GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

LEGEND

PALAEOZOIC

MISSISSIPPIAN

CANSO GROUP

7 — *Grey and maroon siltstone, shale, sandstone; minor limestone and conglomerate*

WINDSOR GROUP

6 — *Limestone and limy siltstone*

HORTON GROUP

5 — *Grey sandstone, siltstone, and shale; minor conglomerate*

DEVONIAN AND EARLIER

4 — *Granite*

3 — *Hybrid rocks;* **3b**, *biotitic;* **3c**, *chloritic;* **3g**, *garnetiferous;* **3h**, *hornblendic;* **3k**, *kyanitic;* **3m**, *muscovitic;* **3s**, *staurolitic*

PRECAMBRIAN

GEORGE RIVER GROUP (?)

2 — *Amphibolite, hornblende schist and metavolcanic rocks;* **2a**, *mainly amphibolite and gneissic amphibolite (with notes on interbedded quartzite);* **2h**, *mainly hornblende schist;* **2x**, *mainly meta-andesite and meta-basalt;* **2r**, *rhyolite and rhyolite porphyry*

1 — *Mainly quartz-feldspar schists and gneisses containing:* **1b**, *biotite;* **1c**, *chlorite;* **1g**, *garnet;* **1h**, *hornblende,* **1m**, *muscovite;* **1s**, *staurolite. Minor amounts of-* **1l**, *crystalline limestone;* **1q**, *quartzite;* **1t**, *meta-conglomerate and sandstone*

Kyanite schist layer in hybrid rocks
Rock outcrop ×
Bedding, tops known (inclined, overturned)
Bedding tops unknown (inclined)
Schistosity and gneissosity (inclined, vertical)
Lineation (arrow indicates direction and plunge)
Minor fold axis (arrow indicates direction and plunge)
Anticline (arrow indicates plunge)
Syncline (arrow indicates plunge)
Fault (approximate, assumed; solid circle indicates downthrow side, arrows indicate relative movement)
Glacial striae (direction of ice movement known)
Fossil locality ⓕ
Mineral occurrence Cu×

MINERAL SYMBOLS

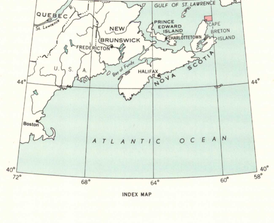
Bismuth	Bi	*Molybdenum*	Mo
Copper	Cu	*Pyrite*	py
Lead	Pb	*Zinc*	Zn

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

Road, all weather
Road, dry weather
Cart track
Trail
Building
Post Office P
Cemetery
Lighthouse
Wharf
Horizontal control point ⊿
Intermittent stream
Rock or small island
Contours (interval 100 feet)
Height in feet above mean sea-level 1417

Cartography by the Geological Survey of Canada, 1963

Approximate magnetic declination 26° 13' West decreasing 2.8' annually



INDEX MAP

DESCRIPTIVE NOTES

The northern tip of Cape Breton Island (Cape North peninsula), in the southwestern part of the map-area, consists of a dissected upland flanked on the west by a broad lowland. The upland, underlain by resistant crystalline rocks, is the northern extremity of an uplifted peneplain known as the Cape Breton Highlands. Remnants of this peneplain, south of the relay station road, have an average elevation of 1,400 feet. The lowland, which forms the south shore of St. Lawrence Bay, is underlain by downfaulted Mississippian sedimentary rocks.

St. Paul Island, 15 miles northeast of the mainland, is underlain by crystalline rocks, which are well exposed on the sea cliffs that bound the island. Relatively flat summits on the island have elevations of about 450 feet.

Striae and stoss-and-lee forms on St. Paul Island and near Money Point on the mainland show that Pleistocene ice-movement was east-southeastward. A thin veneer of coarse, stony till that covers much of the upland area of Cape North peninsula contains fragments of diverse Mississippian sedimentary rocks derived from outcrops to the west. A large erratic of Horton conglomerate near Money Point also substantiates the easterly movement of the ice. Glacial till once partly filled the river valleys. The streams have carved through this till and now flow mainly over bedrock; however, the steep valley sides are largely covered with glacial debris.

Deposits of stratified silt, sand, and gravel are exposed along the coast of St. Lawrence Bay and at several places along the coast south of Money Point. In the former locality, about 7,500 feet northeast of McDougall Pond outlet, abundant wood fragments are contained in tough, black, organic-rich layers (gyttja) that occur near the base of 40 feet of stratified deposits. A few feet of unsorted debris overlies the stratified material at this locality. This stratified material could be glacial outwash overlain by landslide debris from the adjacent upland area or it could be an interstadial deposit overlain by late glacial (Wisconsin) till. The latter interpretation is favoured because of the nature of the wood and spores in the organic-rich layers.

The stratified deposits rest on wave cut rock benches that were formed during one or several periods of relatively higher sea-level. The benches range in elevation from 3 to 20 feet — possibly because of post-glacial faulting of an original bench at about 20 feet elevation. Remnants of the bench at 20 feet elevation were also noted on the east and west coasts of St. Paul Island, and traces of a bench at 35 feet elevation occur near the south end of the island.

The writer's 1955 studies on St. Paul Island were supplemented by the independent observations of W. F. Take[1]. More recently, a detailed study of the metamorphic rocks has been completed on St. Paul Island and part of Cape North peninsula[2].

The oldest rocks (1, 2) are mainly schists and gneisses, which resemble those of the map-areas to the south and southwest. The metasediments (1) are similar to those of the Precambrian George River Group of southeastern Cape Breton Island. The metavolcanic rocks (2) are conformably intercalated with the metasediments (1) and, hence, are included in the George River although similar rocks are not common in the best known sections of this group[3].

The metasediments (1) are chiefly grey, micaceous, quartz-feldspar schists and gneisses that vary greatly in grain size and accessory-mineral content. Schistosity and foliation are commonly parallel to bedding in these rocks. Three metasedimentary units, separated by intercalated metavolcanic units (2a, 2h), are recognized on St. Paul Island. The westernmost sedimentary unit, exposed only south of the east-striking fault at MacDougall Cove, consists chiefly of garnet and staurolite-garnet mica schists with grey quartzite interbeds. Garnets up to 7 inches in diameter occur in the northernmost outcrops of this unit. Interbedded hornblende schist and crystalline limestone, collectively 50 feet thick, form the western part of the section along the south shore of MacDougall Cove. The middle unit consists of schists similar to those of the western unit. Quartzite interbeds are abundant in the western half of this unit; hornblende schist is abundant in the eastern half. The easternmost unit is characterized by coarse-grained garnet-staurolite schists. Black, untwinned staurolite crystals, up to 1½ inches long, constitute up to 30 per cent of some schist layers. A K/Ar age determination on biotite from this unit dates its metamorphism at 360 m. y.[4].

The metasediments (1) on the east coast of Cape North are less metamorphosed than they are on St. Paul Island. Thus, east of the Canadian National Telegraphs relay station, the fine-grained metasediments (1) are phyllites and spotted phyllites, and the coarser-grained facies are slightly schistose feldspathic sandstones and granule conglomerates within which fill-and-scour structures and crossbedding are preserved. Garnet porphyroblasts near Money Point indicate a westward increase in metamorphic grade. In this locality biotite porphyroblasts occur as minute "books" oriented at various angles athwart the schistosity and bedding. Garnetiferous conglomerates with greatly stretched feldspathic and quartzitic pebbles are recognizable near Money Point, but all original sedimentary structures except bedding have been obliterated. Black staurolite crystals in micaceous schists and gneisses first appear farther west at points approximately a mile west of Money Point and ½ mile west of the Canadian National Telegraphs relay station.

Metavolcanic rocks (2) are chiefly dark greenish grey amphibolites, commonly schistose or gneissic, that consist largely of hornblende and oligoclase with locally important amounts of epidote. In the gneissic amphibolite thin pale grey lenses and layers, chiefly oligoclase and associated sphene, alternate with thicker, dark, dominantly hornblendic layers. Thin beds of pale grey quartzite are common within the gneissic amphibolite unit (2a) on St. Paul Island. Hornblende schist (2h) consists largely of hornblende and quartz with only minor amounts of oligoclase. Compositionally, it could be of either sedimentary or volcanic origin, but field relationships favour a volcanic origin. On the northeast coast of Cape North peninsula, about ½ mile south of Money Point, slightly schistose, fine-grained, epidotic hornblende-plagioclase rocks which contain relict amygdules and columnar jointing, are classified as meta-andesites and meta-basalts (2v). Northwestward, toward Money Point, they grade into coarse-grained amphibolite. Rhyolite and rhyolite porphyry (2r) are tentatively intrepreted as thin flows intercalated with the basic metavolcanic rocks (2v), although they may represent sills of a post-granite rhyolite that is common in the area to the southwest[5]. The former interpretation is favoured by evidence of silicic volcanism (i.e., a few thin rhyolite flows and tuff beds) within the metasedimentary sequence on the coast east of the Canadian National Telegraphs relay station.

Medium red, massive, leucocratic biotite granite (4) exposed near the relay station and along the coast to the southeast is intrusive into the metasedimentary rocks (1) and, presumably, the metavolcanic rocks (2). Contacts here are sharp and irregular and calcite gash veins are common in the intruded rocks. Similar granite in the map-area to the south has been dated at 365 m. y.[4].

Introduction of granitic material into the metasedimentary and metavolcanic rocks (1, 2) has produced a variety of hybrid rocks (3). These include pink to grey, fine- to medium-grained, muscovite-biotite-quartz-microcline gneisses with intercalated mica schists; composite gneisses with alternating layers of granite and schist or amphibolite; and, in parts of the Cape North region, massive granitic rocks with numerous feldspathized inclusions of country rock. Concordant and discordant bodies of granite pegmatite are abundant within the hybrid rocks. Kyanite schist layers within the hybrid rocks of St. Paul Island indicate a westward increase in metamorphic grade similar to that on Cape North peninsula. On the west coast of the island, kyanite crystals are up to 1 inch long. Staurolite within the hybrid rocks is medium reddish brown in contrast to the black staurolite of the metasediments (1). It is associated with kyanite in the schist layer that extends northward from Viceroy Cove, but has not been recognized farther west. The hybrid rocks of the Cape North region are highly chloritized near the St. Lawrence fault.

The Mississippian rocks of the St. Lawrence Bay lowland are downfaulted against the crystalline rocks (1-4) in this area, but in adjacent map-areas they unconformably overlie similar crystalline rocks.

The oldest Mississippian rocks belong to the Horton Group (5) and probably to the middle unit (Strathlorne Formation) of that group. They consist mainly of grey micaceous sandstones, some of which are arkosic, and grey siltstones, shaly siltstones, and shales. Minor amounts of quartzose conglomerate and one bed of arkosic conglomerate with fragments of granite up to 4 inches in diameter occur within the sequence. A few thin beds of vuggy, slightly petroliferous limestone outcrop near the fault zone that separates Horton-Group from Canso-Group rocks. Paleoniscid fish scales are common in the dark grey shales, and abundant plant debris, including *Lepidodendropsis corrugata* (Dawson), occurs in some shale and sandstone beds.

Windsor rocks (6) in the area belong largely if not wholly to the upper part of the Windsor Group. They consist of grey limestone and limy siltstone with a small amount of interbedded, coarse, pale brown conglomerate in the southeastern part of the outcrop area. The limestones are generally fetid and/or petroliferous; oolitic varieties are common and crinoidal limestone occurs along the coast at the northeasternmost contact with the Canso Group. Grey, coquinoid limestone, ½ mile east of McDougall Pond outlet, contains an uppermost Windsor fauna, including the subzone-E brachiopod *Chonetes politus* McCoy.

The Canso Group (7) conformably overlies the Windsor Group (6) at shore localities 1,000 feet and 3,000 feet southwest of the St. Lawrence Bay fault. It consists chiefly of thin-bedded grey and maroon sandstones, and argillaceous to arenaceous shales and siltstones. Conglomerate and thin beds of grey limestone together form about 10% of the section. The shales and siltstones commonly show mud-cracks and some beds contain tabular nodules of limestone. Oscillation and current ripples and crossbedding are common in the sandstones. Cobbles of granite, quartz, mica schist and, in one locality, were formed during one or several periods of relatively higher sea-level. The benches range in elevation from 3 to 20 feet — possibly because of post-glacial faulting of an original bench at about 20 feet elevation. Remnants of the bench at 20 feet elevation were also noted on the east and west coasts of St. Paul Island, and traces of a bench at 35 feet elevation occur near the south end of the island.

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Three periods of deformation may be represented in rocks of this area. The oldest rocks (1, 2), if equivalent to the George River Group as suspected, were probably folded and metamorphosed in Precambrian time, as they were in southeastern Cape Breton[3]. Evidences of this earliest period of deformation were obliterated by a second period of metamorphism and deformation that accompanied intrusion of granitic rocks in Devonian time, approximately 360 m.y. ago. Crinkles, minor fold axes, and other linear elements suggest that folding during this second period of deformation took place about north- and north-northeast-striking fold axes. The final period of deformation involved folding and faulting in post-Mississippian time. Folding of the Mississippian strata about north-striking axes was largely controlled by movement of the crystalline basement rocks (1-4), which adjusted to the last deformation largely by faulting.

The crystalline rocks of Cape North peninsula are part of a horst-like wedge bounded on east and west by high-angle faults. The St. Lawrence fault on the west is along a zone of pre-Mississippian weakness, as shown by the wide belt of cataclasis and retrograde metamorphism in pre-Mississippian rocks east of the fault, in contrast to the relatively minor shearing in Mississippian rocks west of the fault. The Aspy fault is also located along a zone of pre-Mississippian weakness[6]. The St. Lawrence fault may have been slightly reactivated in Windsor time, as suggested by outcrops of coarse Windsor clastic rocks near the trace of this fault. Final, major movement along the St. Lawrence and Aspy faults took place in post-Canso time. Movement along the southeast-dipping St. Lawrence reverse fault compressed the Windsor and Canso strata between crystalline rocks on the east, and upthrust competent Horton rocks on the west, and produced a series of northerly plunging folds. The fold pattern is characterized by tight, overturned and fault-breached anticlines and relatively open synclines.

Other faults within the crystalline rocks originated subsequent to Devonian metamorphism and are related in time to initial pre-Mississippian movement along the Aspy and St. Lawrence faults. On St. Paul Island a north-trending strike fault between Atlantic and MacDougall Coves separates hybrid rocks (3) from metasedimentary rocks (1). Movement along this fault is not known, but need not have been great as pegmatites are increasingly abundant westward in the gneisses and the change in lithology at the fault trace is not abrupt. Within units 1 and 2 there are numerous shear zones of small displacement parallel to this fault. An east-striking fault zone between MacDougall Cove and Power Cove has a left-handed horizontal displacement of about 600 feet. An east-striking fault of smaller left-handed, displacement is located along The Tickle at the north end of the island. East-striking shear zones and faults are apparently later than and truncate the north-striking shears and faults. These three faults and most of the minor shear zones are associated with drag-folding and retrograde metamorphism in the surrounding rocks.

Pyrite, molybdenite, and traces of chalcopyrite and bismuthinite are associated with quartz, albite, calcite, and fluorite in veins that fill steeply dipping, northerly and easterly striking conjugate joints, 1,500 feet west of Money Point. The mineralized veins occur within garnetiferous metaconglomerate and fine-grained feldspathic metasediments. Development of pyrite in the wall-rocks is widespread. Abundant disseminated pyrite occurs in crystalline limestone (1l) on the coast southwest of Cape North, particularly near its northeastern contact with granitic rocks. Minute amounts of disseminated galena, sphalerite, and pyrrhotite occur in thin, deformed beds of crystalline limestone exposed on the south shore of MacDougall Cove and small amounts of marcasite are present in quartz-carbonate veinlets in this locality. Disseminated chalcopyrite occurs in granite and adjacent feldspathized, biotitic metasediments on the coast, about 2,500 feet southeast of the Canadian National Telegraphs relay station. A grab sample of the mineralized granite contained 3.7 per cent copper. This last locality merits attention because of its proximity to the assumed northward extension of the Aspy fault.

[1]Take, W. F.: N. S. Mus. Sci., Halifax, unpub. notes (1965).

[2]Phinney, W. C.: Phase Equilibria in the Metamorphic Rocks of St. Paul Island and Cape North, Nova Scotia; Mass. Inst. Technol., unpub. Ph.D. thesis (1959).

[3]Weeks, L. J.: Southeast Cape Breton Island, Nova Scotia; Geol. Surv., Canada, Mem. 277 (1954).

[4]Fairbairn, H. W., Hurley, P. M., Pinson, W. H. and Cormier, R. F.: Age of the Granitic Rocks of Nova Scotia; Bull. Geo. Soc. Amer., vol. 71, pp. 399-414 (1960).

[5]Neale, E.R.W.: Map 1119A, Pleasant Bay Nova Scotia; Geol. Surv., Canada.

[6]Neale, E.R.W. and Kelly, D. G.: Stratigraphy and Structure of Mississippian Rocks of Northern Cape Breton Island; Proc. Geol. Assoc. Can., vol. 12, pp. 79-96.

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MAP 1150A

GEOLOGY

CAPE NORTH

NOVA SCOTIA

Scale: One Inch to One Mile = 1/63,360

Miles 1 ½ 0 1 2 3