite metamorphic facies. Locally, near shear and fault zones, they have been converted to greenschist-facies rocks. Lithologically this unit resembles the Precambrian George River group of southeastern Cape Breton Island.

Basic schists and gneisses (2), with minor exceptions, are restricted to the area west of the Aspy fault and their presence accounts for the high magnetic readings in this region. These schists and gneisses were derived chiefly from basic volcanic rocks and locally grade into recognizable meta-volcanic rocks (2v) with feldspathic amygdules and igneous textures preserved. Commonly, the schists and gneisses are dark grey, fine to medium grained, and consist of more than 50% hornblende and/or biotite with associated chlorite in a groundmass of partly epidotized intermediate plagioclase. They also belong within the almandine-amphibolite metamorphic facies except near shear and fault zones where retrograde metamorphism has produced dark green chlorite-epidote-albite rocks (2c). Rocks of unit 2 appear to be conformable with those of unit 1 and are tentatively interpreted as part of the same group. Basic meta-volcanic rocks are not, however, common in the best known sections of the George River group and it is possible that unit 2 is stratigraphically distinct.

Meta-anorthosite (3a) with associated meta-gabbro (3b) and meta-diorite (3c) occur as two tabular bodies, which may be part of a single sill, and also as several small lense-shaped inclusions within granitic rocks (4, 6) west of Aspy fault. Fresh specimens of anorthosite are light grey, medium grained, and consist almost entirely of andesine with scattered clots of slightly chloritized hornblende. Typically, however, the anorthosite is greyish white or pale greenish to pinkish grey with a waxy lustre; the plagioclase is much altered to clinozoisite, white mica, and scapolite. Meta-gabbro (3b) is a medium- to coarse-grained rock consisting of about 50% intermediate to basic, epidotized plagioclase and 30 to 40% hornblende altered in part to actinolite, with abundant accessory magnetite and minor apatite. Meta-diorite (3c) resembles meta-anorthosite but contains 20 to 30% mafic minerals.

Granitic rocks (6) are intrusive into units 1-3. They are of Devonian age; granodiorite (6c) from the mouth of Mackenzie River is dated at 398 M.Y. and leuco biotite granite from the adjacent Dingwall map-area is dated at 365 M.Y.[1] The granite (6a) is pinkish grey to light brownish grey, medium grained, and is commonly composed of 30 to 40% quartz, 30 to 40% microline, 15 to 20% sodic plagioclase, and 2 to 10% biotite and muscovite in various proportions. Massive to slightly gneissic, medium-grained, reddish brown syenite (6b) commonly consists of more than 50% microcline and microperthite with up to 20% plagioclase. Biotite and chlorite are the common mafic minerals in the central part of the area; hornblende is the dominant mafic mineral in the northern part. Between Blair River and Cabot Trail, plagioclase is locally more abundant than potash feldspar and the rock is a syenodiorite. Grey, medium-grained granodiorite (6c) outcrops south of Pleasant Bay and also between Donovan Brook and Glasgow Brook in the southeast quarter of the area. The granodiorite consists of 50 to 60% plagioclase, commonly zoned andesine, 20 to 25% quartz, up to 15% microcline, 10% biotite, and up to 5% muscovite. In a few localities, hornblende rather than biotite is the chief mafic mineral. Crosscutting relationships suggest that the granodiorite crystallized before the leuco granite (6a).

Intrusion of granitic rocks (6) into the country rocks (1-3) has produced various hybrid rocks (4) that underlie approximately half the map-area. In some places the granitic rocks have intruded (or replaced) the rocks of units 1 and 2 parallel with their foliations to form pink-and-grey-layered composite gneisses. In other places the granitic rocks contain numerous, angular, feldspathized inclusions of units 1-3. The country rock component is commonly highly chloritized near the Aspy fault zone.

Coarse-grained, porphyroblastic granite (5), which outcrops near the headwaters of Grande Anse and Mackenzie Rivers, is tentatively interpreted as a product of feldspathization related to the granitic rocks. This pale reddish brown rock contains subhedral porphyroblasts of microperthite up to 3 inches long that penetrate the medium-grained quartz and plagioclase components. It may have formed through feldspathization of either quartz-feldspar gneiss (1) or a pre-Devonian granitic rock.

Thin gabbroic dykes (7) cut the granitic and hybrid rocks (4, 6). Their relationship to the younger rocks of the area is not known.

Rhyolite porphyry (8) consists typically of subhedral to euhedral phenocrysts of reddish orange feldspar (chiefly albite, less commonly analbite and/or anorthoclase) up to 2.5 mm. in length, and clear to smoky quartz in an aphanitic greyish red to reddish brown groundmass. Graphically intergrown quartz and potash feldspar form 'micropegmatite' phenocrysts in some specimens. The groundmass is microfelsitic and spherulitic and consists chiefly of intergrown quartz and feldspar with small amounts of finely divided biotite, chlorite and, in a few specimens, amphibole. This porphyry outcrops chiefly as elongated lenses along the basal contact of the Mississippian rocks in the western and northern parts of the area, although it also occurs as dykes intruded along shear zones in crystalline rocks (2, 3, 5) of the upland in several places west of Aspy fault. In southeast Cape Breton, similar rhyolite porphyry is interpreted as a marginal, chilled facies of batholithic granite[2] whereas in west-central Cape Breton it is interpreted as related to volcanism of pre-Horton age[3]. The latter interpretation is favoured in this area because: (a) the unit appears to occupy a distinct stratigraphic position below Mississippian rocks; (b) there is a distinctly flow-layered facies (8a) exposed between Red River and Otter Brook; and (c) a facies (8b) exposed on Meat Cove Brook appears to be intercalated with highly indurated but otherwise unmetamorphosed clastic sedimentary rocks.

Mississippian sedimentary rocks (9,10) lie disconformably on rocks of unit 8 and with angular unconformity on older rocks (1-6). The Lower Mississippian Horton group, where exposed in the valleys of the Aspy Rivers, consists of three conformable units that roughly correspond to three formations, the Craignish, Strathlorne, and Ainslie, that have been distinguished[4] and mapped[5] in central Cape Breton Island. The basal unit (9A), equivalent to the Craignish formation, consists largely of red arkosic sandstone, conglomerate, and siltstone with a few interbeds of grey, clastic sedimentary rocks. Much of the clastic material has been derived from granitic rocks. The middle unit (9B), equivalent to the Strathlorne formation, is characterized by medium to dark grey, micaceous sandstone, siltstone, and quartz-pebble conglomerate with numerous thin beds of grey limestone and limy siltstone. A few thin beds of limestone intra-formational conglomerate occur within this middle unit although they are not known in the Strathlorne formation of central Cape Breton Island. The upper unit (9C), equivalent to the Ainslie formation, resembles unit 9A except that conglomerate is less abundant and a few beds of limestone and limestone conglomerate are present. Horton rocks in the northern part of the map-area are divisible into the same three units but, owing to scarcity of outcrops and complexity of structure, boundaries between units can only be drawn in part. The trends and distribution of Horton units in this northern outcrop area and in the Aspy valleys suggest that they formed in a single basin of deposition whose continuity has since been disrupted by an upthrust wedge of crystalline rocks[6]. Dynamically metamorphosed middle Horton rocks (9Ba) in Wilkie Brook valley have been downfaulted into this intervening wedge of crystalline rocks.

Horton rocks exposed along the west coast belong chiefly to the basal unit (9A) and in many places they constitute a distinct facies (9Aa) owing to the abundant granules, pebbles, and cobbles of rhyolite porphyry within them. In this locality the middle unit (9B) is locally exposed by faulting or along the axial zones of synclines but boundaries could not be delineated.

Comminuted plant debris is common in all Horton rocks, particularly the grey siltstones of unit 9B wherein the pteridosperm, ***Aneimites acadica*** Dawson, was identified at several localities.

Medium grey, thinly laminated, sandy, basal limestone (10a), the A_1 Windsor limestone[7], outcrops at the following localities: in Middle Aspy River valley, where it lies on unit 9C of the Horton group; near the road bridge over South Aspy River, where it apparently lies directly on composite gneiss (4) although eastward along strike there is an intervening wedge, a few feet thick, of coarse, regolithic conglomerate; and in South Aspy River valley, where it overlies unit 9C of the Horton group and overlaps onto composite gneiss (4). A sinkhole near the Aspy fault zone and an outcrop of Lower Windsor limestone, the A_2 limestone[7], north of North Pond and just east of the map boundary suggest extension of the Windsor-Horton contact northwestward as shown.

Windsor strata that outcrop near Pleasant Bay village include massive, medium grey limestone, gypsum, and red and grey siltstone and sandstone. Their position within the Windsor group is not known.

Rocks of the Pleasant Bay map-area have probably undergone three periods of deformation. Evidence from southeastern Cape Breton Island[2] suggests that the oldest sedimentary and volcanic rocks (1, 2) were folded and metamorphosed in Precambrian time. A second period of folding, along northeast-striking axes, accompanied intrusion of the granitic rocks (6) in Lower Devonian time. Structures developed at this time appear to have influenced the trend of Mississippian basins of deposition. The final period of folding took place in post-Mississippian time. It is probable that the crystalline rocks acted as resistant buttresses during this final folding, and deformation of the Mississippian rocks varied from place to place with the type and amount of movement of the adjacent crystalline rocks. Thus, dips are moderate to gentle in the Aspy valleys and moderate in the northern part of the area, whereas steep dips and overturned and breached west limbs of north-northeast-trending anticlinal structures are common along the west coast.

High-angle faulting accompanied and followed post-Mississippian folding and in many places the Mississippian rocks are truncated by normal and reverse faults of large displacement. In part, at least, Mississippian and post-Mississippian faulting followed old lines of weakness as illustrated by the Aspy fault. Horton rocks are sheared only in the immediate vicinity of this fault whereas there is a wide zone of cataclasis and chloritization in the crystalline rocks west of the fault. Also, in the adjacent area to the south, a dyke of pre-Horton rhyolite porphyry is localized along a probable extension of the Aspy fault. There is no evidence that the Aspy fault zone was active during Horton sedimentation but there is indication of movement along it in Windsor time — for Windsor redbeds northeast of North Pond contain fragments of cataclastic, chloritized hybrid rock (4) similar to that common along the Aspy fault-line scarp. If sediments of both the northern outcrop area and the Aspy valley area formed in a single basin of deposition, as suggested above, then truncation of this basin by the Aspy fault must have involved minimum vertical displacement in the order of 2,000 feet. The distribution of Mississippian units in this and adjacent areas to the east and northeast also suggests a large, right-handed, strike-slip component along the Aspy fault and/or the fault between Wilkie Brook and Salmon River[6].

A gypsum deposit on the west side of the Red River road, ½ mile north of Pleasant Bay village, is not large enough to be of economic importance. At the mouth of Mackenzie River green and purple fluorite and small amounts of finely divided galena occur in calcite veins that cut granodiorite and overlying Horton sandstone (9A). This lead prospect was unsuccessfully explored by test pits 75 years ago[8]. In Mackenzie River and tributary valleys, disseminated pyrite is locally abundant in mafic schists and gneisses and, in one locality, is associated with minor amounts of molybdenite and arsenopyrite in rusty, silicified shear zones. Minor concentrations of pyrite and, less commonly, chalcopyrite and molybdenite occur in units 1, 2, and 4 here and there throughout the area. One of these, at the east boundary of the map-area 1¼ miles north of North Pond, consists of pyrite and chalcopyrite, which occur in crinkled chlorite schist over a zone 30 feet wide, both as lenses parallel with the schistosity and as fracture fillings perpendicular to the schistosity. Beyond the mineralized zone the chlorite schist grades into strongly lineated hornblende-biotite gneiss. This prospect was explored by an adit many years ago. Another prospect, recently examined by Mineral Exploration Corp., Ltd., consists of small lenses and stringers of pyrite and chalcopyrite in dark green chlorite and chlorite-hornblende schist exposed along the major northern tributary of Gray Glen Brook. These two prospects suggest that chloritized basic schists and gneisses (2c) near the Aspy fault zone are favourable rocks for base metal deposits. Crystalline limestone (1l) remnants in the granitic and syenitic rocks are also worth prospecting. A small inclusion of crystalline limestone within syenitic rocks in Pine Brook valley contains up to 15% sphalerite in selected specimens. Similar zinc mineralization is extensive in skarn rocks in the adjacent area to the north.

[1] Fairbairn, H. W., Hurley, P. M., Pinson, W. H., Cormier, R. F.: Age of the Granitic Rocks of Nova Scotia; Geol. Soc. America Bull. vol.71, pp. 399-414, 1960.
[2] Weeks, L. J.: Southeast Cape Breton Island, Nova Scotia; Geol. Surv., Canada, Mem. 277, 1954.
[3] Norman, G. W. H.: Lake Ainslie Map-area, Nova Scotia; Geol. Surv., Canada, Mem. 177, 1935.
[4] Murray, B. C.: Stratigraphy of the Horton Group in Parts of Nova Scotia; Ph.D. thesis, M.I.T., Cambridge, Mass., 1955.
[5] Kelley, D. G.: Mississippian Stratigraphy and Petroleum Possibilities of Central Cape Breton Island, Nova Scotia; Bull. Can. Inst. Min. Met., vol. 51, pp. 341-351, 1958.
[6] Neale, E. R. W. and Kelley, D. G.: Stratigraphy and Structure of Mississippian Rocks of Northern Cape Breton Island; Geol. Assoc. Canada Proc., vol. 12, pp. 79-96, 1960.
[7] Stacey, M. S.: Stratigraphy and Paleontology of the Windsor Group (Upper Mississippian) in Parts of Cape Breton Island, Nova Scotia; Nova Scotia Dept. Mines, Mem. 2, 1953.
[8] Fletcher, Hugh: Geology of Northern Cape Breton; Geol. Surv., Canada, Rept. of Prog. 1882-1884, pt. H, p. 93A, 1885.

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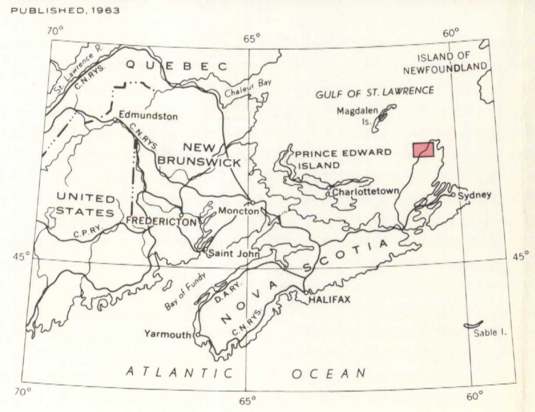

MAP 1119A

GEOLOGY
PLEASANT BAY
CAPE BRETON ISLAND
NOVA SCOTIA

Scale: One Inch to One Mile = $\frac{1}{63,360}$

Miles
1 ½ 0 1 2 3

COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA, OTTAWA

REFERENCE

Road and buildings
Road (dry weather)
Trail
Bridge
Church
School
Post Office . . . P.
Cemetery . . . C
Horizontal control point
Reef or small island
County boundary
Park boundary
Marsh
Intermittent stream
Cliff
Foreshore flats
Contours (interval 50 feet)