GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF ENERGY, MINES AND RESOURCES

LEGEND

PALEOZOIC

CARBONIFEROUS

15 — *15a, poorly indurated red conglomerate with red sandstone partings; 15b, poorly indurated buff, brown, and grey conglomerate, sandstone, and mudstone*

DEVONIAN AND EARLIER

14 — *Granitic rocks with minor unseparated metamorphic rocks (4); 14a, medium- to coarse-grained, pink to grey, porphyritic (feldspar) to equigranular biotite granite, minor muscovite-biotite granite, garnetiferous muscovite granite, altered pink granite, and granodiorite; 14b, medium- to coarse-grained, pink, grey, and buff hornblende granite, fine- to medium-grained, pink to orange alaskitic granite and syenite, hornblende syenite, pink to grey hornblende-biotite granite, granodiorite, and quartz diorite; 14c, fine- to medium-grained foliated biotite granite commonly with sugary texture, muscovite-biotite granite, fine- to medium-grained pink granite, minor metadiorite; 14d, monzonite, quartz monzonite, and syenite; 14e, granodiorite, quartz diorite, and green altered granitic rocks; 14f, micropegmatite*

13 — *Diorite, biotite diorite, gabbro; minor quartz diorite, granodiorite, and unseparated mafic volcanic (1) and sedimentary (2) rocks; 13a, foliated, grey, biotite quartz diorite*

12 — *Brownish weathering serpentinized and carbonatized ultramafic rocks, peridotite, pyroxenite, and associated gabbroic rocks*

SILURIAN

11 — *Finely laminated grey argillite, siltstone, and phyllite with sandstone and quartzite interbeds and minor interlayered silicic tuff and pebble conglomerate; 11a, yellow to grey silicic volcanic rocks dominantly of pyroclastic origin and porphyritic (quartz) silicic volcanic rocks*

10 — *Sheared and altered intermediate to mafic green lava (locally pillowed), tuff, and agglomerate; minor interlayered finely laminated limestone and argillite; 10a, amphibolite*

9 — *Conglomerate, sandstone, siltstone, and argillite; 9a, purple to grey volcanic pebble conglomerate and sandstone; 9b, brownish weathering, grey to buff, brown, and red micaceous sandstone and siltstone; 9c, grey-green argillite and siltstone; 9d, sheared conglomerate, green sandstone, siltstone, and contorted phyllite*

8 — *Silicic to intermediate and mafic volcanic rocks; 8a, grey, green to purple silicic lavas, commonly porphyritic (quartz, feldspar) and locally pillowed, silicic agglomerate and tuff, sheared silicic volcanic rocks and minor altered green mafic volcanic rocks (possibly includes Ordovician volcanic rocks (1); 8b, green to purple and red amygdaloidal (calcite) lavas (locally pillowed) and agglomerate, minor sedimentary rocks*

7 — *Grey conglomerate with chert, shale, limestone, and granitic pebbles, grey micaceous sandstone, greywacke, and argillite*

SILURIAN AND (?) EARLIER

6 — *Quartzose siltstone and greywacke, tuffaceous greywacke, red sandstone, red and grey argillite and siltstone; 6a, red micaceous sandstone*

5 — *Silicic to intermediate and mafic volcanic rocks, minor sedimentary rocks and unseparated diorite intrusions (13); 5a, green to purple and red amygdaloidal (calcite) lava (locally pillowed) and agglomerate, sheared carbonatized red and green lava, minor massive green lava; 5b, grey to pink and purple silicic lava, tuff, agglomerate, and porphyry; 5c, grey to pink porphyritic silicic tuff; 5d, tuffaceous greywacke, siliceous siltstone, and chert (interlayered with 5c); 5e, altered, green, intermediate to mafic lava and agglomerate*

SILURIAN, ORDOVICIAN, AND (?) EARLIER

4 — *Metamorphic rocks; minor unseparated granitic rocks (14); 4a, spotted slate, phyllite, quartzite, fine-grained biotite schist and hornfels (locally containing cordierite or andalusite); 4b, fine-grained to coarsely crystalline biotite-quartz-feldspar gneiss and schist and muscovite-biotite gneiss and schist locally containing garnet, staurolite, and sillimanite; granitic gneiss and schist, and migmatite (by action of 14a), minor biotite-chlorite-albite schist and amphibolite; 4c, porphyroblastic (feldspar) granitic gneiss and schist and foliated granitic gneiss*

ORDOVICIAN OR (?) SILURIAN

3 — *Grey sandstone, siltstone, argillite, and phyllite; purple, red, and grey slate; conglomerate; purple and green amygdaloidal (calcite) lava and agglomerate; 3a, red and grey intraformational conglomerate; 3b, green to purple lava (locally amygdaloidal) with some red and green slate and chert interbeds*

ORDOVICIAN

2 — *Grey to black slate, siltstone, and argillite; greywacke and pebble conglomerate; siliceous siltstone, tuffaceous greywacke, siliceous argillite, tuff, and chert; minor red slate and siltstone, green micaceous sandstone, and unseparated volcanic rocks (1) and diorite intrusions (13); 2a, dominantly greywacke and conglomerate with slate interbeds (probably includes Silurian beds in upper parts)*

1 — *Sheared, altered, green lava and pillow lava, amygdaloidal green lava, silicic porphyritic (quartz) green and grey lava and tuff, altered green agglomerate and tuff, grey silicic agglomerate and tuff (probably includes Silurian volcanic rocks (8) near West Brook); minor greywacke, siliceous siltstone, slate, chert, and unseparated diorite intrusions (13); 1a, dominantly pyroclastic rocks*

Geological boundary (defined, approximate, assumed)
Bedding, tops known (inclined, vertical, overturned) 90
Bedding, tops unknown (inclined, vertical)
Schistosity, cleavage, and shearing (inclined, vertical, dip unknown)
Lineation (drag fold axes and fragment and mineral elongation with plunge) 60
Fault (defined, assumed)
Anticline (defined, approximate; arrow indicates plunge)
Syncline (defined)
Glacial striae (direction of ice movement known)
Fossil locality Ⓕ
Locality where age has been determined, in millions of years Ⓐ
Producing mine ⚒
Mineral occurrence ×
Exploration shaft (abandoned)

MINERALS

Chalcopyrite	cp	*Native silver and argentite*	Ag
Chromite	cr	*Pyrite*	py
Galena	gn	*Sphalerite*	sp

Geology by Harold Williams, 1965-66

Geological cartography by the Geological Survey of Canada

Base-map at the same scale published by the Surveys and Mapping Branch in 1962. Revisions to the roads by the Geological Survey of Canada

Copies of the topographical edition of this map may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa

Magnetic declination 1970 varies from 28°00′ westerly at centre of west edge to 28°04′ westerly at centre of east edge. Mean annual change decreasing 2.9′

Elevation in feet above mean sea-level

Published, 1970
Copies of this map may be obtained from the Geological Survey of Canada, Ottawa

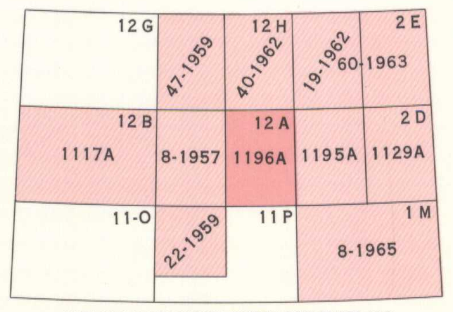
Printed by the Surveys and Mapping Branch

MAP 1196A
GEOLOGY
RED INDIAN LAKE
(EAST HALF)
NEWFOUNDLAND

Scale 1:250,000

Miles 4 0 4 8 12 Miles
Kilometres 6 0 6 12 18 Kilometres

INDEX MAP



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO GEOLOGICAL SURVEY OF CANADA MAPS

DESCRIPTIVE NOTES

The map-area is mainly a gently undulating to hummocky upland surface with a mean elevation of about 1,000 feet and rarely exceeding 1,500 feet. The northern part, except for the barren terrain north of Red Indian Lake is heavily wooded with spruce and fir. In the southern part of the region, large barren areas alternate with sparsely wooded ones. The grain of the topography in the north trends northeast and directly reflects bedrock structure. Most of the southern part of the map-area has no consistent topographic grain and is underlain by boulder-strewn isotropic granite or by metamorphic rocks of variable trend. In the northwest corner of the map-area the highest upland surface is underlain by granite, whereas in the southern part metamorphic rocks rather than granites form the most prominent highlands and outcrop areas. All parts have been glaciated; ice in the south half of the area moved southerly. The area surrounding Meelpaeg Lake will become a water reservoir in connection with the Bay d'Espoir Hydro-Development Project. Present drainage patterns will be disrupted and the waters of Granite and Meelpaeg Lakes will be diverted eastward into the southward flowing Salmon River.

The geotectonic setting of the map-area is the Paleozoic mobile belt of the Newfoundland Appalachians[1]. The rocks are tightly folded and faulted, cut by a variety of intrusions, and in wide areas of the southern part of the map-area are metamorphosed to schist and gneiss. Few of the layered rocks are dated by fossils, but most are thought to be Ordovician and Silurian, possibly with some of Devonian age.

Volcanic rocks of map-unit 1 southeast of Red Indian Lake contain interlayers of sedimentary rocks (2), and along Victoria River the volcanic rocks (1) appear to inter-tongue with the sedimentary rocks (2). The volcanic rocks, although generally considered older than the sedimentary rocks because of relationships outside the map-area[2,3], may represent southwestward facies equivalents. The sedimentary rocks (2) contain graptolites at several localities in the northeastern part of the map-area including such diagnostic species as *Nemagraptus gracillis* (Hall), *Climacograptus bicornis* (Hall), and *Corynoides* sp. These identifications by L. M. Cumming of the Geological Survey of Canada, indicate a Middle Ordovician (Porterfield to Trenton) age.

Volcanic rocks (1) and sedimentary rocks (2) of the Pipestone Pond-Cold Spring Pond area are undated but are lithologically similar to Ordovician strata of central Newfoundland[1].

Greywackes and pebble conglomerates (2a) are locally predominant among sedimentary rocks of map-unit 2, and apparently they are more abundant toward its upper part. The greywackes and conglomerates locally contain granitic pebbles and resemble Ordovician and Silurian greywackes and conglomerates of Notre Dame Bay[2,3]. In the map-area some of these rocks (2a) are interlayered with Middle Ordovician graptolitic slates (2), but others may be of Late Ordovician or Silurian age. One exposure of conglomerate (2a) along Noel Paul's Brook about 4 miles southeast of Exploits River, contains fragments of black slate and limestone along with granite pebbles; lithologically the rock is similar to Silurian Goldson conglomerate[3].

Sedimentary and volcanic rocks (3) at Harbour Round on Red Indian Lake are lithologically unlike Ordovician rocks of map-units 1 and 2 and may be Silurian. Some of the volcanic rocks (3b), closely resemble volcanic rocks of map-units 5a and 8b. The stratigraphic relationship between these rocks (3) and Ordovician rocks (1) to the southeast is unknown. To the northwest, Silurian (?) red micaceous (detrital muscovite) sandstones (6a) are faulted against map-unit 3.

Metamorphic rocks (4) are almost entirely of sedimentary derivation and are gradational with Ordovician and Silurian rocks where contacts have been observed. The metamorphic rocks are predominantly biotite schists that resulted from one or more regional thermal and deformative events. The main metamorphic episode pre-dated the emplacement of granite intrusions (14a), which truncate secondary structures in the metamorphic rocks and in some places, e. g. Round Pond-Ahwachanjeesh Pond, are partly bordered by rocks that are relatively unmetamorphosed. For the most part metamorphic rocks(4) are derivations of nearby Ordovician (2) and Silurian (7, 11) rocks, but in the Sitdown Pond area, the rocks (4a, 4b) are quartzites, unlike expected metamorphic equivalents of map-unit 2 nearby. The grade of metamorphism decreases from biotite to chlorite from east to west in the vicinity of Sitdown Pond with the least metamorphosed rocks (4a) bordering the ultramafic intrusion (12).

Volcanics rocks (5) that locally form the host rocks for the Buchans base metal ores, are reassigned from the Ordovician to the Silurian, although Ordovician rocks are probably also represented locally in this map-unit. The rocks (5) north of Red Indian Lake were previously assigned to the Ordovician[4], although it was concluded that they were younger than the rocks (1, 2) south of the lake. The rocks of these two areas have contrasting structural styles: those north of the lake (5) are openly folded on a fairly broad scale but those to the south are tightly folded with steep dips. The majority of the rocks of map-unit 5 appear lithologically more representative of Silurian volcanic rocks of north-central Newfoundland rather than Ordovician volcanic rocks. Amygdaloidal (calcite) lavas (5a), locally with associated red micaceous sandstones (6a), are typical of the Silurian Botwood Group[2] and siliceous flows, tuffs, agglomerates, and porphyries compare well with tentative Silurian volcanic rocks of the Springdale Group and Silurian (?) volcanic rocks west of Sheffield Lake to the north of the map-area[4].

Sedimentary rocks of map-unit 6 appear to be interlayered with volcanic rocks (5a) at the northeast end of Red Indian Lake. Red sandstones with detrital muscovite (6a) on the southeast shore of Red Indian Lake, previously assigned to the Carboniferous[6,7], are correlated lithologically with red micaceous sandstones of the Silurian Botwood Group. The rocks are more highly indurated and more deformed than nearby Carboniferous rocks (15b) and pebbles of red micaceous sandstone (6a) are abundant in Carboniferous conglomerates (15a) along the east shore of Red Indian Lake three miles southwest of Millertown.

Rocks of map-unit 7 are assigned to the Silurian because of their lithologic similarities to conglomerates, greywackes, and siltstones of the Silurian Goldson Formation in Notre Dame Bay[2,3]. Chert pebble conglomerates with a shaly matrix and exposed along the west shore of Dolland Pond, contain limestone pebbles and cobbles, clasts of typical Ordovician black graphitic argillite, and granite pebbles. Top determinations made locally at Dolland Pond suggest the rocks (7) form an unmetamorphosed southeast to east-trending synclinal remnant within the metamorphic terrane (4).

Volcanic and sedimentary rocks of map-units 8 and 9 can be traced into similar strata to the east[8] that in turn continue northeastward into dated Silurian rocks of the Botwood Group[2,9]. The relationship between volcanic rocks (8) and Ordovician rocks (2) toward the northwest is unknown but a stratigraphic discontinuity is suggested by the absence of intervening rocks that separate similar map-units northeast of the map-area[2,3]. Accordingly, the contact is interpreted as a fault. Some of the volcanic rocks included in map-unit 8a, especially those in the vicinity of Beaver Lake and southwestward, are not lithologically distinctive of Silurian volcanic rocks and are possibly Ordovician. Others, which in most respects are typical of Silurian volcanic rocks, are pillowed, a feature not common to Silurian rocks northeast of the map-area[2].

Sedimentary rocks (9) are mainly red, purple, and grey conglomerates and red, brown, and grey sandstones typical of a shallow water continental depositional environment. These contrast with Ordovician black slates and greywackes (2) which are indicative of deeper water, marine conditions. Conglomerates of map-unit 9 commonly contain abundant volcanic fragments some of which are similar to volcanic rocks of map-unit 8. In a few places the sedimentary rocks (9) face southeast, indicating that they are younger than the volcanic rocks (8). The contact between map-units 8 and 9 appears conformable where seen near Sandy Lake, but on rather tenuous evidence, it was previously interpreted as an unconformity in the vicinity of Tally Pond[10]. Northeast of the map-area, Silurian volcanic and sedimentary rocks, thought to be equivalent to map-units 8 and 9, respectively, are conformable[2,8].

Rocks of map-units 10 and 11 appear to form a continuous southeast-facing succession that overlies rocks of map-unit 9. Rocks of map-unit 10 are mainly sheared green volcanic rocks that include altered green pillow lavas with minor interlayered finely laminated limestones. These rocks, together with finely laminated argillites and siltstones of map-unit 11, indicate a different depositional environment than that which prevailed during deposition of conglomerates and micaceous sandstones (9) to the northwest. The nature of the contact between map-units 9 and 10 is uncertain; it may be a fault, but if on the other hand the contact is conformable with the beds facing southeast, then map-units 10 and 11 represent atypical upper units in the Silurian succession that are absent northeast of the map-area.

In the northern part of the map-area structures trend northeasterly to easterly and the regional structural pattern is interpreted as being dominated by fault-bounded northeast-trending belts. The main belt of Ordovician rocks (1, 2) along Exploits and Victoria Rivers is interpreted to be faulted against younger volcanic (5) and sedimentary (6) rocks to the north and faulted against Silurian volcanic (8) and sedimentary (9) rocks to the south. In the southern part of the map-area the distribution and extent of both metamorphic rocks (4) and intrusive rocks (14) obscures the regional structural patterns.

Aeromagnetic maps are available for almost all of the map-area. Those for the northern part are dominated by alternating northeast-trending areas of relatively strong and weak magnetic intensity with the relatively strong areas following volcanic belts and basic intrusions. In the southern part of the map-area the patterns of magnetic intensity are more irregular but can be matched with bedrock geology in most places.

Ultramafic rocks (12) are commonly brecciated and altered to serpentine, talc, and carbonate. The age of the intrusions is unknown but they appear to have been affected by at least one period of deformation that does not seem to have affected nearby granitic rocks[11]. The position of the ultramafic intrusions (12) and associated mafic intrusions (13) at Pipestone Pond presents a geologic pattern somewhat analogous to the occurrence of ultramafic and mafic intrusions along the Gander River belt to the northeast[1,2]. In the map-area the ultramafic intrusions are closely associated with volcanic rocks (1) and slates and greywackes (2), and the intrusions are bordered to the east by metamorphosed quartzose arenaceous rocks (4). Similarly along the Gander River belt, ultramafic intrusions are spatially associated with Ordovician volcanic rocks and slates and are flanked southeastward by quartzose arenaceous rocks of the lower unit of the Gander Lake Group. The analogy, although tenuous, may have some regional stratigraphic or structural significance.

Mafic intrusions (13) are probably of at least two ages. Those associated with ultramafic intrusions (12) are interpreted to be of the same age as the ultramafic rocks – possibly Ordovician. Other mafic intrusions (13) clearly cut Silurian rocks; locally those throughout the metamorphic terrane at Wilding and Rodeross Lakes are fresh and massive and apparently post-date metamorphism in the surrounding rocks (4).

Granitic rocks (14) of the map-area can be broadly subdivided into two groups: coarse-grained, commonly porphyritic (perthite), potassic, biotite granites (14a) that occur throughout the metamorphic terrane (4); and hornblende granites and granodiorites with associated syenites (14b) and mafic intrusions (13) that occur among relatively unmetamorphosed Paleozoic rocks in the northern part of the map-area. Similar granitic intrusions are distributed in a like manner throughout most of the Newfoundland central Paleozoic mobile belt.

Rocks of map-unit 15 occur in loosely consolidated beds of horizontal or subhorizontal attitude. They are dominantly conglomerates, which are red along the southeast shore of Red Indian Lake and buff and brown along the northwest shore. Those along the northwest shore of the lake and immediately west of the map-area[12] contain fossil plants that indicate a Carboniferous age[13].

The Buchans orebodies, situated near the town of Buchans, have produced more than 12,000,000 tons of ore since production started in 1928. The average grade ore was 1.45% copper, 7.85% lead, 15.5% zinc, 0.05 oz. of gold per ton, and 3.52 oz. of silver per ton[4]. The highest grade orebodies are localized along volcanic breccia zones, and granite-boulder conglomerate zones that grade downward into volcanic breccias. The deposition of the breccias and conglomerate zones, along with associated and underlying sandstones and siltstones, is interpreted to have been controlled by a series of palaeotopographic troughs and channels . Swanson and Brown[4] considered that the ores are of epigenetic hydrothermal replacement origin but Anger[14], through a review of earlier work, suggested that the ores are syngenetic and he drew attention to the similarities of the Buchans deposits and those of the Rammelsberg type in Germany.

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MAP 1196A
RED INDIAN LAKE
(East Half)
NEWFOUNDLAND

1196A