

GEOLOGY OF THE WESTERN MESOPROTEROZOIC SEAL LAKE GROUP, CENTRAL LABRADOR (INCLUDING ALL OF NTS MAP AREAS 13L/2 AND 7 AND PARTS OF 13L/1, 3, 6, 8, 9, 10, 11, 14, 15 AND 16 AND 13E/14 AND 15)

T. van Nostrand and C. Corcoran¹

Regional Mapping Section

¹ Department of Earth Sciences, Memorial University of Newfoundland,
St. John's, NL, A1B 3X5

ABSTRACT

The map area includes rocks of the two lowest stratigraphic formations of the western part of the Mesoproterozoic Seal Lake Group, as well as the unconformities with the older plutonic and volcanic rocks of the Letitia Lake Group, Red Wine Intrusive Suite, Harp Lake Complex, Trans-Labrador Batholith and Archean granitoid rocks and gneiss. The southern mapped area is underlain by quartz arenite, arenite, siltstone, shale, slate, and pebble-, and cobble-bearing conglomerate, which are intercalated with amygdaloidal basalt flows, volcanoclastic rocks and intruded by gabbro sills. The rocks occur as tabular-shaped layers that follow a north- to northeast-strike direction. The northern mapped area is underlain predominantly by quartz arenite and arenite, and interbedded shale and siltstone, intercalated with massive basalt flows and rare gabbro sills of the basal stratigraphic formation.

Structures are dominated by east-, northeast-, and north-striking bedding, foliation and cleavage, which are best developed in sedimentary rocks and basalt flows. Mineral lineations and slicken striae have a predominant southwest- to south-east-plunge direction, and rotated phenocrysts imply a north-, to northwest-directed movement along thrust faults associated with the unconformities along the southern margin.

Mineral occurrences include minor bornite, chalcocite, malachite and azurite hosted in basalt flows, gabbro sill margins and argillaceous rocks of the Wuchusk Lake Formation. Local, elevated radioactive signatures are recorded from shale, and quartz-feldspar conglomerate of the Seal Lake Group and older igneous rocks associated with unconformities.

INTRODUCTION

The 2012 field season marked the fourth year of a 1:50 000-scale, geological bedrock-mapping project of the Seal Lake Group and included all of NTS 1:50 000-scale map areas 13L/2 and 13L/7 and parts of 13L/1, 3, 6, 8, 9, 10, 11, 14, 15 and 16 and 13E/14 and 15, using helicopter, boat and ground traversing.

The map area encompasses the western part of the Mesoproterozoic Seal Lake Group and is a continuation of 1:50 000-scale bedrock mapping efforts completed in the eastern and central Seal Lake area (van Nostrand, 2009; van Nostrand and Lowe, 2010; van Nostrand and MacFarlane, 2011). Ground traverses were carried out in moderately to well exposed areas. Poorly exposed areas, particularly in the northern map area, were covered primarily using helicopter and some ground traversing.

LOCATION AND ACCESS

The centre of the map area is located approximately 100 km northeast of the town of Churchill Falls, Labrador. The Orma Road runs along the extreme western map area and continues to the northern part of the Smallwood Reservoir (Figure 1). A part of the western margin of the group can be accessed by ground traversing from the Orma Road; however most of the area is best accessed by helicopter.

PHYSIOGRAPHY

Much of the northern and western map areas are underlain by extensive glaciofluvial deposits, including sorted and unsorted gravel, till and clay. The major ice-flow direction was to the northeast, followed by a later northeast to east-southeast direction (McCuaig and Smith, 2005). Striae directions in the map area are a dominant northeast trend

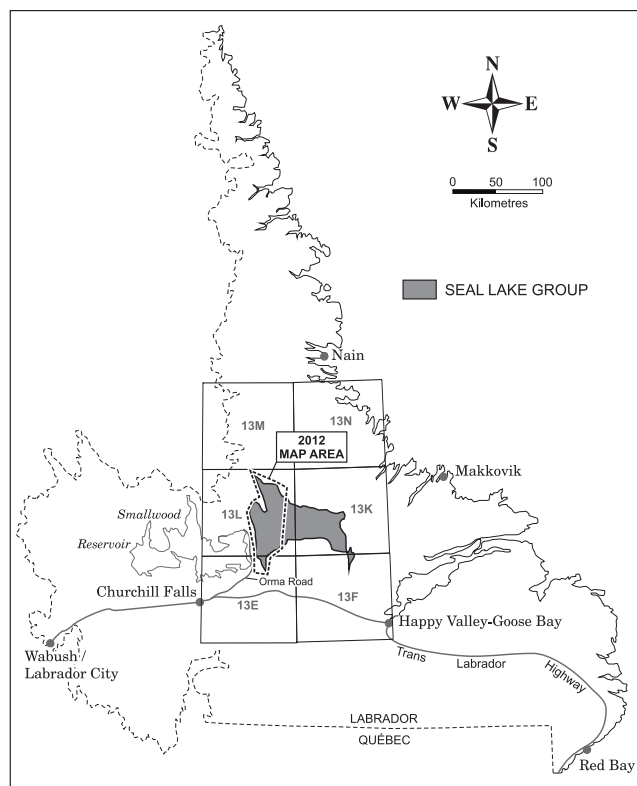


Figure 1. Location and extent of the Mesoproterozoic Seal Lake Group, in central Labrador. The limit of 2012 bedrock mapping is outlined by the dashed line. The extreme western part of the map area can be accessed from the Orma Road, which runs from the town of Churchill Falls to the eastern side of the Smallwood Reservoir.

(060–070°) and a weaker east-northeast trend (080–090°). The main drainage system, which flows east- to northeastward through the map area, includes the headwaters of the Kanairiktok River and the Naskaupi River, initiating from the eastern Smallwood Reservoir. These rivers, as well as smaller tributaries, are deeply incised ravines, commonly bordered by sinuous eskers and extensive sand plains. Elevations range from 275 m above sea level in the southern area, to 725 m above sea level in the north. The northern area, underlying the Seal Lake Group, is low-relief, caribou moss-covered sand plains, sparse spruce forests and string bogs. In the south, the terrain is wooded hills and ridges of moderate relief with dense alder growth along rivers and swamps in low-lying valleys. Small, scattered boulder fields occur throughout the map area.

PREVIOUS WORK

The Geological Survey of Canada produced 1:250 000-scale geological maps of NTS map 13L (Roscoe and Emslie, 1973) and 13K (Fahrig, 1959). Marten (1975) mapped parts of 13L/1 and 13L/2 at 1:50 000 scale in the Letitia Lake

area. Thomas (1981, 1983) produced a 1:50 000-scale bedrock map of parts of NTS map areas 13L/1, 13L/2 and 13L/8. Curtis and Currie (1981) mapped the northern part of 13E/14 and 13E/15 at 1:50 000 scale, and Nunn (1993) mapped parts of 13L/2, 13L/6 and 13L/7 along the western map area at 1:100 000 scale.

Kilfoil (2008) released shaded-relief, 1:250 000-scale airborne magnetic and gravity compilations of NTS maps 13K and 13L, which include the eastern Smallwood Reservoir area. Several recent, aeromagnetic and ground surveys over mineral claims within the map area were completed by various mineral exploration companies (Dimmell, 2007; Eaton and Morgan, 2008; Cole and Downey, 2009). To the east of the current map area, all of 13K/5, and parts of 13K/3, 13K/4, 13K/6, 13K/11, 13K/12, 13L/1 and 13L/8, had geological mapping surveys at 1:50 000 scale completed as part of this study (van Nostrand, 2009; van Nostrand and Lowe, 2010; van Nostrand and MacFarlane, 2011).

REGIONAL GEOLOGY

The Mesoproterozoic Seal Lake Group (Robinson, 1953; Brummer and Mann, 1961; Baragar, 1981) is the youngest of the volcano-sedimentary sequences in the Central Mineral Belt of Labrador (Figure 2). The Seal Lake Group is transected by the Grenville Front Zone (Gower *et al.*, 1980; Thomas, 1981) and lies immediately to the west of the triple-junction of the Nain, Churchill and Grenville structural provinces. The age of the Seal Lake Group is constrained between *ca.* 1270 to 1225 Ma (Cadman *et al.*, 1993; Romer *et al.*, 1995). The group consists of a subaerial to shallow-marine succession of arenaceous and argillaceous sedimentary rocks and amygdaloidal and massive basalt flows intruded by ophitic gabbro sills. The rocks are disposed in a regional-scale, doubly plunging syncline, of which the southern limb has been variably deformed and overturned to the north, adjacent to several southward-dipping Grenvillian thrust faults and ductile shear zones. Metamorphic effects show a gradational decrease from lower greenschist-facies to zeolite-facies assemblages from south to north. Rocks on the extreme northern limb of the regional syncline show only minimal deformation and metamorphism.

The Seal Lake Group unconformably overlies several older terranes, complexes, suites and undifferentiated basement rocks ranging from the Archean to the Mesoproterozoic (Wardle *et al.*, 1997).

Numerous, historical native copper and copper sulphide occurrences are associated with the margins of basalt flows, clastic sedimentary rocks and gabbro sills of two of the upper stratigraphic formations (Gandhi and Brown, 1975;

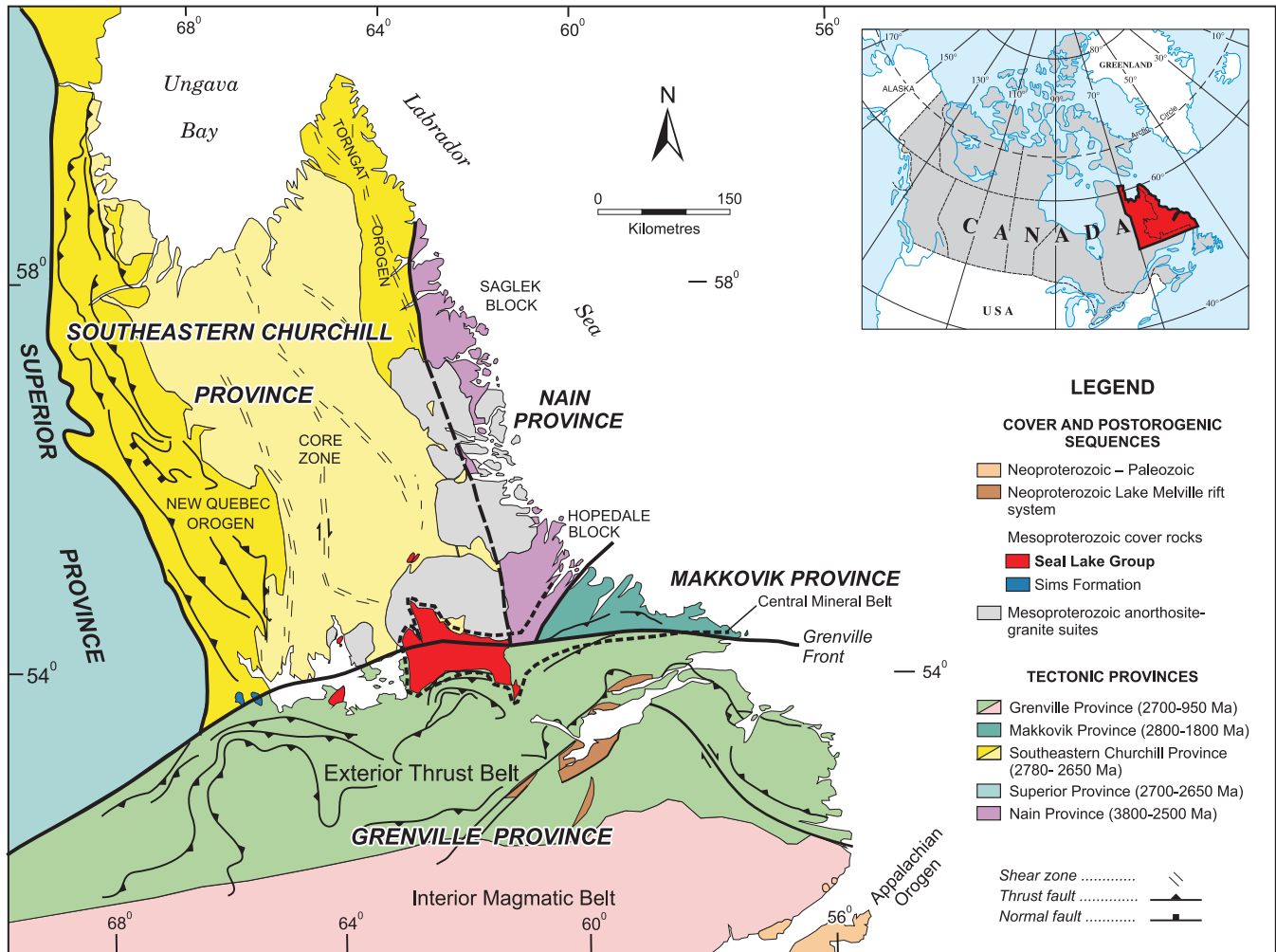


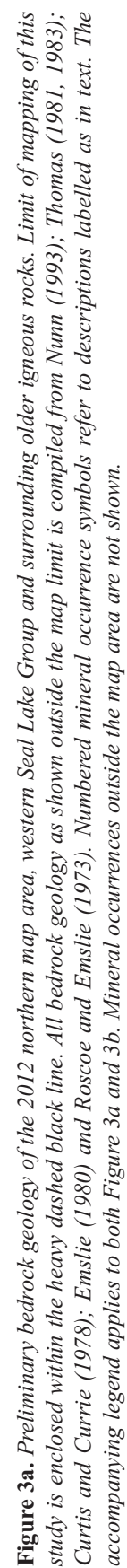
Figure 2. Location of the Seal Lake Group with respect to the structural provinces and major stratigraphic and tectonic features of Labrador and surrounding region (modified after Wardle *et al.*, 1997). The position of the Grenville Front is depicted as transecting the Seal Lake Group such that rocks to the south exhibit strong effects of Grenvillian deformation and metamorphism, whereas rocks to the north are weak to moderately deformed, with minimal fabric development and recrystallization. The extent of the Central Mineral Belt is outlined by the dashed line.

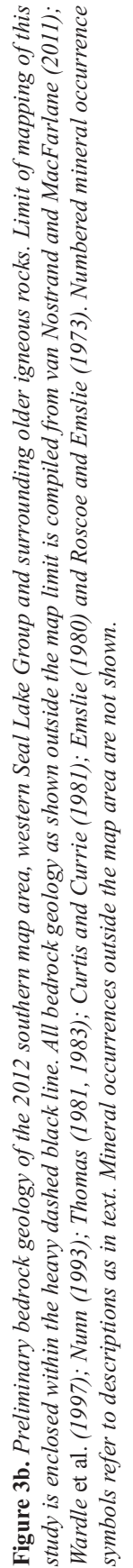
Wilton, 1996). Local, elevated and anomalous levels of radioactivity are recorded from quartz arenite, conglomerate, shale and fine-grained tuffaceous units in the two lowest stratigraphic formations and are associated with the unconformities with older igneous rocks (Marten and Smyth, 1975; van Nostrand and MacFarlane, 2011).

GEOLOGY OF THE STUDY AREA

The oldest rocks within the map area are Archean granitoid intrusions and gneiss of the Seal Lake Intrusive Suite (Nunn, 1993) that unconformably underlie the western limit of the Seal Lake Group (Figure 3a and b).

Undifferentiated, granitoid rocks of probable Archean age, underlie an area to the north of Shipikan Lake (Emslie, 1980) and also occur as inliers in the western Seal Lake Group (Roscoe and Emslie, 1973). Late Paleoproterozoic granitoid rocks of the Trans-Labrador Batholith and Mesoproterozoic igneous rocks of the Red Wine Intrusive Suite and Letitia Lake Group occur along the southern margin of the map area (Currie *et al.*, 1975; Curtis and Currie, 1981; Thomas, 1981). In the northern map area, anorthosite and related granitoid rocks of the Mesoproterozoic Harp Lake Complex (Emslie, *op. cit.*) are in unconformable contact with basal formation sedimentary rocks of the Seal Lake Group. The youngest rocks in the map area are of the Seal Lake Group (Brummer and Mann, 1961; Figure 3a and b).





LEGEND FOR FIGURE 3a AND 3b

MIDDLE MESOPROTEROZOIC

SEAL LAKE GROUP (ca. 1270-1225 Ma)

WUCHUSK LAKE FORMATION


- M₂aq** Predominantly pink-, white-, grey-, to red-weathering, quartz arenite, and arenite occurring as layers of variable thickness that are interleaved with gabbro sills and basalt flows. Contains cm-, and m-scale, interbeds of siltstone, mudstone and calcareous rocks. Rocks of this subunit exhibit an increasing degree of recrystallization toward the southern thrust faulted unconformities
- M₂st** Brown-, to tan-weathering, fine-grained, thinly bedded to laminated siltstone. Also contains thin quartz arenite, arenite, chert, and calcareous layers
- M₂sh** Fine-grained, red-, maroon-, to brown-weathering mudstone, grading to shale and slate with a weak to strongly developed S₁ axial-planar cleavage
- M₂bs** Black-, to grey-weathering, fine-grained shale, interbedded with siltstone and quartz arenite subunits. Exhibits localized and intermittent elevated radioactive signatures recorded by scintillometer analyses on outcrop surface
- M₂b** Green-, grey-brown-, to red-weathering, fine-, to medium-grained plagioclase + clinopyroxene + magnetite basalt. Textures range from homogeneous, massive, amygdaloidal, vesicular and porphyritic. Amygdaloidal phases consist of epidote, chlorite, calcite, quartz, and zeolites. Phenocrysts include plagioclase, quartz, olivine and clinopyroxene. Intruded by chlorite epidote and quartz veins along contacts with other rock types. May contain intercalated layers of volcanic tuffaceous rocks, sedimentary rocks and gabbro (as thin sills), which are not depicted in Figure 3a
- M₂g** Green-, grey-, brown-, to rusty-weathering, fine-, to very coarse-grained, massive to strongly foliated ophitic gabbro. Rocks are disposed as tabular-shaped sills in which marginal zones are primarily concordant with supracrustal rock subunit contacts, although some slightly discordant contacts are present. Gabbroic compositions range from melanogabbro to leucogabbro (based on greater than and less than 50 % mafic content, respectively). Very local leucotroctolite and leuconorite zones occur containing olivine and clinopyroxene contents are greater than 40 %. Some sills as depicted on Figure 3a may consist of composite intrusions

MAJOQUA-BESSIE LAKE FORMATIONS (STRATIGRAPHICALLY EQUIVALENT FORMATIONS)

- M₁g** Green-, to grey-green-weathering, fine-, to medium-grained, massive, ophitic-textured gabbro. Occurs as two thin (less than 100 m thick) sills intercalated with quartz arenite (subunit M₁aq) in the northwestern map area and with basalt flows (M₁b) in the west-central map area
- M₁b,a** Green-, grey, brown-, to red-weathering, fine-, to medium-grained plagioclase + clinopyroxene + magnetite basalt. The flows consist of massive, fine-grained, homogeneous basalt and amygdaloidal, vesicular, porphyritic and rare pillow basalt which comprise the flow tops. Amygdales consist of epidote, chlorite, calcite, quartz, and zeolites and phenocryst phases are plagioclase, quartz, olivine and clinopyroxene. Locally intruded by extensive chlorite epidote quartz veins, particularly along contacts with other rock types. May contain intercalated layers of volcanic tuffaceous rocks, sedimentary rocks and gabbro (as thin sills) which may not be depicted in Figure 3a and 3b
- M₁bv** Green-, grey-, to brown-weathering, fine-, to medium-grained, "rubbly-textured" volcanoclastic rocks. Locally exhibits a diffuse layering which may include volcanoclastic breccia and intrusive breccia. May also include fine-grained, homogeneous basalt flows and sedimentary rocks
- M₁bx,i** Green-, grey-, to brown-weathering, medium-grained, volcanic and intrusive breccia. Occurs as localized layers within thick sequences of basalt flows. Contains clasts and fragments of basalt, volcanoclastic rocks, gabbro and sedimentary rocks in basaltic and gabbroic matrix
- M₁bg** Green-weathering, fine-grained, very strongly deformed basalt, metamorphosed to mylonitic chlorite schist. Occurs as thin zones adjacent to north and northeast-striking thrust fault, partially delineating the unconformities
- M₁aq** White-, pink-, red-, green- to grey-weathering, fine- to coarse-grained quartz arenite and arenite. This is the predominant rock type within the basal stratigraphic formation and contains abundant cm-, to 10s of m-scale interbedded layers of siltstone, mudstone, shale and minor calcareous rocks. Most of the quartz arenite and arenite is characterized by quartz and feldspar in a homogeneous, well-sorted, subrounded-, to rounded texture. Bedding is near-ubiquitous and commonly contains trough-, and planar crossbedding, ripple marks, mud cracks and locally flute casts and imbricated grains
- M₁st** Brown-weathering, fine-grained, thinly bedded siltstone. Contains layers of quartz arenite and arenite
- M₁cg** White-, pink-, red-, to grey-weathering, medium-, to coarse-grained granule-, pebble-, and cobble-bearing arenaceous conglomerate. Consists of variable clast proportions of quartz, alkali feldspar, arenite, quartz arenite, argillaceous rocks, volcanic rocks, granitoid rocks and gneiss. The type of rock clasts being dependent on the position and contact source rock relationships of the conglomerate layer within the stratigraphy. The majority of conglomerates are matrix-supported
- M₁qs** White-, to grey-weathering, fine-, to medium-grained, strongly foliated and recrystallized quartz sericite schist, derived from quartz arenite (subunit M₁aq) and arenaceous conglomerate (subunit M₁cg). Contains quartz + alkali feldspar + sericite ± muscovite ± magnetite

MESOPROTEROZOIC

HARP DYKES (1271± 1 Ma)

-  Northeast-striking, olivine diabase dykes that intrude anorthosite and related rocks of the Harp Lake Complex and undifferentiated granitoid gneiss, north of Shipiskan Lake

MESOPROTEROZOIC (continued)

LETITIA LAKE GROUP (ca. 1327 Ma)

- MLmt** Fine-, to medium-grained, black-, to grey-weathering, strongly foliated and lineated hornblende-bearing mafic-rich schist or volcanic tuff. Interpreted as uppermost layer of Letitia Lake Group in unconformable contact with quartz-sericite schist of the base of the Seal Lake Group
- MLrg** Well-banded and complexly folded felsic volcanic rocks, volcanic derived sedimentary rocks of the Letitia Lake Group and may include quartz-feldspar-rich sedimentary rocks of the overlying Seal Lake Group
- MLrp** White-, buff-, to grey-weathering, weakly foliated to gneissic, medium-grained, recrystallized rhyolite porphyry to trachyte and ignimbritic tuffs. Locally intercalated with undifferentiated felsic volcanic rocks

RED WINE INTRUSIVE SUITE (ca. 1337 Ma)

Quartz saturated series

- MRgr** Medium-grained, moderate to strongly foliated mafic to intermediate peralkaline granitoid intrusions. Includes granite, quartz syenite, alkali feldspar granite and alkali feldspar quartz syenite.

Quartz undersaturated series

- MRsy** Alkali syenite and metamorphic equivalents
- MRgn** Medium-grained, strongly foliated to gneissic, pyroxene + amphibole mafic gneiss. Thomas (1981) noted the presence of aenigmatite (Na-Ti silicate) indicative of peralkaline igneous compositions, although this mineral has not been identified by the authors. This subunit records local, elevated radioactive signatures

HARP LAKE COMPLEX (ca. 1450 Ma)

- MH,a,t** Grey-, to grey-white weathering, medium- to coarse-grained, massive to layered, clinopyroxene + magnetite ± ilmenite ± olivine anorthosite, leucogabbro, leucotroctolite and leuconorite. The predominant rock type mapped along the unconformity with Seal Lake Group rocks is massive anorthosite, with zones of leucotroctolite
- MH,gr** Light brown-, to rust-weathering, medium-, to coarse-grained, massive biotite ± hornblende granite, locally gradational to quartz monzonite. The granite unconformably underlies flat-lying to shallow-dipping quartz arenite in the northwest portion of map area

LATE PALEOPROTEROZOIC**TRANS LABRADOR BATHOLITH (1660-1650 Ma, reworked during Grenvillian orogeny)**

NORTH POLE BROOK INTRUSIVE SUITE

- P₂qm** White-, to pink-weathering, fine-, to medium-grained, recrystallized, weakly foliated to mylonitic, K-feldspar porphyritic, biotite ± hornblende quartz monzonite to granite, locally gradational to granodiorite. Mylonitic fabrics are developed along the extreme northern margin of this subunit adjacent to thrust faults

EARLY TO MIDDLE PALEOPROTEROZOIC

- P₁sgn** Predominantly undifferentiated quartzofeldspathic gneiss
- P₁gr** Medium-grained, strongly foliated granite. Intruded by granitoid rocks of the North Pole Brook Intrusive Suite
- P₁p** Plutonic suite consisting of layered gabbro, diorite and granite. Rocks of this suite are not differentiated on Figures 3a and 3b


ARCHEAN TO EARLY PALEOPROTEROZOIC

- A₃gr** Undifferentiated foliated granite and orthogneiss. Includes rocks of the large intrusion north of Shipiskan Lake. Quartz arenite of the Majoqua Lake Formation unconformably overlies the granite

ARCHEAN GRANITOID ROCK INLIERS (includes A₂gr, A₂qd and A₂mz)

- A₂gr** Fine-, to medium-grained, weak to moderately foliated, biotite ± hornblende granite to quartz monzonite. This is the dominant rock type of the two granitoid rock inliers located in the western map area
- A₂qd** Medium-grained, weakly foliated, hornblende + biotite quartz diorite to diorite. Occurs as an isolated exposure on the northern margin of the large granitoid rock inlier in western Seal Lake Group. May be correlated with rocks of the Sail Lake Intrusive Suite to the west
- A₂mz** Medium-grained, weakly to strongly foliated hornblende + biotite monzonite. Occurs on the northern and southern margin of the large granitoid rock inlier in western Seal Lake Group. May be correlated with rocks of the Sail Lake Intrusive Suite to the west
- A₁sl** Sail Lake Intrusive Suite. Includes foliated to gneissic granite, quartz monzonite, granodiorite, quartz diorite and diorite which may include compositional gradations between various subunits
- A₁m** Mafic metavolcanic rocks, including tuffaceous rocks and amphibolite, felsic volcanic rocks, pelitic and psammitic

SYMBOLS FOR FIGURE 3a AND 3b

Bedding and amount of dip (tops unknown)	
Bedding, overturned. Developed along the southern margin of the Seal Lake Group associated with thrust faults	
Igneous layering, varies from weak to moderately developed in gabbro and basalt flows, tops unknown	
1st generation foliation	
2nd generation foliation	
1st generation fold axis, with amount of plunge	
2nd generation fold axis, with amount of plunge	
1st generation mineral lineation, with amount of plunge	
2nd generation mineral lineation, with amount of plunge	
1st generation slicken striae, with amount of plunge	
Rock subunit contact, definite, approximate and assumed are not distinguished	
Thrust fault, based on presence of ductile features such as mylonitic fabric, rotated phenocrysts and asymmetric pressure shadows, and in part on aeromagnetic signatures. Direction of thrust "teeth" indicate the dip of the thrust fault	
Strike-slip, primarily brittle fault, based on the presence of breccia, extensive chlorite and hematite alteration and local kinematic indicators	
Unconformity surface between rocks of the Seal Lake Group and surrounding older igneous rocks. Exposed unconformity surfaces are rare and most delineations of the contacts are assumed or approximate based on intermittent outcrops, topographic relief and aeromagnetic signatures	
Synform structure (plunge direction unknown, overturned)	
Antiform structure (plunge direction unknown, overturned)	
Mineral Occurrence Database System (MODS) copper sulphide occurrence. Numbered symbols refer to descriptions of occurrences in text	
Elevated radioactivity occurrence within the map area. Readings were recorded as total counts per second (tcps) in addition to preliminary "quick" assays using hand-held scintillometers. The use of the "U" symbol does not presuppose indication of uranium mineralization. Numbered symbols refer to descriptions of occurrences in text	
Elevated radioactivity occurrence	U
Minor bornite mineralization	bo
Minor chalcocite mineralization	cha

DESCRIPTION OF ROCK UNITS

Archean Granitoid Rocks, Volcanic Rocks, Sedimentary Rocks and Gneiss

The following descriptions are of rocks that underlie the Seal Lake Group and occur within the study area; hence not all units in Figure 3a and b are included. For description of the geology outside of the study area, refer to references listed in the caption.

Unit A_{1sl} – Sail Lake Intrusive Suite

The western limit of the map area is underlain by Archean granitoid and mafic rocks of the *ca.* 2690 to 2660 Ma Sail Lake Intrusive Suite (Nunn, 1993). This unit consists of granite, granodiorite, quartz monzonite, tonalite, diorite, quartz diorite, orthogneiss, amphibolite and undifferentiated mafic rocks. The predominant rock type underlying rocks of the Seal Lake Group in the western map area is a moderate to strongly foliated biotite ± hornblende granite to granodiorite (Plate 1).

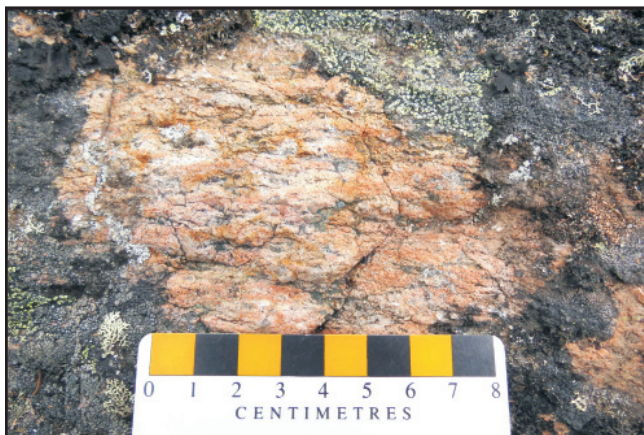


Plate 1. Strongly foliated and recrystallized biotite ± hornblende granite of the Sail Lake Intrusive Suite (Unit A_{1sl}) directly underlying the unconformity with brecciated basalt of the base of the Seal Lake Group as shown in Plate 31. Outcrop is located 5 km south of Marie Lake.

Undifferentiated Archean (?) Granitoid Rock Inliers

In the western part of the map area, two granitoid rock inliers are surrounded by rocks of the Seal Lake Group (Figure 3b). Roscoe and Emslie (1973) interpreted these as undifferentiated Archean granite, although no age data are available.

The larger, northern inlier is approximately 85 km² and consists of at least three rock types: i) a predominant fine- to medium-grained biotite ± hornblende granite to quartz mon-

zonite, ii) hornblende monzonite, and iii) hornblende + biotite diorite to quartz diorite, respectively, subunits A_{2gr}, A_{2mz} and A_{2gd}. The two latter rock types appear to be limited to the margins of the inlier. Along the southern edge of the inlier, 3.5 km east of Bibikwasin Lake, the hornblende monzonite is intruded by biotite + hornblende quartz monzonite to granite (Plate 2). South of the large inlier, a smaller inlier, approximately 3 km², consists of medium-grained biotite ± hornblende granite and is directly overlain by basalt of the Seal Lake Group (*see* Unconformities).



Plate 2. Grey-weathering hornblende + biotite monzonite intruded by red-weathering biotite + hornblende quartz monzonite to granite, located 3.5 km east of Bibikwasin Lake. The later quartz monzonite to granite subunit is the dominant rock type underlying the inlier and the earlier monzonite subunit appears to be limited to the southern margin.

Unit A_{3gr} – Undifferentiated Archean (?) Granite Gneiss

In the Shipiskan Lake area, the unconformity between the overlying Seal Lake Group and the underlying granitoid gneiss was not observed; however, flat-lying, undeformed, quartz arenite and siltstone bedding at the base of the Seal Lake Group, along the southern shore of Shipiskan Lake, suggests the contact may be subhorizontal. To the northwest of Shipiskan Lake, the outcrop consists of grey-weathering, medium-grained, recrystallized, and strongly foliated to gneissic biotite granite (Plate 3).

Paleoproterozoic Rocks

Unit P_{1p} – Granitoid, Mafic and Sedimentary Rocks

In the Proof Lake area, Paleoproterozoic intrusions and related sedimentary rocks of Unit P_{1p} are surrounded by the Sail Lake Intrusive Suite, and a small intrusion occurs as an inlier within the Seal Lake Group (Figure 3b). Nunn (1993)



Plate 3. Strongly foliated to gneissic biotite granodiorite (Unit A_3gr) comprising the large Archean? intrusion north of Shipiskan Lake. The light-weathering lenses are leucosome composed of quartz and alkali feldspar.

recognized several rock types within this subunit including: diorite, quartz diorite, amphibolite, metagabbro and metasedimentary rocks. These lithological divisions are not shown in Figure 3b. During this mapping project, only a few outcrops of strongly foliated quartz diorite and psammitic gneiss were examined.

Trans-Labrador Batholith

Unit P_2qm – Granite to Quartz Monzonite

Granitoid rocks of the Paleoproterozoic Trans-Labrador Batholith occur in the Marie Lake, Mary Lake and Shallow Lake areas. The rocks are part of the North Pole Brook Intrusive Suite (Thomas, 1981), and consist of medium- to coarse-grained, moderate to strongly foliated, recrystallized, locally K-feldspar porphyritic, hornblende \pm biotite granite, quartz syenite, granite and quartz monzonite (Plate 4).

Mesoproterozoic Rocks

Harp Lake Complex

Emslie (1980) divided the Mesoproterozoic Harp Lake Complex into several mafic and granitoid rock units, however only three rock types were part of the map area, namely anorthosite, leucotroctolite, and granite, and are here treated as subunits.

Subunit MH_a – Anorthosite – Within the map area, the most abundant mafic rock of the Harp Lake Complex is a medium- to coarse-grained, grey- to grey-white-weathering, homogeneous, and massive to moderately foliated anorthosite. Compositions range from 70–90% plagioclase, 5–15% clinopyroxene, 5–10% olivine, 5% magnetite, 2 to

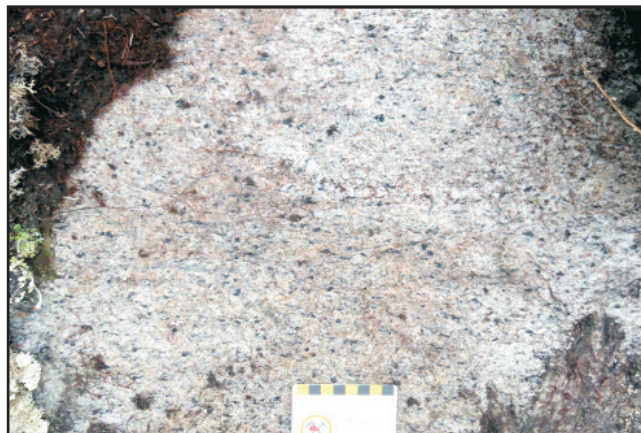


Plate 4. Strongly foliated, locally K-feldspar porphyritic, hornblende \pm biotite quartz monzonite of the North Pole Brook Intrusive Suite (Unit P_2qm). The dark-weathering phenocrysts are hornblende. Outcrop located immediately south of unconformity with strongly, foliated basalt at the base of the Majoqua Lake Formation, southern shore of Mary Lake.

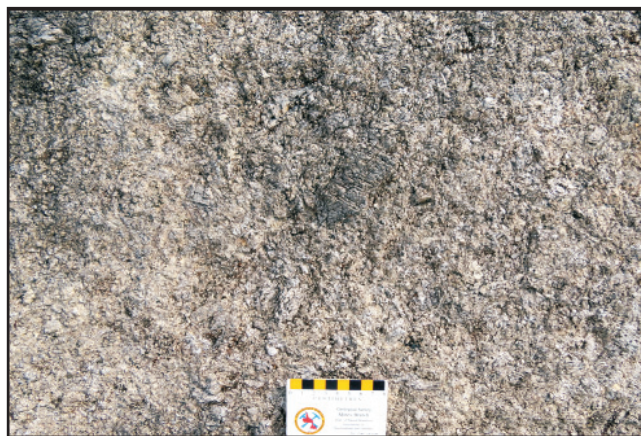


Plate 5. Coarse-grained, massive anorthosite (Subunit MH_a) of the Harp Lake Complex. Rock consists of 70–90% plagioclase, 5–8% magnetite + ilmenite, and 5–10% olivine and is the dominant rock type along the contact with quartz arenite of the Majoqua Lake Formation in the northern map area. Outcrop is located approximately 200 m below the unconformity with quartz arenite (Subunit M_1aq).

3% ilmenite (Plate 5). Layering is developed in a few areas, defined by concentrations of magnetite \pm ilmenite, alternating with plagioclase-rich layers.

Subunit MH_t – Leucotroctolite – Leucotroctolite also occurs within the Harp Lake Complex. This rock is grey weathered, medium grained, massive to weakly foliated, and contains 60–65% plagioclase, 25–30% olivine, 5–10% magnetite \pm ilmenite, and \pm 1–3% clinopyroxene. Only a few outcrops of this subunit were examined in the map area.

Subunit MHgr – Granite – In the west-northwest part of the map area, granite to alkali-feldspar granite is included as a subunit of the Harp Lake Complex. Emslie (1980) referred to this subunit as adamellite. The granite is pink, brown, to grey-weathering, coarse grained, massive, variably altered and contains 35–65% K-feldspar, 20–25% quartz, 5–10% plagioclase, 5–10% biotite and 2–3% magnetite.

Red Wine Intrusive Suite

The Mesoproterozoic Red Wine Intrusive Suite (Thomas, 1981) was originally referred to as the Red Wine Alkaline Complex (Currie *et al.*, 1975), and consists of “a series of elongate, sinuous, tectonically deformed lenses of agpaitic alkaline rocks of amphibolitic aspect enveloped in peralkaline quartzofeldspathic gneisses” (Curtis and Currie, 1981). These authors defined the suite by ‘undersaturated’ and ‘saturated’ series and divided them into the North and South Red Wine plutons (Figure 3b). Two main subunits of the suite are encountered in the southern map area; these include i) quartz syenite to granite (subunit MRgr), part of the ‘saturated’ series, and ii) pyroxene ± amphibole-bearing gneiss, part of the ‘undersaturated’ series (subunit MRgn).

Subunit MRgr – Quartz Syenite to Granite (Saturated Series) – Subunit MRgr consists of white-, pink-, to tan-weathering, moderately foliated to banded, medium- to coarse-grained, locally K-feldspar porphyritic, quartz syenite to granite. Rocks of this subunit are in fault contact with the Seal Lake Group to the northeast and south-southwest of Shallow Lake, and consist of 40–60% alkali feldspar (groundmass and phenocrysts), 10–15% plagioclase, 10–25% blue-grey quartz, 5–10% amphibole and 5% opaque phases (Plate 6).

Subunit MRgn – Mafic-rich Gneiss (Undersaturated Series) – Rocks of subunit MRgn are tectonically interleaved with quartz syenite and granite of subunit MRgr, and with rhyolite of the Letitia Lake Group, northeast of the Shallow Lake area. Thomas (1981) referred to some rocks of this subunit as “green-pyroxene- and aenigmatite-bearing gneiss”, and are exposed along, and immediately east of, the Partridge River (Figure 3b)

The rocks are green-weathered, fine- to medium-grained, strongly foliated to banded, plagioclase, pyroxene, amphibole, and magnetite-bearing gneiss (Plate 7). In some areas, cm- to 10s-of-cm-scale, light-green-weathering lenses composed of pyroxene ± light-green amphibole (?) occur within a strongly foliated matrix of plagioclase, pyroxene and magnetite. The mineral ‘aenigmatite’, as reported by Thomas (*op. cit.*) may be present, although it has not been identified during this survey. Along the shoreline, and east of the Partridge River, rocks of this subunit record elevated radioactivity, up to ten times background levels and appears



Plate 6. Strongly foliated, medium-grained amphibole-bearing, alkali-feldspar porphyritic quartz syenite of the Red Wine Intrusive Suite (Subunit MRgr). Exposure is located within the arcuate-shaped pluton southwest of the west end of Ten Mile Lake. Pen is 15 cm in length.

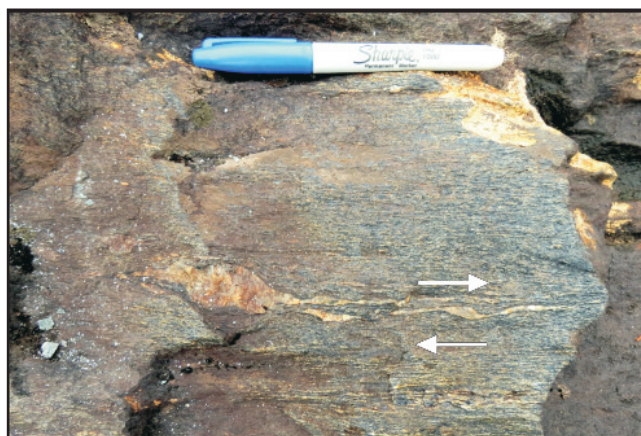


Plate 7. Strongly deformed amphibole + pyroxene-bearing gneiss of the “unsaturated series” (Subunit MRgn) of the Red Wine Intrusive Suite exposed along the Partridge River. The boudinaged and dextrally rotated quartz-plagioclase vein fragments and a southwest-plunging lineation (parallel to plane of photograph) suggest a northwest shear sense associated with the thrust fault.

to be consistent throughout the subunit in this area (see Mineralization).

Letitia Lake Group

Rocks of the Mesoproterozoic Letitia Lake Group underlie a small part of the southeastern margin of the map area (Figure 3b). The Letitia Lake Group (Marten, 1975; Thomas, 1981; Miller, 1987) is subdivided into three main units: 1) a basal, quartz-feldspar porphyry, 2) a middle unit of rhyolite crystal tuff and ignimbrite tuff, and 3) an upper

unit interpreted to be a paleo-weathered ‘regolith’ surface of underlying units. Only the extreme northwestern margin of the Letitia Lake Group was mapped and two main rock types were encountered: a) quartz-feldspar porphyritic rhyolite, and b) mafic-rich tuffaceous rocks. Refer to Thomas (1981), Miller (1987) and van Nostrand and MacFarlane (2011) for descriptions of the upper Letitia Lake Group in the Bessie Lake and Letitia Lake area (Figure 3b).

Subunit MLrp – Rhyolite Porphyry – Rhyolite porphyritic rocks are grey, green, to cream weathering, fine to medium grained, range from moderately foliated to banded and contain up to 20% pink-, and grey-weathering alkali-feldspar phenocrysts and characteristic blue-grey-weathering quartz (Plate 8). The matrix consists of quartz, alkali feldspar, plagioclase, clinopyroxene ± amphibole and minor biotite and magnetite.

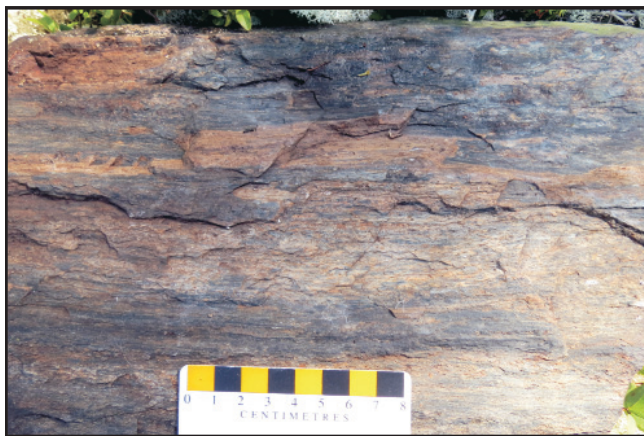


Plate 8. Banded rhyolite porphyry of the upper Letitia Lake Group (Subunit MLrp) proximal to the sheared unconformity with quartz sericite schist at the base of the Majoqua Lake Formation. Note southwest-plunging, north-verging, ‘Z’-fold developed in brown-weathering layer in upper right of photograph suggesting a northwestward sense of thrusting associated with the unconformity. Located 200 m north of west end Ten Mile Lake.

Subunit MLmt – Mafic-rich Volcanic Tuff – Rocks of this subunit occur as a lens-shaped zone at the top of the Letitia Lake Group at the western end of Ten Mile Lake (Figure 3b) and consist of a black- to grey-weathering, fine-grained, strongly foliated and lineated mafic-rich schist of probable tuffaceous protolith. Plagioclase + amphibole + magnetite ± pyroxene ± biotite are the main phases of the subunit (Plate 9). The tuff is immediately overlain by, and in thrust contact with, a thin zone of strongly foliated quartz-sericite schist (subunit M₁qs) at the base of the Seal Lake Group, although the unconformity surface is not exposed. Elevated radioactive signatures were recorded from outcrops of this subunit, immediately north of Ten Mile Lake (see Mineralization).



Plate 9. Fine-grained, strongly lineated, mafic-rich volcanic tuff (Subunit MLmt) near the top of the Letitia Lake Group stratigraphy. The tuff is tectonically interleaved with quartz-sericite schist (Subunit M₁qs) and banded rhyolite porphyry of Subunit MLrp (shown in Plate 8), located 250 m north of the west end of Ten Mile Lake.

Seal Lake Group

The stratigraphic nomenclature used in the description of Seal Lake Group subunits in the map area follows that of van Nostrand and Lowe (2010) and van Nostrand and MacFarlane (2011), although some unit designators and rock type names have been modified. Refer to Figure 3a and b for subunit locations.

Majoqua Lake Formation

The term Majoqua Lake Formation was created by Frobisher Limited geologists (Robinson, 1953; Brummer, 1957) to distinguish undeformed and relatively unaltered basalt flows and sedimentary rocks of the basal formation of the group on the northern limb of the Seal Lake syncline from the moderate to strongly deformed rocks on the southern limb (Bessie Lake Formation). Subsequent mapping by Brummer and Mann (1961), Gandhi and Brown (1975), Baragar (1981), van Nostrand and Lowe (2010) and van Nostrand and MacFarlane (2011) reported that the rocks included in these two formations are stratigraphically and lithologically equivalent units because some units can be traced from the northern limb to the southern limb around the eastern hinge zone of the syncline. Most of the rocks in the map area lie on the northern limb of the regional syncline and are thus grouped as part of the Majoqua Lake Formation; rocks on the southern limb are interpreted to have been overthrust by older igneous rocks and tectonically removed from the sequence. The exception is a thin zone of quartz-sericite schist and basalt in the Shallow Lake area, which are tentatively correlated with rocks on the southern limb of the syncline and thus considered part of the stratigraphically equivalent Bessie Lake Formation.

The rocks of the Majoqua Lake Formation (and the Bessie Lake Formation) within the map area consist predominantly of quartz arenite, arenite, conglomerate, siltstone, shale and quartz-sericite schist with intercalated homogeneous and massive to amygdaloidal basalt flows, volcaniclastic rocks and rare gabbro sills in the northern map area.

Subunit $M_{1aq,a}$ – Quartz Arenite and Arenite – Quartz arenite and arenite are the dominant rock types in the area and vary from white, grey, green, pink, maroon to red weathering, fine to coarse grained, and are massive to well bedded. Quartz ranges from 60 to 90% and alkali-feldspar content varies from 3% up to 25% of the total rock with accessory fine-grained magnetite, hematite, calcite, plagioclase, apatite and sphene.

In the northern part of the map area, most of these rocks are exposed as vertical sections within deeply incised river valleys (Plate 10) with very little outcrop on the upland plateaux. The rocks are predominantly unrecrystallized, well sorted, with subrounded to rounded quartz and alkali-feldspar grains and subordinate fine-grained magnetite, hematite and sphene. Rocks of this subunit are variably recrystallized in the southern map area. Bedding attitudes are generally shallow south-dipping (Plate 11). Steeply dipping, variably striking beds are evident in areas where open F_1 fold structures and strike-slip faults are present. Axial-planar fabrics are weakly developed to non-existent in most sedimentary rocks and have a weak cleavage, enhanced by fine-grained magnetite or hematite, at a low angle or concordant with bedding. Graded bedding, crossbedding, ripple marks, dessication cracks and rare flute casts and imbricated grains are commonly preserved sedimentary features (Plate 12). A paleocurrent analyses has not been carried out, however, the wide range of attitudes of these features suggest several flow directions.

Subunit M_{1qs} – Quartz-sericite (\pm Muscovite) Schist – Subunit M_{1qs} is limited to the southern map area adjacent to northeast-striking faults and occurs in the Shallow Lake and Mary Lake areas (Figure 3b). These rocks are interpreted as strongly recrystallized and foliated equivalents of quartz arenite (Subunit M_{1aq}) with interbedded, fine-grained argillaceous rocks. The rocks are white, cream, to light grey-weathering, fine to medium grained, exhibit a pervasive schistose to mylonitic fabric and contain quartz, alkali feldspar, minor plagioclase, magnetite, fine-grained sericite \pm muscovite (Plate 13). The schists are locally intercalated with thin zones of strongly deformed and partially recrystallized quartz-pebble conglomerate and semi-pelitic rocks.

Extensive zones of this subunit have been mapped to the east of the present map area in the Bessie Lake area and

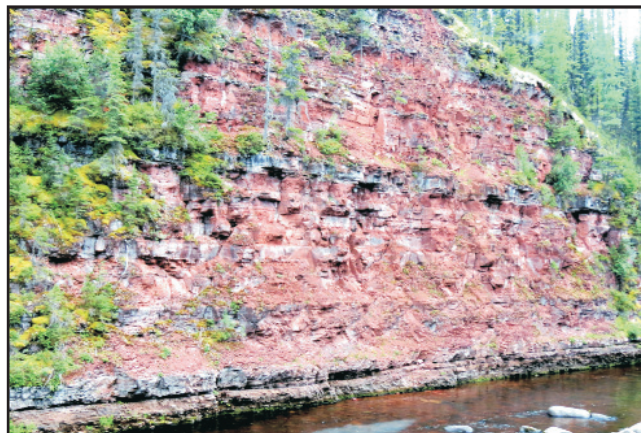


Plate 10. Vertical section of very shallow (5 to 10°), south-dipping, interbedded red-weathering quartz arenite to arenite and grey-weathering siltstone to mudstone typical of the extensive sedimentary rock sequences in the northern map area. Located on a tributary of the South Shipiskan River, 16.5 km due west of Shipiskan Lake. Height of section in the view of photograph is approximately 20 m.



Plate 11. Shallow (5°), south-dipping, interbedded quartz arenite (Subunit M_{1aq}) and quartz-granule conglomerate (Subunit M_{1cg}) at the base of the Majoqua Lake Formation. The unconformity, although not exposed, is interpreted as near flat-lying and relatively undisturbed with little evidence of subsequent deformation. This exposure is directly overlain by a 10 - to 15 -m-wide, fine-grained gabbro sill.

in the extreme southeast portion of the Seal Lake Group (van Nostrand and Lowe, 2010; van Nostrand and MacFarlane, 2011). These rocks are interpreted as the stratigraphically lowest subunit of the basal formation (Bessie Lake Formation) of the group along most of the southern margin of the group.

Subunit M_{1cg} – Conglomerate – Conglomerate occurs throughout the map area as m- to 10s-of-m-scale beds and layers interbedded with other sedimentary rocks and associ-



Plate 12. Steeply dipping, symmetrical ripple marks developed in fine-grained, grey-weathering recrystallized quartz arenite near the top of the Majoqua Lake Formation (Subunit M_{1aq}). Located 1 km west of the unconformity with foliated granite of the Sail Lake Intrusive Suite on the southern shoreline of Marie Lake.



Plate 13. Strongly recrystallized and sheared, foliated to banded, quartz-sericite schist of subunit M_{1qs} (recrystallized Subunit M_{1aq}) at the base of the Seal Lake Group, along a thrust fault contact with tuff of the Letitia Lake Group (shown in Plate 9). The green-weathering bands are composed of sericite + chlorite + minor quartz. The white-weathering bands consist predominantly of sheared quartz grains with minor alkali feldspar and sericite. Pencil tip is 1.25 cm in length. The outcrop is located 500 m north of the west end of Ten Mile Lake.

ated with unconformities. The conglomerates are predominantly quartz arenite to arenite and consist of 10–60%, 2–25 mm in diameter, quartz and lesser alkali feldspar and rock clasts in a fine-grained, moderately sorted to graded matrix. Along the unconformities with the older igneous rocks, the conglomerate contains subrounded to rounded granitoid rock, gneiss, volcanic rock and lesser arenite and quartz-arenite cobbles and pebbles, up to 3 cm in diameter. The

matrix of the conglomerate varies from partially unconsolidated arenite and quartz arenite along the undeformed unconformities, to strongly recrystallized and mylonitic quartz-sericite schist adjacent to thrust faults (see Unconformities, Plate 30).

Subunit M_{1st} – Siltstone – Siltstone occurs as m-scale layers interbedded with arenite and quartz arenite to 10s-of-m-scale layers intercalated with basalt flows. The siltstones are well bedded to laminated and characterized by light- and dark-weathering beds of silty arenite, mudstone and fine-grained quartz arenite.

Subunit M_{1ms} – Maroon-weathering Slate, Shale and Undifferentiated Calcareous Rocks – Maroon-weathering slate and shale are subordinate rock types in the map area and occur primarily as cm- to m-scale beds and layers interbedded with quartz-rich arenite and lime-rich argillites. These rocks vary from grey, green to red weathering are fine grained, and consist of a siltstone to mudstone matrix with light-coloured calcite-rich laminations.

Subunit M_{1b} – Homogeneous Basalt Flows – The predominant basalt type of the Majoqua Lake Formation within the map area are green, grey, black, and red weathering, aphyric to medium grained, massive to foliated, commonly fractured and variably altered and have a homogeneous appearance (Plate 14). In most of the exposures, only one type of the basalt is present, although individual flow contacts can be observed that have a massive, homogenous base, grading upward to amygdaloidal, vesicular and porphyritic phases of individual flows. Individual flow thicknesses, throughout the area, range from 3 m to more extensive flows, which have an apparent thickness of greater than 300 m. Some of the thicker basalt subunits as depicted on Figures 3a and b are likely composite layers composed of several individual flows although contacts are not always exposed. The mineral composition of the basalt is relatively consistent throughout the subunit, containing 65–80% fine-, to very fine-grained plagioclase laths and 10–25% intergranular augite, 2–10% olivine, and 5–10 % magnetite. Sphene, apatite and rutile are accessory phases.

In the southern part of the map area, adjacent to thrust faults, the basalt flows are strongly altered to chlorite ± tremolite schists (Plate 15). Plagioclase is saussuritized to varying degrees and chlorite ± tremolite ± epidote assemblages replace clinopyroxene and olivine with the most extensive alteration occurring north and southwest of Shallow Lake.

Subunit M_{1ba} – Amygdaloidal Basalt Flows – Amygdaloidal basalt flows are intercalated with homogeneous, fine-grained basalt throughout the map area and locally are iden-



Plate 14. Representative fine-grained, massive, homogeneous, altered and fractured basalt flow (Subunit M_{1b}) of the Majoqua Lake Formation.



Plate 15. Very strongly foliated to mylonitic, steeply dipping, fine-grained, homogeneous basalt flow of subunit M_{1bg} metamorphosed to a chlorite \pm tremolite schist. Located adjacent to a thrust fault marking the unconformity with granite of the North Pole Brook Intrusive Suite. Outcrop located 300 m southeast of Mary Lake in the extreme southern map area. Scale card is 8 cm in length

tified as representing the upper portion of thick basalt flows. These rocks are green, red, grey weathering, fine to medium grained and contain calcite, quartz, epidote, zeolite and locally chlorite-filled amygdules ranging up to 30% of the total rock (Plate 16). In several areas, the amygdules are commonly altered and deformed, indicating the increase in the effects of metamorphism and deformation toward the southern margin of the map area.

Subunit M_{1bv} – Volcaniclastic Rocks – Volcaniclastic rocks are a subordinate rock type in the southern map area occurring as thin intercalations with massive and amygdaloidal basalt flows. In the northern area, these rocks occur as thick



Plate 16. Fine-grained, strongly foliated amygdaloidal basalt flow (Subunit M_{1ba}) immediately overlying the unconformity with Archean granite of the Sail Lake Intrusive Suite. Amygdules consist of fractured epidote, calcite, and quartz, some with pressure shadows suggests a sinistral sense of localized shearing associated with the unconformable contact with the older granite basement.

layers that are intercalated with lesser amygdaloidal and homogeneous basalt flows. The rocks are extensively altered and exhibit a distinct granulated to ‘rubbly’ texture in which a well-defined to diffuse igneous layering can be observed and sedimentary rocks are locally intercalated. The rocks are green, grey, to red weathering, fine to medium grained and consist of variable proportions of plagioclase, clinopyroxene, olivine and magnetite.

Subunit $M_{1bx/bi}$ – Volcanic and Intrusive Breccia – Rocks of subunit M_{1bx} (volcanic breccia) and M_{1bi} (intrusive breccia) are limited to a 10s-of-m-thick zone along the South Shipiskan River (Figure 3a) and as cm- to m-scale layers within basalt flows throughout the map area. On the Shipiskan River, the rocks consist of several types of matrix-supported, xenolithic blocks including fine-grained basalt and gabbro, volcaniclastic mafic tuff, siltstone and quartz arenite occurring in a variably altered and foliated matrix of both basaltic and gabbroic material (Plates 17 and 18). The origin of these rocks is uncertain although the presence of several rock types incorporated in both a basaltic and gabbroic matrix suggests a complex assimilation and/or faulting involving gabbro sills, basalt flows, volcaniclastic rocks and sedimentary rocks.

Subunit M_{1bg} – Banded to Gneissic Basalt Flows – Basalt flows exhibiting a gneissic to banded texture are limited to areas adjacent to strike-slip and/or thrust faults associated with unconformities in the Shallow Lake and Mary Lake areas. The rocks are green to grey weathering, fine grained, strongly foliated and have a distinct to diffuse banding defined by alternating chlorite \pm relict augite-bearing and plagioclase-rich layers (Plate 19).



Plate 17. Intrusive breccia (Subunit M_{1bi}) consisting of angular and subrounded, fine-grained basalt, volcaniclastic rock, gabbro and siltstone xenolithic blocks incorporated in a fine-, to medium-grained gabbroic matrix material, Majoqua Lake Formation. Outcrop is located on the shoreline of the Shipiskan River, 11.5 km west-northwest of Shipiskan Lake. Scale card is 8 cm in length.

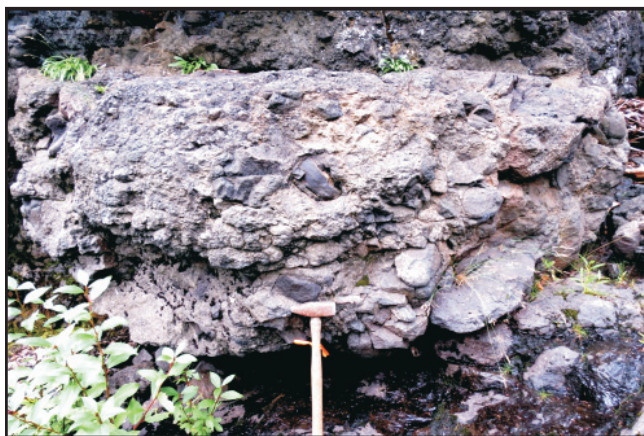


Plate 18. Matrix-supported, volcanic breccia (Subunit M_{1bx}) consisting of subrounded blocks of fine-grained gabbro, very fine-grained basalt, siltstone and volcaniclastic tuff in a matrix of fine- to medium-grained basaltic material. Outcrop is located 2 m north of the exposure of intrusive breccia as shown in Plate 17. Hammer is 50 cm in length.

Subunit M_{1g} – Gabbro – Gabbro is probably a minor rock type in the Majoqua Lake Formation, observed as thin sills in only two localities. One of these sills overlies flat-lying to shallow-dipping, interbedded quartz arenite and quartz-pebble conglomerate, 6 km north of the Kanairiktok River (Figure 3b). The gabbro is fine grained, homogenous and has an equigranular to subophitic texture. The contact is not exposed; however, the attitude of the underlying quartz arenite suggests the sill dips very shallowly to the south.



Plate 19. Strongly foliated and banded, fine-grained, chlorite ± tremolite schist (Subunit M_{1bg}) with thin concordant plagioclase-rich bands, located proximal to faulted unconformity with granite of the Red Wine Intrusive Suite, 5 km south-southeast of Shallow Lake. Pen is 15 cm in length.

A second gabbro sill is intercalated with basalt flows on the southern limb of a large F_1 anticline structure, south of the Desolation River (Figure 3b). Both of these sills are each based on a single outcrop. The paucity and relative thinness of gabbro sills in the basal formation, in comparison to extensive and thick sills in the overlying Wuchusk Lake Formation, were also noted by van Nostrand and MacFarlane (2011).

Wuchusk Lake Formation

The Wuchusk Lake Formation (Robinson, 1953; Brummer and Mann, 1961) conformably overlies the Majoqua Lake Formation and consists of a general fining-upward sedimentary sequence of conglomerate, quartz arenite, arenite, siltstone, mudstone, shale, slate and subordinate interbedded limestone and undifferentiated calcareous layers. The sedimentary rocks are intercalated with basalt flows, volcaniclastic rocks and numerous gabbro sills. These rocks occur primarily as east-, northeast-, to north-striking layers that lie on the northern limb of the regional syncline (Figure 3a and b).

Subunit M_{2aq} – Variably Recrystallized Quartz Arenite and Arenite – Subunit M_{2aq} is the dominant sedimentary rock in the Wuchusk Lake Formation and consists of red-, grey-, white-, pink-, and green-weathering quartz arenite and arenite. The rocks are variably recrystallized exhibiting a well-developed equigranular texture and foliation in the southern area to relatively pristine with matrix-supported textures in most areas in the north. Original sedimentary features are commonly preserved (Plates 20 and 21).

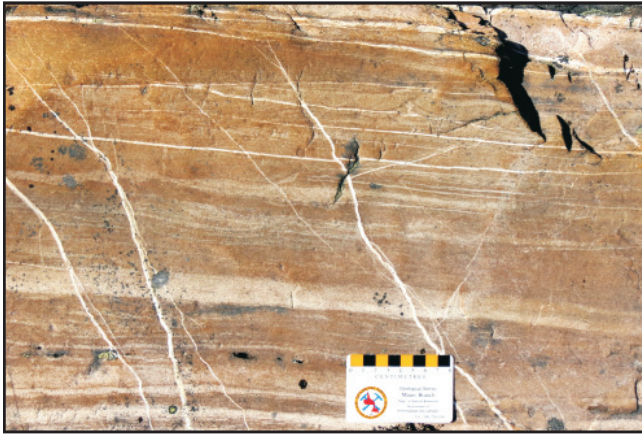


Plate 20. Well-bedded, steeply dipping, partially recrystallized quartz arenite (Subunit M_{2aq}) cut by concordant and discordant quartz veins. Bedding is defined by alternating strong and weakly hematized alkali feldspar and quartz contents. Located on the southern shoreline of Marie Lake, approximately 1 km west of unconformity with granitoid rocks of the Sail Lake Intrusive Suite.



Plate 21. Strongly recrystallized quartz arenite to arenite (Subunit M_{2aq}) of the Wuchusk Lake Formation exhibiting diffuse, low-angle trough crossbedding. Pink-weathering grains are hematized alkali feldspar. Outlines of bedding surfaces are enhanced by the presence of very fine-grained magnetite \pm hematite grain concentrations. Pen is 15 cm in length.

Quartz arenite and arenite range from white, pink to red weathering, fine to medium grained, well bedded to massive and contain greater than 75% quartz and less than 25% alkali feldspar with minor magnetite, hematite, sericite and muscovite.

The layers of this subunit are thickened in the western part of the map area, compared to relatively thin layers farther to the northeast; a result of significant folding of these



Plate 22. Strongly foliated, red-weathering slate (Subunit M_{2sl}) with folded and sheared quartz veins. Cleavage is a S_1 fabric that is folded about a weakly developed, southwest-plunging F_2 axes. Naskaupi River, 4 km east of Marie Lake.

subunits about northeast-striking, F_1 axial traces in the southern map area.

Subunit M_{2st} – Siltstone – Siltstone in the Wuchusk Lake Formation occurs as 10- to 25-m-wide layers interleaved between gabbro sills, and as cm- and m-scale layers interbedded with other sedimentary subunits. The rocks are light-brown weathering, fine grained and well bedded to laminated. Constituent phases include quartz, alkali feldspar and fine-grained clay minerals.

Subunit M_{2sl} – Maroon Shale – Shale and slate in the Wuchusk Lake Formation occur as maroon-weathering, mm-, to cm-scale laminations interbedded with quartz arenite and siltstone and as thicker horizons ranging up to 100 m in width. Rocks of this subunit exhibit a variably developed cleavage, which in some areas, transposes bedding surfaces and are commonly cut by numerous generations of quartz \pm calcite veins and small shear zones (Plate 22).

Subunit M_{2bs} – Black Shale – Black shale is a subordinate rock type in the map area and consists of cm- to m-scale interbeds within arenite and quartz arenite in a few areas. The shale is fine grained and exhibits a weakly to moderately developed cleavage. Locally, rocks of this subunit in the map area record elevated scintillometer readings (*see* Mineralization).

Subunit M_{2b} – Basalt Flows – Subunit M_{2b} includes green-, red-, to brown-weathering, aphyric- to medium-grained, amygdaloidal to fine-grained, massive to strongly foliated basalt flows. The flows are intercalated with quartz-rich sed-

imentary rocks and gabbro sills. Basalt is a subordinate rock type in the Wuchusk Lake Formation in comparison to the thick and extensive flows in the underlying Majoqua Lake Formation.

As with many exposures in the area, only one rock type is observed at any given locality, and is designated accordingly. On extensive outcrops, individual flows are recognized and contacts are locally marked by thin breccia zones (Plate 23).

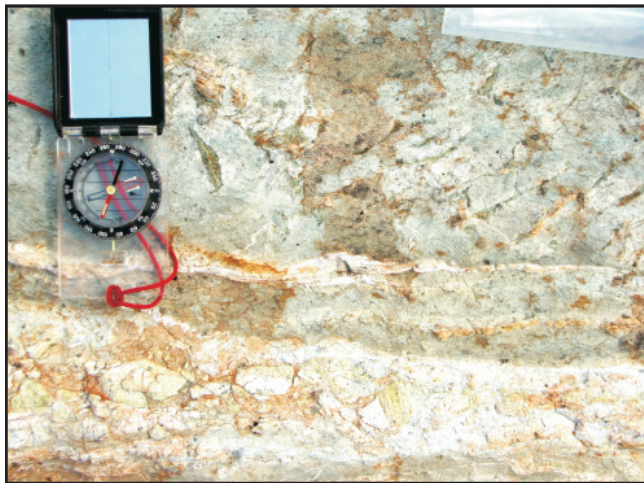


Plate 23. Thin (10–12-cm-wide), horizontal, brecciated layer along the contact of two strongly epidotized and sheared basalt flows of the Wuchusk Lake Formation (Subunit M_2b). The white- and green-weathering clasts in the breccia layer consist of partially epidotized plagioclase grains and aggregates. Two kilometers east-northeast of Marie Lake on the Naskaupi River.

Subunit M_{2g} – Gabbro – Gabbro is the predominant rock type in the Wuchusk Lake Formation and occurs primarily as tabular-shaped sills ranging from 20 m up to 250 m in thickness, where the thicker sills as depicted on Figure 3b may be composite intrusions. The rocks exhibit a wide variety of grain sizes and textures ranging from fine to very coarse grained, ophitic to equigranular and are melanogabbroic to leucogabbroic in composition. Mineral phases include variable proportions of plagioclase, clinopyroxene (specifically augite), olivine, magnetite and ilmenite. Fine-grained, disseminated pyrite is a near-ubiquitous accessory phase ranging 1–2 % of the total rock.

The interior zones of most sills consist of medium-, to very coarse-grained, ophitic to subophitic gabbro (Plate 24). The margins of the gabbro sills vary from having aphanitic to fine-grained, homogeneous ophitic and equigranular tex-



Plate 24. Well-developed ophitic texture in coarse-grained, massive, melanogabbro sill of the Wuchusk Lake Formation (Subunit M_{2g}). Dark anhedral grains are augite crystals that are partially altered to chlorite ± epidote. Plagioclase laths up to 10 cm in length are partially saussuritized. Located 8 km southwest of Shallow Lake.



Plate 25. Sharp, steeply dipping, concordant contact of medium-grained, massive gabbro sill margin (Subunit M_{2g}) overlain by well-bedded quartz-arenite sequence (Subunit M_{2aq}). Very fine-grained chilled sill margin and thin hornfels in quartz arenite are shown at the tip of black arrow in the bottom right of photograph. Hammer is 75 cm in length. Located along the Naskaupi River, 5.5 km northeast of Marie Lake.

tures to a ‘spotted’ appearance in which plagioclase-rich glomerocrysts occur within a mafic-rich matrix. Chilled margins and hornfels zones in adjacent rocks are developed in several areas and indicate that the contacts are conformable and sharp (Plate 25).

STRUCTURAL GEOLOGY

STRUCTURE OF THE SEAL LAKE GROUP IN THE SOUTHERN MAP AREA

The southern map area encompasses rocks located south of the Kanairiktok River as shown on Figure 3b. The area is dominated by east-, northeast-, to north-striking bedding and foliations and southeast- to southwest-plunging mineral lineations and slicken striae. Northeast-striking brittle faults occur throughout the area (Plate 26), and east to northeast ductile thrust faults are associated with the unconformities along the southern margin of the Seal Lake Group. Rotated and asymmetric kinematic indicators within some of these thrust zones suggest a north- to northwest-directed shear movement (Plate 27). The southern unconformities are marked by zones of strong deformation such as the northeast-striking thrust faults in the Ten Mile Lake and Mary Lake areas, or as primarily strike-slip faults, with some thrust component as in the Shallow Lake and Partridge River areas. Well-developed S_1 and S_2 foliations are generally concordant with these contacts; however, deviations from these trends reflect localized shear zones and isoclinal, recumbent folds associated with the thrust faults.



Plate 26. Strongly limonitic-altered base of the gabbro sill shown in Plate 25. The white arrow in centre of photograph indicates south-southwest plunge direction of a well-developed stretching lineation along a northeast-striking, strike-slip fault that cuts the base of the sill along the Naskaupi river. Hammer is 50 cm in length.

First-generation fold structures in the southern area consist of open to tight, south- to southeast-plunging anticlines and synclines in most subunits, with a variably developed axial-planar S_1 cleavage or foliation (Plate 28).

Along the extreme southern margin of the Seal Lake Group, the early F_1 structures are overprinted by tight to isoclinal, southwest-, to southeast-plunging, recumbent sec-



Plate 27. Strongly deformed semi-pelitic schist (Subunit M_{1qs}) at the base of the Seal Lake Group along the fault-bounded unconformity with coarse-grained granite of the North Pole Brook Intrusive Suite in the extreme southern map area. The strong fabric is defined by a transposition of S_0 and a S_1 foliation. A southeast-plunging L_1 mineral lineation (parallel to the plane of the photograph) and sinistally rotated quartz fragments and clasts (shown by yellow arrows) suggest a northwestward sense of shearing associated with the unconformity. A isoclinal, south-plunging F_2 fold closure is observed in the right centre of the photograph (circled). Outcrop is located 2.5 km northwest of Mary Lake.

ond-generation F_2 folds related to thrusting (Plate 29). Several, predominantly northeast-striking brittle faults, along, or parallel to river valleys are defined by pervasive hematite and epidote alteration, extensive quartz \pm calcite veining and local fault breccia and mylonitic fabrics. The major faults occur parallel to the Desolation River and the Naskaupi River. In the Desolation River area, a northwest-striking fault displaces, in a dextral sense, one of these early northeast-striking faults as well as the closure of a large F_1 antiform structure (Figure 3b), and indicates an earlier fault (syn- F_1 ?) transected by a later, northwest-striking, post- F_1 brittle fault. Along the Naskaupi River, just east of Marie Lake, a fault or series of faults, partially deflect the north-northeast-striking subunits to a northeast-strike direction, suggesting a component of dextral strike-slip associated with this structure.

STRUCTURE OF THE SEAL LAKE GROUP IN THE NORTHERN MAP AREA

In the northern map area, north of the Kanairiktok River (Figure 3a), deformational fabrics are weakly developed compared to those in the southern area. Structures range from open folding of thick basalt and quartz-arenite layers to tight F_1 folds of bedding and concordant quartz veins about south-, and southeast-plunging axes in individual out-

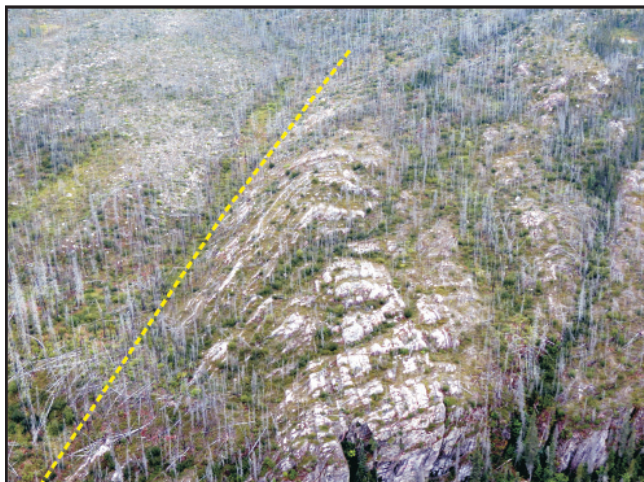


Plate 28. Southeast-plunging F_1 fold in interbedded, recrystallized quartz-arenite-siltstone sequence located at the base of the Wuchusk Lake Formation. The left (east) limb of the fold is partially truncated by a minor south-southwest-striking fault (dashed line). Width of photograph view is approximately 100 m. Located along the Naskaupi River, 5 km northeast of Marie Lake.



Plate 29. Recumbent F_2 folds developed in muscovite-bearing, semi-pelitic schist (part of subunit M_{2qs}). The F_2 fold axes are southwest-plunging and perpendicular to the plane of photograph. Original bedding is completely transposed by a very strong S_1 cleavage that is folded about the shallow-plunging F_2 folds. Located 2.5 km west of Shallow Lake, adjacent to northeast-striking thrust fault.

crops. Second-generation F_2 folds that occur in the southern map area, were not observed north of the Kanairiktok River. In the northern most map area, fabrics are limited to bedding attitudes in sedimentary rocks, a local, very weak, slightly oblique, axial-planar S_1 foliation and a moderately developed layering in some volcanoclastic rocks. Northeast-striking brittle faults along river valleys are marked by hematite, epidote alteration and quartz \pm calcite veining, with local,

southwest-plunging slickenside lineations. Local brecciated and strongly altered zones in basal Seal Lake Group rocks are associated with northward-striking brittle faults along parts of the unconformity with Archean granite of the Sail Lake Intrusive Suite. In other areas along this contact there is little to no evidence of deformation.

METAMORPHISM

Metamorphic grade within the map area varies from greenschist-facies assemblages associated with thrust faults along the southern map area, to zeolite facies and unmetamorphosed rocks in the north. A preliminary analysis of assemblages includes chlorite \pm tremolite alteration in mafic rocks and sericite \pm muscovite-bearing assemblages in sedimentary rocks in the southern map area. Zeolite-bearing mafic rocks north of the Naskaupi River were reported by Baragar (1981) and van Nostrand and MacFarlane (2011); farther to the east within the map area, they have only been tentatively identified. Rocks in the northernmost map area are very weakly altered to unaltered and exhibit weak saussuritization and epidotization. The exceptions are thin marginal hornfels of sedimentary rocks in contact with basalt flows and rare intrusive gabbro sills. Preliminary investigation of alteration assemblages indicates that metamorphic isograds are approximately parallel to the unconformities and associated thrust faults along the southern margin of the map area.

UNCONFORMITIES

The Seal Lake Group, within the map area, unconformably overlie the units of seven older groups, suites, complexes and undifferentiated granitoid intrusions (Figure 3a and b). These contacts are poorly exposed, and most are based on sparse outcrops, aerial photograph lineaments, topographic relief and aeromagnetic signatures. The following are brief descriptions of the unconformities that occur within the map area.

Seal Lake Group – Sail Lake Intrusive Suite

The unconformity of quartz arenite at the base of the Seal Lake Group and Archean granodiorite and granite of the Sail Lake Intrusive Suite is exposed in a few areas along the western limit of the map area. One locality, 3.5 km west of Bibikwasin Lake, exposes a deeply weathered, matrix-supported, conglomerate containing 10 to 20%, rounded granodiorite to granite, basalt and quartz arenite and arenite pebbles and cobbles, ranging from 1 to 4 cm in diameter. Smaller granules of fine-grained, dark-weathering basalt, slate and arenite comprise 10% of the rock in some layers and range from 0.5 to 1 cm in diameter (Plate 30). The matrix consists of partially unconsolidated, rubbly textured,



Plate 30. *Strongly weathered, matrix-supported conglomerate (Subunit M_{1cg}) along the unconformity of quartz arenite at the base of the Majoqua Lake Formation and underlying Archean biotite–hornblende granodiorite of the Sail Lake Intrusive Suite (Unit A_{1sl}). The matrix material consists of medium-grained, partially unconsolidated arenite to quartz arenite. Subrounded clasts consist of the underlying granodiorite (cobble-sized clasts), and quartz arenite and fine-grained basalt of the Seal Lake Group (pebble-sized clasts). Exposure located 3.5 km west of Bibikwasin Lake.*

red-weathering, medium-grained arenite to quartz arenite. Individual beds are defined by a variation in percent pebble content, size of pebbles and weathering colour of the arenaceous matrix.

Directly underlying the conglomerate is a weakly foliated, hornblende \pm biotite granodiorite of the Sail Lake Intrusive Suite (Nunn, 1993). The presence of only a weak to non-existent deformational fabric in either the conglomerate or the underlying granodiorite suggests that this part of the unconformity is unmodified by faulting. In contrast to this relationship along the unconformity, strongly foliated granite to granodiorite is in fault contact with brecciated and undeformed basalt flows, located 20 km to the south (Figure 3b; Plate 31). The lack of arenaceous conglomerate along the latter unconformity surface might suggest this subunit has been removed, either through subsequent erosion or, as evidenced by the basalt breccia, brittle faulting, or a combination of both.

Seal Lake Group – Undifferentiated Archean Granite Unconformity

The unconformity between basalt at the base of the Seal Lake Group and older granite is exposed along the margin of the small inlier, southeast of Bibikwasin Lake (Figure 3b). At this locality, a thin zone of fine-grained, strongly altered basalt (subunit M_{1b}) directly overlies medium-grained, quartz-rich, biotite \pm hornblende granite, with little to no evidence of deformation (Plate 32).

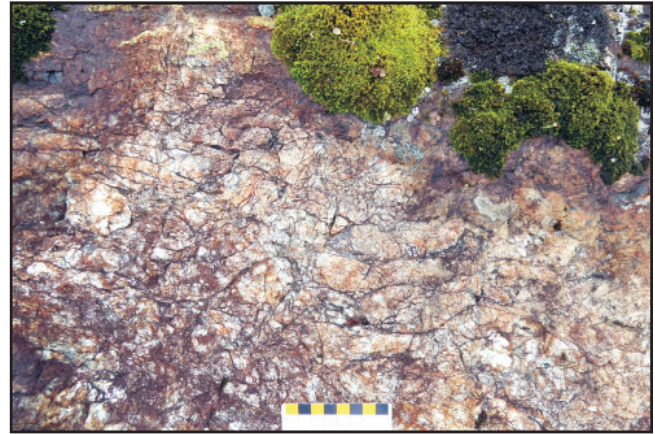


Plate 31. *Fine-grained, strongly altered and brecciated basalt flow (Subunit M_{1bx}) at the base of the Majoqua Lake Formation directly overlying strongly foliated granite of the Sail Lake Intrusive Suite. Located 4.5 km south of Marie Lake. The basalt flow occurs 20 km south along the same unconformity as the undeformed conglomerate as shown in Plate 30.*



Plate 32. *Quartz-rich granite (Unit A_{2gr}) at the western edge of the small granitoid rock inlier in the western map area. The granite is overlain by a thin layer of strongly altered basalt to volcaniclastic rock (Subunit $M_{1b,v}$) and marks a sharp unconformity between Archean? granite basement and the base of the Majoqua Lake Formation.*

Seal Lake Group – Undifferentiated Granite Gneiss (North Of Shipiskan Lake)

The contact with this intrusion was not observed, although flat-lying, relatively undisturbed quartz arenite and siltstone layers along the southern shore of Shipiskan Lake may suggest the unconformity is subhorizontal.

Seal Lake Group – Letitia Lake Group Unconformity

The contact of the Seal Lake Group with rocks of the

Letitia Lake Group has been discussed in detail by Calon and Hibbs (1980); Thomas (1981); Miller (1987) and van Nostrand and MacFarlane (2011) in the Bessie Lake–Letitia Lake area. Only a small portion of the unconformity occurs in the map area. The contact is marked by a poorly exposed zone of complexly interleaved and strongly deformed banded rhyolite and mafic tuff of the Letitia Lake Group and quartz-sericite schist of the Seal Lake Group (Plates 8, 9 and 13) along a northeast-striking, southeast-dipping thrust fault in the Ten Mile Lake area (Figure 3b).

Seal Lake Group – Red Wine Intrusive Suite Unconformity

The unconformity is marked by a north-northwest-striking fault along a portion of the Partridge River separating potassium-feldspar porphyritic granite (Subunit MRgr) and a thin zone of strongly foliated to mylonitic basalt flows of subunit M₁bg. To the east, the granite is juxtaposed against gabbro along a northeast-striking thrust zone. Southeast of Shallow Lake, the unconformity is interpreted as a north-striking fault having a predominant sinistral strike-slip component.

Seal Lake Group – Harp Lake Complex Unconformity

The unconformity between the Seal Lake Group and the Harp Lake Complex is not exposed in the study area. The northwestern area is covered by extensive glacial and fluvial sands, gravels and boulders. Outcrops in the area are limited to the larger rivers, some rounded hilltops and small escarpments. The contact is defined to within 100 to 200 m in many areas, based on intermittent outcrops and topographic relief. On the basis of near-horizontal bedding attitudes in quartz arenite and arenite at the northern and north-western limit of the Seal Lake Group (Plates 10 and 11), this unconformity is interpreted as relatively flat-lying and undeformed.

Seal Lake Group – Trans-Labrador Batholith Unconformity

The unconformity of the Trans-Labrador Batholith and the base of the Seal Lake Group has been constrained to within approximately 10 m in the Mary Lake area (Figure 3b). At this locality, a coarse-grained granite to quartz syenite directly underlies intercalated quartz arenite, basalt and pelitic schist, the latter is the stratigraphically lowest subunit of the Seal Lake Group and exhibits a strong transposed foliation, recumbent folds and numerous rotated quartz fragments, indicating a sinistral (northward-directed) shear sense associated with the unconformity (Plate 27). Seven kilometres to the southeast of this locality, the same (or similar) granite is in assumed thrust contact with very strongly foliated to mylonitic basalt flows.

MINERALIZATION

Mineralization includes: i) minor bornite, chalcocite, chalcopyrite, malachite and azurite hosted along, or proximal to, contacts of basalt flows, gabbro and sedimentary rocks; ii) elevated radioactivity in sedimentary rocks of the Seal Lake Group and older igneous rocks adjacent to unconformities; iii) iron sulphide (pyrite) concentrations in several different rock types and (iv) magnetite \pm ilmenite concentrations in gabbro. The majority of these occurrences are previously reported indications and one showing included in the Mineral Occurrence Database System (MODS) of the Newfoundland Geological Survey. A few of the indications are new, minor occurrences.

Copper-Sulphide Indications

Several Cu-sulphide indications are reported in the MODS for the map area. Most of the MODS indications were located in this study; however, considering many of these occurrences were taken from locations in historical reports and maps, the coordinates as presented in the MODS database may be estimates. In most cases, the descriptions are style of mineralization and not individual occurrences.

The following are brief descriptions of three of the MODS occurrences and four new minor indications examined during this study. Numbers in open brackets refer to locations of occurrences as shown on Figure 3a and b.

1) MODS Occurrence 13L/02/Cu004

Along the northern shoreline of a U-shaped lake, 3 km southeast of Maid Marion Falls, rust, to grey-weathering gossan zone occurs in an altered basalt flow near the contact with red-weathering, interbedded quartz arenite, slate and siltstone. The mineralized zone occurs in a small vertical rock face measuring 2.5 m in height by 4 m in length and contains minor bornite (1% over a 25-cm-wide zone) and trace chalcopyrite in a black-weathering zone at the base of the outcrop (Plate 33).

2) MODS Occurrence 13L/07/Cu002

Malachite alteration and trace chalcocite (less than 1%) are hosted along the contact of monzonite and granite of the large, undifferentiated granitoid rock inlier located in the western part of map area, 3.5 km east of Bibikwasin Lake. The mineralization occurs across a 60-cm-wide by 1-m-long, altered and strongly foliated zone (Plate 34). Trace malachite also occurs in several, localized areas of the outcrop.

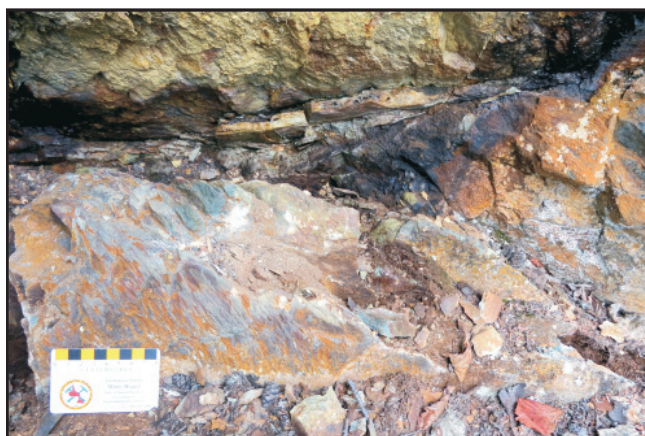


Plate 33. MODS Occurrence 13L/02/Cu004. Malachite (green alteration) and minor bornite (1%) hosted in strongly altered limonite-bearing gossan zone in strongly foliated, fine-grained, homogeneous basalt flow margin. The mineralization is associated with a steeply dipping, north-striking shear zone developed along the contact of the basalt flow with slate and quartz arenite. Wuchusk Lake Formation, southeast of Maid Marion Falls, Naskaupi River; UTM coordinates 517820E / 6004888N, NAD 27, Zone 20.

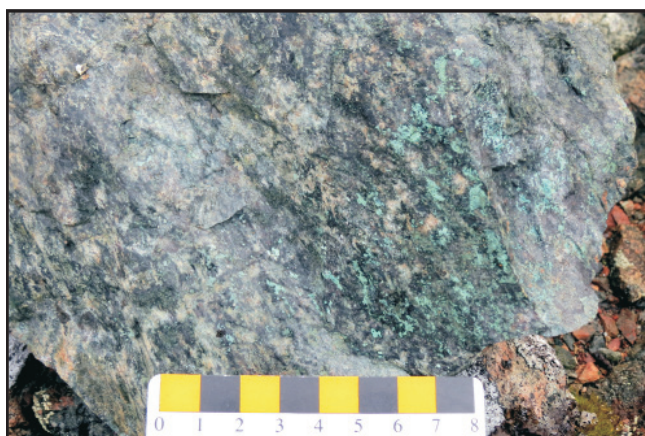


Plate 34. MODS Occurrence 13L/07/ Cu002. Malachite alteration and trace chalcocite hosted in small shear zone within hornblende monzonite at the southern margin of the undifferentiated, large granitoid rock inlier located in the western part of map area, 3.5 km east of Bibikwasin Lake. The mineralization occurs across a 60-cm-wide by 1-m-long zone, and trace malachite occurs in several other areas of the outcrop. UTM coordinates 512627E / 6012999N, NAD 27, Zone 20.

Radioactivity Survey

Approximately 90% of visited outcrops were spot checked for radioactivity, measured as total counts per second (tcps) using either a hand-held RS-120 scintillometer or a RS-230 BGO spectrometer. The latter instrument is also

capable of measuring quick ‘preliminary’ assays of % K and ppm of uranium (U) and thorium (Th). Cursory prospecting was carried out in areas where elevated readings were recorded (two times background levels or greater); however, no significant trends were defined. Gabbroic rocks recorded the lowest readings ranging from 25 to 75 tcps and 0.1 to 0.3% K, 1 to 3 ppm U and 1 to 4 ppm Th. Basalt flows yielded similar, although slightly higher readings of 50 to 120 tcps and 0.1 to 0.5% K, 1 to 5 ppm U, and 1 to 6 ppm Th. No anomalous values were noted in either the gabbro or basalt flows. Sedimentary rocks yield a higher average range of 100 to 225 tcps and 1.0 to 4.0% K, 1 to 14 ppm U and 1 to 12 ppm Th. Conglomerate and fine-grained argillaceous rocks recorded the higher readings.

A single radioactive occurrence is listed in MODS for the map area.

3) MODS Occurrence 13L/02/Th001 – Partridge River Thorium Showing

The showing is located 2 km northeast of Shallow Lake, along, and immediately east of, the Partridge River, and consists of several outcrops of green-weathering, mafic-rich gneiss (subunit MRgn) of the Red Wine Intrusive Suite. The gneiss yields elevated signatures ranging from an average of 1000 to a maximum of 9860 tcps, and up to 50 ppm U and 1650 ppm Th. The maximum recorded values are from areas of the gneiss that contain cm- to 10s-of-cm-scale, elliptical amphibole + pyroxene lenses and discontinuous layers (Plate 35). This subunit and its potential for hosting radioactive mineralization have been described by Eaton and Morgan (2008); Miller (1987); Thomas (1981) and Curtis and Currie (1981). Another exposure of this subunit is located 500 m north, along the Partridge River, where a reading of 1960 tcps was recorded (Plate 7).

New, Minor Radioactive Occurrences

Four, minor occurrences of elevated radioactivity within the map area are discussed below.

4) Grey- to Black-weathering Shale (Majoqua Lake Formation)

Elevated scintillometer readings of 650 tcps were recorded from one exposure of grey shale (subunit M₂bs) interbedded with thin siltstone layers on an island in Majoqua Lake, in the upper stratigraphic levels of the Majoqua Lake Formation. The shale outcrop is poorly exposed and true thickness is difficult to determine, although appears to be 1 to 3 m thick. Examination of similar rocks to the east of the present map area (van Nostrand and MacFarlane, 2011) reported intermittent, elevated radioactivity signatures.

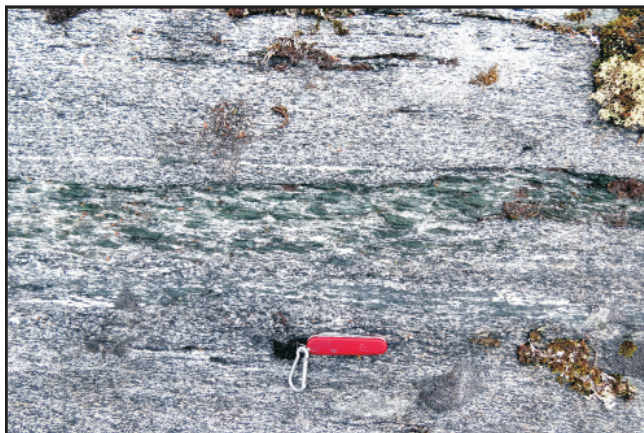


Plate 35. MODS Occurrence 13L/02/Th001. Partridge River thorium showing. Strongly deformed amphibole-pyroxene-bearing gneiss (Subunit MRgn) of the Red Wine Intrusive Suite. The gneiss is interleaved with quartz syenite to granite (Subunit MRgr). The locality consists of several closely spaced outcrops that record elevated radioactive signatures up to 9860 total counts per second and preliminary assays of 50 ppm U and 1650 ppm Th. Knife is 8 cm in length. UTM coordinates 534454E / 5994910N, NAD 27, Zone 20.

5) Quartz-pebble Conglomerate (Majoqua Lake Formation)

Two times background levels (ca. 500 tcps) were recorded from a single exposure of quartz-pebble conglomerate in the northern map area, 15 km southwest of Shipiskan Lake (Figure 3a). These readings are associated with hematite-filled fractures and appear to be very localized.

6) Mafic-rich Volcanic Tuff (Letitia Lake Group)

Elevated readings were recorded from a black-weathering, fine-grained schistose mafic-rich rock interpreted as a volcanic tuff of the Letitia Lake Group (subunit MLmt), located 250 m north of the southwest end of Ten Mile Lake. The unit is in thrust contact with quartz-sericite schist at the base of the Seal Lake Group, and occurs as several outcrops, which yield readings up to 4800 tcps and preliminary assays of 45 ppm U and 550 ppm Th, from the base of a sloping, 2-m-high cliff face (Plate 9). Several readings on outcrops over a 50- by 50-m-size area averaged approximately 2000 tcps and 20 ppm U and 200 ppm Th.

7) Granite (Trans-Labrador Batholith)

In the extreme southwestern map area, 3 km northwest of Mary Lake, two outcrops of coarse-grained granite of the Trans-Labrador Batholith (subunit M₂qm) record spot read-

ings of 600 and 730 tcps (3X background levels) and preliminary assays of 6 ppm U and 42 ppm Th. The granite is in thrust contact with pelitic schist, quartz arenite and basalt of the Seal Lake Group.

Fe-sulphide Indications

The Fe-sulphide indications as reported in MODS consist of localized, 1-4% fine-grained, disseminated pyrite and small cubic crystals. Considering that most rock types contain pyrite as a near-ubiquitous phase, its presence at these localities does not necessarily suggest any indication of mineralization.

Magnetite ± Ilmenite Occurrences

Magnetite and ilmenite are ubiquitous accessory phases in basalt flows and gabbro sills, although, in a few areas, concentrations range up to 15% of the total rock over a few square metres and also occur as irregular lenses and layers up to 10 cm wide, particularly in coarse-grained gabbro sill interiors. No significant occurrences were observed.

ACKNOWLEDGMENTS

The authors extend appreciation to Daniel Niquet, Marina Schofield and Sarah Turner for eager, competent and able assistance in the field. Wayne Tuttle is thanked for his usual efficient logistical field support out of Goose Bay. Thanks go to Alana Hinchey for a visit in July and, Universal Helicopters Limited, through pilot Tim Williams, is thanked for providing excellent service throughout the summer. Earlier versions of this report were reviewed by Alana Hinchey, and gratitude is extended for suggested improvements.

REFERENCES

- Baragar, W.R.A.
1981: Tectonic and regional relationships of the Seal Lake and Bruce River magmatic provinces, Geological Survey of Canada, Bulletin 314, 72 pages.
- Brummer, J.J.
1957: Report on operations including geology maps, diamond drilling, geophysical and geochemical plans in the Frobisher Seal Lake Concessions, central Labrador. Unpublished Kennco Canada Limited Company and Frobisher Limited report, 162 pages.
- Brummer, J.J. and Mann, E.L.
1961: Geology of the Seal Lake area, Labrador. Geological Society of America Bulletin, Volume 72, pages 1361-1382.

- Cadman, A.C., Heaman, L.M., Tarney, J., Wardle, R.J. and Krogh, T.E.
1993: U-Pb geochronology and geochemical variation within two Proterozoic mafic dyke swarms, Labrador. *Canadian Journal of Earth Sciences*, Volume 30, Number 7, pages 1490-1504.
- Calon, T.J. and Hibbs, D.C.
1980: Structure of an area along the boundary of the Letitia Lake Group and Seal Lake Group, central Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 80-1, pages 177-181.
- Cole, B. and Downey, N.
2009: First and second year assessment report on field reconnaissance 2008 work program. NTS sheets 13L/02, Isabella Falls area, central Labrador, Tripple Uranium Resources Incorporated, 53 pages.
- Currie, K.L., Curtis, L.W. and Gittins, J.
1975: Petrology of the Red Wine Alkaline Complexes, central Labrador and a comparison with the Ilimaussaq Complex, southwest Greenland. *In* Report of Activities, Part A. Geological Survey of Canada, Paper 75-1A, pages 271-280.
- Curtis, L.W. and Currie, K.L.
1981: Geology and petrology of the Red Wine Alkaline Complex, central Labrador. Geological Survey of Canada, Bulletin 294, 61 pages.
- Dimmell, P.M.
2007: Report on 2006 exploration on the Central Mineral Belt, Seal Lake, Snegamook properties, central Labrador. NTS 13 J, K, L. Silver Spruce Resources Incorporated, 193 pages.
- Eaton, S. and Morgan, J.A.
2008: First and second year assessment report on the Partridge River and Stormy properties, central Labrador, NTS 13K/2, 3, 13L/2. Crosshair Exploration and Mining Corporation, 77 pages.
- Emslie, R.F.
1980: Geology and petrology of the Harp Lake Complex, central Labrador: an example of Elsonian magmatism. Geological Survey of Canada, Bulletin 293, 136 pages.
- Fahrig, W.F.
1959: Snegamook Lake, coast of Labrador, Newfoundland. Geological Survey of Canada, "A" Series Map 1079A.
- Gandhi, S.S. and Brown, A.C.
1975: Cupriferous shales of the Adeline Island Formation, Seal Lake Group, Labrador. *Economic Geology*, Volume 70, pages 145-163.
- Gower, C.F., Ryan, A.B., Bailey, D.G. and Thomas, A.
1980: The position of the Grenville Front in eastern and central Labrador. *Canadian Journal of Earth Sciences*, Volume 17, Number 6, pages 784-788.
- Kilfoil, G.
2008: Compilation of color shaded relief images generated from airborne magnetic data flown by the Geological Survey of Canada from 1969 through 1972. Unpublished map, Newfoundland and Labrador Department of Natural Resources, Geological Survey.
- Marten, B.E.
1975: Geology of the Letitia Lake area, Labrador. *In* Report of Activities. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 75-1, pages 75-86.
- Marten, B.E. and Smyth, W.R.
1975: Uranium potential of the basal unconformity of the Seal Lake Group, Labrador. *In* Report of Activities. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 75-1, pages 106-115.
- McCuaig, S.J. and Smith, J.S.
2005: Quaternary geology of the Snegamook Lake area, Central Mineral Belt, Labrador. *In* Current Research. Newfoundland Department of Natural Resources, Geological Survey, Report 05-1, pages 15-25.
- Miller, R.R.
1987: The relationship between Mann-type Nb-Be mineralization and felsic peralkaline intrusives, Letitia Lake project, Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 87-1, pages 83-91.
- Nunn, G.A.G.
1993: Geology of the northeastern Smallwood Reservoir (NTS Map Area 13L/SW), Labrador. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey Branch, Report 93-3, 140 pages.
- Robinson, W.G.
1953: Exploration on the Seal Lake Concession, Labrador during 1952. Unpublished Frobisher Limited company report, 17 pages.

- Romer, R.L., Scharer, U., Wardle, R.J. and Wilton, D.H.C.
1995: U-Pb age of the Seal Lake Group, Labrador: relationship to Mesoproterozoic extension-related magmatism of Laurasia. *Canadian Journal of Earth Sciences*, Volume 32, pages 1401-1410.
- Roscoe, S.M. and Emslie, R.F.
1973: Kasheshibaw Lake (East Half), Newfoundland – Quebec. Geological Survey of Canada, “A” Series Map 1342A, 1:250 000 scale.
- Thomas, A.
1981: Geology along the southwestern margin of the Central Mineral Belt. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 81-4, 40 pages.

1983: Geology, Letitia Lake - Wapustan Lake area, Newfoundland Department of Mines and Energy, Mineral Development Division, Map 83-31.
- van Nostrand, T.S.
2009: Geology of the Seal Lake Group, central Labrador (parts of NTS map areas 13K/5 and 6). *In* Current Research. Newfoundland and Labrador Department of Natural Resources, Geological Survey, Report 09-1, pages 249-270.
- van Nostrand, T. and Lowe, D.
2010: Geology of the Seal Lake area, central Labrador (parts of NTS map sheets 13K/3,4,5 and 6). *In* Current Research. Newfoundland and Labrador Department of Natural Resources, Geological Survey, Report 10-1, pages 1-20.
- van Nostrand, T. and MacFarlane, A.
2011: Geology of the west-central Seal Lake Group, central Labrador (including parts of NTS map sheets 13K/4, 5 and 12 and 13L/1, 8 and 9). *In* Current Research. Newfoundland and Labrador Department of Natural Resources, Geological Survey, Report 11-1, pages 313-335.
- Wardle, R.J., Gower, C.F., Ryan, A.B., Nunn, G.A.G., James, D.T. and Kerr, A.
1997: Geological map of Labrador, 1:1 million scale. Government of Newfoundland and Labrador, Department of Mines and Energy, Geological Survey, Map 97-07.
- Wilton, D.H.C.
1996: Metallogeny of the Central Mineral Belt and adjacent Archean basement, Labrador. Mineral Resource Report 8. Newfoundland Department of Mines and Energy, Geological Survey, St. John's, Newfoundland, 178 pages.