Geology of the Giant Lake Area Southeastern Cape Breton Island Nova Scotia

by P.K. Smith

Nova Scotia Department of Mines

a joint project with the Canada Department of Regional Economic Expansion

Paper 78 · 3

PROVINCE OF NOVA SCOTIA

DEPARTMENT OF MINES

PAPER 78-3

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by

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HALIFAX, NOVA SCOTIA

1978

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ABSTRACT

Mapping in the Giant Lake area has led to a revision of the stratigraphy there. The oldest rocks, the Late Precambrian Giant Lake Complex, are interbedded tuffs, lavas and minor volcanogenic sediments. These rocks were deformed, metamorphosed at greenschist facies and intruded by diorite and monzonite during a Late Hadrynian orogenic event. This Complex is overlain by the Cambrian Kelvin Glen Group which is divided into three formations. The lowest unit, the Eo-Early Cambrian Kelvin Lake formation consists of conglomerate, sandstone, siltstone and minor shale. The conglomerates contain pebbles of Giant Lake Complex affinity possessing an internal tectonic fabric attributed to the Late Hadrynian orogeny. The middle unit, the Middle Cambrian Gillis Brook Formation, consists of rhyolite, basalt, siltstone and sandstone which contain the oldest fossils recovered in the area. The highest unit, the Middle Cambrian Victoria Bridge Formation, is very poorly exposed but includes fossiliferous siltstone and shale. The Kelvin Glen Group is (?)disconformably overlain by the Upper Cambrian MacNeil Formation which consists of shale and limestone. These Cambrian rocks are intruded by granite, granodiorite and syenite stocks, and felsic and diabasic dykes. They are gently folded, northeasterly plunging, upright folds of probably Acadian age, metamorphosed at greenschist facies. Mineral potential of the area is promising because this study indicates that the Giant Lake Complex may be an eastern continuation of the Lake Precambrian rocks hosting the Mindamar Mine orebody.

INTRODUCTION

The Giant Lake area (Fig. 1) lies on the west side of the Mira River in Cape Breton Island. The area extends from the Salmon River (latitude 45°56') in the north, to the Cape Breton-Richmond County line (latitude 45°45') in the south. The Mira River (longitude 60°18') forms the eastern margin of the area with the western margin lying at approximately longitude 60°23'.

Topographically, the area is characterized by low relief, giving rise to numerous swamps and bogs. Maximum elevation does not exceed 400 feet. Most exposures are confined to streams and road cuts.

PREVIOUS WORK

Systematic mapping in the area was conducted by Weeks (1954) who compiled the most recent geological map for southeastern Cape Breton Island. Other notable work was carried out by Dawson (1855), Fletcher (1877, 1878, 1879), Matthew (1903), and Hutchinson (1952).

		After: Hutchinson (1952) and Weeks (1954)			Giant Lake Area (This study)		
		Boisdale Hills	Trout Brook area east of Mira River	Giant Lake area west of Mira River	Group or Formation	Lithology	Thickness(m)
DEVONIAN		Granite, diorite, gabbro			Granite, granodiorite, syenite, felsic and diabase dykes		
		INTRUSIVE CONTACT			INTRUSIVE CONTACT		
DEVONIAN to SILURIAN		(rocks absent)	(rocks absent)	Middle River Group	(rocks absent)	(rocks absent)	
ORDOVICIAN	Upper	UNCONFORMITY			(rocks absent)	(rocks absent)	
ORDOVICIAN	Lower	⊛ Mc Leod Brook Fm.	(rocks absent)	(rocks absent)	(rocks absent)	(rocks absent)	
CAMBRIAN	Upper	⊛ Mac Neil Fm.	⊛ Mac Neil Fm.	(rocks absent)	⊛ Mac Neil Formation	shale, minor limestone	> 200 m
CAMBRIAN		DISCONFORMITY		(rocks absent)	PROBABLE DISCONFORMITY		
CAMBRIAN	Middle	(rocks absent)	Mac Lean Brook Fm.	(rocks absent)	KELVIN GLEN GROUP: Victoria Bridge Formation	Siltstone, shale	
CAMBRIAN	Middle	⊛ Mac Mullin Fm.	⊛ ⊛ ⊛ Trout Brook Formation	⊛ Kelvin Glen Group	KELVIN GLEN GROUP: (?)⊛ ⊛ Gillis Brook Formation	Rhyolite, basalt, siltstone, conglomerate	? 100 m
CAMBRIAN	Middle	⊛ Bourinot Group		Bourinot Group			
CAMBRIAN		(rocks absent)	PROBABLE DISCONFORMITY				
CAMBRIAN	Lower	(rocks absent)	Canoe Brook Formation		KELVIN GLEN GROUP: Kelvin Lake Formation	Siltstone, litharenite, quartz pebble conglomerate, red conglomerate, volcanic pebble conglomerate, minor shale, slate.	> 1000 m
CAMBRIAN	Lower	(rocks absent)	⊛ Mac Codrum Formation				
CAMBRIAN	Lower	(rocks absent)	Morrison River Formation			Purple conglomerate – member: conglomerate	> 20 m
					ANGULAR UNCONFORMITY		
					Diorite, monzonite		
					(?) INTRUSIVE CONTACT		
PROTEROZOIC		Fourchu Group	Fourchu Group		Giant Lake Complex	Mafic-felsic lithic tuff, lithic crystal tuff, rhyolite, basalt, volcanic ash; volcanic sediments siltstone, litharenite, conglomerate.	?
		(?) UNCONFORMITY					
PROTEROZOIC or ? ARCHEAN		George River Group	(rocks absent)	(rocks absent)	(rocks absent)	(rocks absent)	

⊛ Fossils present   ▨ Rocks absent

Table 1. Correlation chart of the Giant Lake area, showing correlation with previous work in Southeastern Cape Breton.

The stratigraphy reported by Hutchinson (1952) and Weeks (1954) is summarized in Table 1. Several observations merit further comment. First, note the differing Middle Cambrian stratigraphy east and west of the Mira River, which Weeks attributed to a facies change. Second, Weeks recorded that the unfossiliferous Middle River Group rests with angular unconformity upon the fossiliferous Kelvin Glen Group on Kelvin Glen Brook. On lithological grounds Weeks (1954) correlated the Middle River Group with the Late Silurian to Early Devonian Springdale Formation in Newfoundland. Third, Weeks (1954) assigned all intrusive rocks to the late Lower Devonian-early Middle Devonian.

During 1976, Dr. J. D. Keppie visited the unconformity on Kelvin Glen Brook reported by Weeks (1954) between the Kelvin Glen Group and the overlying Middle River Group. He found that the rocks are conformable throughout this section. He also believed that some rocks assigned by Weeks to the Bourinot Group were equivalent instead to rocks of the Fourchu Group. Additionally, Rb/Sr ages on some of these plutonic rocks indicates that the majority are probably Cambrian-Late Precambrian in age (Cormier, 1972). These observations laid the foundation for this mapping project.

STRATIGRAPHY

The revised stratigraphy of the area is summarized on the right hand side of Table 1. The petrography of the rocks is given in the Appendix and selected stratigraphic columns are shown in Figure 2.

The sandstone classification after Folk (1968) is adopted in this study. Plutonic rocks are named using the I.U.G.S. scheme (Streckeisen, 1975) and pyroclastic rocks after Fisher (1961) and Cook (1965).

? PRECAMBRIAN

GIANT LAKE COMPLEX

This name is used for the extrusive volcanic rocks, intrusive igneous rocks and minor interbedded volcanogenic sedimentary rocks that crop out around Giant Lake in the southern part of the area (Fig. 1). They have not been subdivided, hence the use of the term, complex. Intermediate to acid volcanics with minor interbedded red and grey volcanogenic sediments are found along the newly constructed Caledonia road and on streams that cross that road. Exposures are also located along the Giant Lake-Victoria Bridge road and on the Currie's Lake Road. These volcanic rocks extend northward from Giant Lake approximately 7 km. Their western limit was not determined.

Lithology

The Giant Lake Complex consists of interbedded mafic to felsic lithic tuffs, lithic crystal tuffs, rhyolite, and basalt flows. Volcanic ash and minor volcanogenic siltstones, litharenite and conglomerates are interbedded with the pyroclastic rocks. Two small exposures of diorite

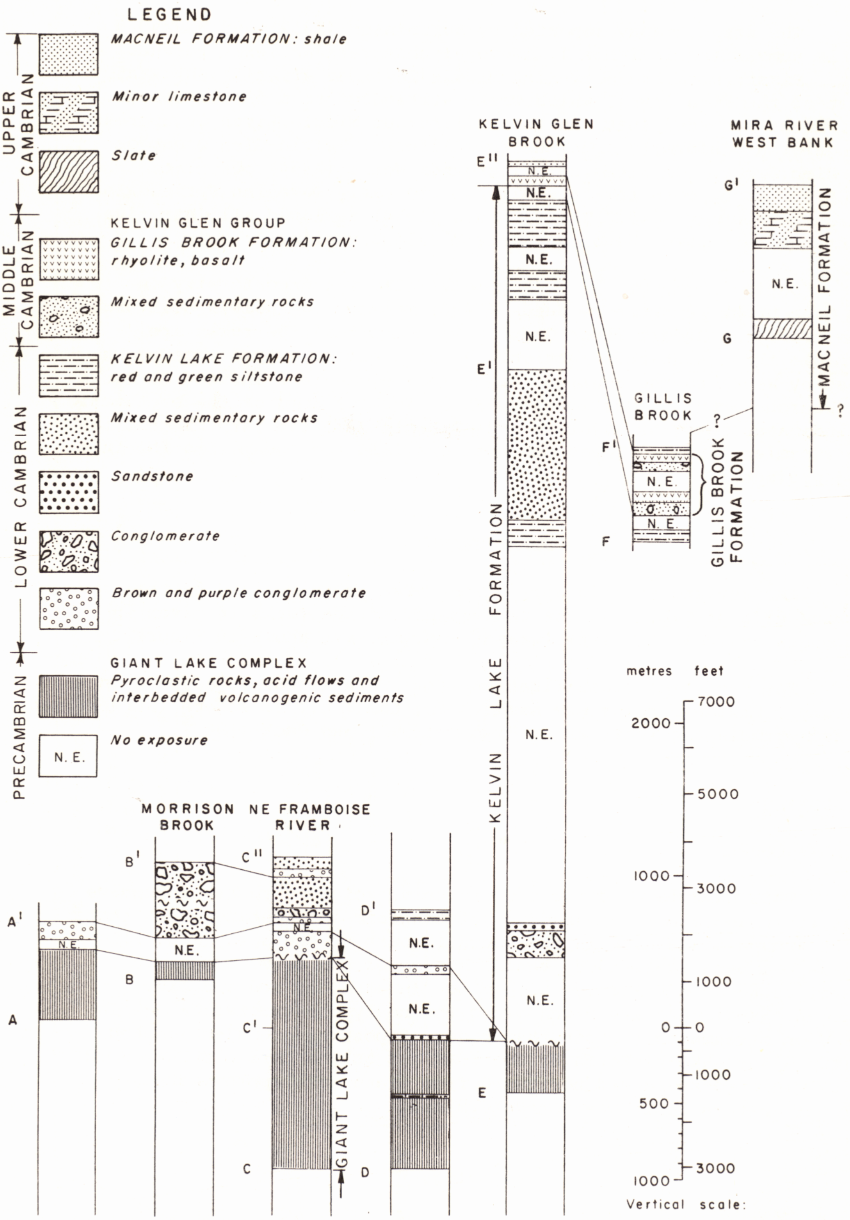

Figure 2. Selected stratigraphic sections. See Figure 1 for location of sections.

were also encountered. Outcrops of volcanic rocks are massive, with moderate internal brecciation and generally no obvious tectonic fabric. Banding in felsic tuffs west of McMullin Lake is attributed to extensive shearing. Interbedded rock units west of Currie Lake show well developed stratification throughout several tens of metres of section, best defined by a thin, fine-grained, reddish ash bed. Cross bedding and graded bedding west of Currie Lake indicate that the rocks are right way up. The tuffs encountered seldom have fragments greater than 10 cm across. In all rock types internal brecciation is common. Thin mylonite zones on the Northeast Framboise River and the Caledonia Road may be associated with this brecciation.

In thin section (see Appendix) the tuffs have angular to subrounded grains which seldom exceed 2 cm. Matrix material is fine-grained to amorphous and is often altered to quartz and sericite. The lithic fragments consist of abundant plagioclase laths in an amorphous matrix with associated calcite, sericite and chlorite. Pyroxene is uncommon. Extrusive volcanics have aphanitic-phaneritic texture with phenocrysts of plagioclase, quartz and alkali feldspar. Rhyolites are typically red in colour with minor spherolitic texture, while basalts are dark grey-green in colour and massive. Plagioclase phenocrysts show a high degree of recrystallization to quartz and sericite, making composition determination difficult. Resorption of quartz and plagioclase is moderate. High albite compositions in both felsic and mafic volcanics indicate that these rocks have been considerably altered. The volcanogenic sediments contain abundant volcanic detritus, sericite, chlorite and quartz. Grains are usually angular to subrounded but one conglomerate has well rounded pebbles of volcanic detritus. The volcanic pebbles show variable degrees of recrystallization, from virtually none to almost complete. Metamorphic minerals are chlorite, sericite, muscovite, biotite which defines two foliations, and epidote.

The thickness of the Giant Lake Complex could not be determined due to extensive faulting, lack of continuous exposure, and absence of good marker horizons.

Contacts

An undisturbed upper contact was not observed anywhere in the area. On the Northeast Framboise River, volcanics of the Giant Lake Complex are separated from Lower Cambrian conglomerates and siltstones by a fault defined by a thin 20 cm wide mylonite zone. A similar mylonite zone is seen on a small stream west of Giant Lake. The lower contact was not observed.

Age

No fossils were recovered from the Giant Lake Complex. However, pebbles of deformed rock similar to rocks of the Giant Lake Complex are present in the overlying Eo-Middle Cambrian Kelvin Glen Group. This suggests a Precambrian age for the Giant Lake Complex. The pebbles of deformed rock imply a structural break between the Giant Lake Complex and the Kelvin Glen Group. A similar break has been noted elsewhere between the Fourchu Group and the overlying Cambrian rocks (Helmstaedt and Tella, 1973; Keppie, in press).

Correlation

The Giant Lake Complex is assigned to the Late Precambrian because (i) pebbles of deformed volcanic rocks of Giant Lake Complex affinity occur in the Cambrian strata; (ii) it has a more complex structure than the Cambrian rocks. This suggests that the volcanic rocks of the Giant Lake Complex are equivalent to the Late Precambrian Fourchu Group found in the southeastern part of the area and elsewhere in southern Cape Breton.

EO-CAMBRIAN - MIDDLE CAMBRIAN

KELVIN GLEN GROUP

The Kelvin Glen Group was first named by Weeks (1954) to include a sequence of sparsely fossiliferous red and green sedimentary rocks occurring west of the Mira River. The rocks which Weeks (1954) assigned to the Middle River Group are here included within the Kelvin Glen Group since they form an integral part of the conformable sequence. The Kelvin Glen Group is redefined here as the sequence of sparsely fossiliferous red and green sediments with minor volcanic rocks of (?)Eo-Early and Middle Cambrian age. Rocks of this group underlie about 60 per cent of the map area.

The type section (Figs. 1 & 2, E-E'-E") occurs along Kelvin Glen Brook between Mira River and Kelvin Lake and thence along an unnamed brook flowing into the northwest corner of Kelvin Lake. The Kelvin Glen Group is divided into three units. The lowermost unit, the Kelvin Lake Formation, consists of mixed sedimentary rocks. The Gillis Brook Formation lies conformably upon the Kelvin Lake Formation and consists of rhyolite, basalt, siltstone and conglomerate. The sequence of sedimentary rocks above the Gillis Brook Formation is not well exposed but has been named the Victoria Bridge Formation. They are probably equivalent to the MacLeod Brook Formation (Hutchinson, 1952).

Kelvin Lake Formation

The Kelvin Lake Formation is named after Kelvin Lake, through which the type section passes, and constitutes the lowest unit of the Kelvin Glen Group. The best exposures of the Kelvin Lake Formation occur at the type section on Kelvin Glen Brook and on the Northeast Framboise River north of Giant Lake. A portion of section is also exposed on the northern part of the newly constructed Caledonia Road. Scattered exposures occur throughout the central portion of the map area along road, streams and in wooded areas.

Lithology

The Kelvin Lake Formation is thinly bedded with a general trend of coarse to fine sedimentary rocks from bottom to top of the section. The rock types (see Appendix) are red and green siltstone, litharenite, quartz pebble conglomerate, polymictic conglomerate, volcanic pebble conglomerate, purple-brown conglomerate, and minor slate and shale. The purple-brown conglomerate near the base is a distinct marker horizon and has been mapped as a member. Contacts between rock types are sharp and only rarely is grading observed. Pebbles in the conglomerates range in size from 2 mm to about 15 cm. Pebbles are typically sub-angular to sub-rounded, although one conglomerate on the Northeast Framboise River has tuffaceous pebbles which are well rounded and spherical, but the rock possesses an immature texture, with abundant feldspar. A tectonic foliation is rarely observed, however, a local cleavage is often found associated with faults.

In thin section (see Appendix) the siltstones contain abundant quartz with variable amounts of muscovite, chlorite, sericite and calcite. Biotite is also present in one section. The quartz grains have angular grain boundaries. Sandstones have abundant quartz with a minor amount of plagioclase (high albite) and a moderate amounts of rock fragment detritus. They very closely resemble the litharenites except for a smaller grain size and a lesser concentration of rock fragments. The conglomerates all have quartz and rock pebbles as major constituents. Muscovite, chlorite, sericite, calcite and opaque minerals constitute the remainder of the rock. Pebble types include banded rhyolite, basalt, tuff, siltstone, and quartz arenite. The purple conglomerate member near the base of the formation has foliated siltstone pebbles and volcanic pebbles of Giant Lake Complex affinity which are randomly oriented throughout the rock. Chlorite, sericite, muscovite and biotite are the common metamorphic minerals in the Kelvin Lake Formation.

A foliation is present in some thin section from rocks of the Kelvin Lake Formation. A second cleavage is sometimes present near faults.

Thickness

Thickness of the sequences is unclear due to faulting and lack of continuous exposure. A minimum stratigraphic thickness established from Kelvin Glen Brook and Northeast Framboise River is 1000 m. The purple conglomerate member at the base of this formation has a minimum thickness of 20 m as observed on a small stream west of Giant Lake.

Contacts

The base of the Kelvin Lake Formation is nowhere exposed in the area. On Northeast Framboise River approximately 2 km northeast of Giant Lake, the contact is represented by a 15 cm wide mylonite zone, and is inferred to be a faulted contact. A small gap in exposure obscures this contact on a small stream west of Giant Lake and on

Morrison Brook. The contact with the Gillis Brook Formation is not exposed, but similar attitudes suggest that they are conformable or disconformable (Hutchinson, 1952).

Age

No fossils have been recorded within the Kelvin Lake Formation. Weeks (1954) recognized five fossil localities (Fig. 1) in his Kelvin Glen Group, two of which yielded a Late Early or Middle Cambrian age. All these fossil localities occur stratigraphically above the Kelvin Lake Formation. Therefore, the age of the Kelvin Lake Formation is probably Early Cambrian, but its lower part could be as old as Eo-Cambrian. This is supported by correlations with neighbouring areas (see below).

Correlation

Tentative correlation with the area east of the Mira River (Weeks, 1954; Hutchinson, 1952) suggests that the Kelvin Lake Formation is approximately equivalent to the Morrison River, MacCodrum and Canoe Brook Formations (Table 1). Fossils from the MacCodrum Formation indicate an Early Cambrian age.

Gillis Brook Formation

The Gillis Brook Formation is named after the brook in which the type section occurs (Fig. 1) and is defined by the first and last occurrence of volcanic rocks (Fig. 2). A reference section is located on Miller's Brook. Other exposures occur on Kelvin Glen Brook and on a small stream about 1 km west of Victoria Bridge.

Lithology

The Gillis Brook Formation is a thin (∿100 m) sequence of sedimentary and volcanic rocks. Massive orange porphyritic rhyolite is the characteristic rock type although it does not occur at the type section. The type section (Fig. 2) is typified by interbedded grey marine siltstone, conglomerate, minor sandstone and two amygdaloidal basalt flows. Basalt flows are also found on Miller's Brook, where a single flow occurs in association with an orange rhyolite flow. All other exposures of the Miller's Brook Formation are characterized by the presence of orange porphyritic rhyolite which is not banded. The contacts of this rhyolite are not exposed; however, its invariable association with the marine strata of the Gillis Brook Formation suggest that it is extrusive. Pebbles in the sandstone and conglomerates of the Gillis Brook Formation, are mainly quartz and quartz arenite. The conglomerates have an average grain size of about 2.5 cm. Primary structures are abundant and tops were always observed to be right way up in the type section.

A tectonic foliation was not observed in this formation. In the dark grey sedimentary units bedding is easily detected.

In thin section the rhyolites contain moderate amounts of quartz, plagioclase and sometimes alkali feldspar phenocrysts in a micro-crystalline matrix. The plagioclase phenocrysts have a composition of An_{10-30} (Michel-Levy method) with a considerable amount of exsolution of all phenocrysts. Alteration includes saussurization of plagioclase and chlorite and calcite are common. The basalts are fine-grained with abundant amygdules filled with calcite, chlorite and zeolites. Plagioclase laths are predominant with moderate amounts of chlorite and calcite alteration products. Pyroxene was not observed in the dark matrix of these flows. The grey, well bedded sedimentary rocks contain abundant quartz, varying amounts of biotite, chlorite, and one specimen has muscovite as a major constituent. Sericite, chlorite, calcite and biotite are the metamorphic minerals.

Thickness

The thickness of the Gillis Brook Formation varies from about 300 metres in the type section to about 50 metres west of Victoria Bridge.

Contacts

Neither contact is exposed but constant attitudes suggest that both contacts are conformable.

Age

All the fossil localities reported by Weeks (1954) lie within or slightly above the Gillis Brook Formation (Fig. 1). On Gillis Brook brachiopod fossils identified as *Indiana* sp. lie within the Gillis Brook Formation and indicate a late Early or Middle Cambrian age. A brachiopod from the brook 1 km north of Victoria Bridge was identified as *Acrothele* sp. of probable Middle Cambrian age (Weeks, 1954). This locality occurs just above the Gillis Brook Formation. Thus, a Late Early Cambrian or early Middle Cambrian age is probable for the Gillis Brook Formation.

Correlation

Correlation of the Gillis Brook Formation with the type section of the Bourinot Group in the Boisdale Hills (Hutchinson, 1952; Weeks, 1954) is suggested by the presence of Middle Cambrian volcanic rocks in both units. The author believes that the Gillis Brook Formation represents the distal extremity of the Middle Cambrian volcanic rocks which die out to the southeast (Fig. 4). Weeks (1954, p. 53) correlated the Bourinot Group with the lower part of the early Middle Cambrian Trout Brook Formation, east of the Mira River. However, the Trout Brook Formation is devoid of volcanic rocks.

Victoria Bridge Formation

Poorly exposed rocks lie above and to the east of the Gillis Brook Formation and form the uppermost unit of the Kelvin Glen Group. Only two isolated sections of these strata are exposed. The largest section lies on a small stream west of Victoria Bridge. The other section of this unit crops out on Miller's Brook just upstream from the road.

Lithology

The rock types are shale and siltstone. The siltstones exhibit a weakly developed fissile cleavage. Unidentified trace fossils were found. In thin section the shale is found to consist of quartz, muscovite, biotite, and chlorite. Quartz grains are angular and some specimens show completely random mica orientation. Chlorite, muscovite, and biotite are the chief metamorphic minerals.

Thickness

The total thickness of this uppermost unit of the Kelvin Glen Group cannot be determined due to lack of exposure. However, approximately 100 m or more of section is exposed on the small stream west of Victoria Bridge.

Contacts

Neither the upper nor lower contacts of the Victoria Bridge Formation are exposed in the area, although only a small gap separates siltstones from orange porphyritic rhyolite of the Gillis Brook Formation.

Age

The brachiopod, *Acrothele* sp. of probable Middle Cambrian age, was recovered from a stream 1 km west of Victoria Bridge (Weeks, 1954) and this dates this formation.

Correlation

A tentative correlation is made with the upper part of the middle Cambrian Trout Brook and MacLean Brook Formations in the Mira area (Weeks, 1954; Hutchinson, 1952) and possibly with the Middle Cambrian MacMullin Formation (Hutchinson, 1952) in the Boisdale Hills. However, the rocks of this formation closely resemble shales and siltstones of the Bourinot Group found on Gregwa Brook in the Boisdale Hills, and such a correlation is also possible.

MacNeil Formation

The name MacNeil Formation is used for Upper Cambrian shales exposed along the west bank of the Mira River because there is good correlation with the nearby type section located on MacNeil Brook, south of Marion Bridge. An isolated exposure also occurs along the road approximately 1.2 km east-northeast of Gillis Lake.

Lithology

In the Giant Lake area, the MacNeil Formation consists of sparsely fossiliferous soft grey shale with interbedded thin limestone. The limestone beds, some of which are laterally discontinuous, range from 0.5 cm to 15 cm thick and most of these beds exhibit cone-in-cone structure. Manganese nodules are also present. Just south of the mouth of the Salmon River the shales have been sheared and crenulated into slates. Except for this location, cleavage is absent.

In thin section (see Appendix) the shales contain abundant angular grains of quartz and moderate amounts of biotite, muscovite and chlorite which define a primary bedding plane foliation. The slates have a similar mineralogy, but possess a crenulation cleavage. The limestones were not studied in thin section. Biotite, muscovite and chlorite are the metamorphic minerals.

Thickness

A minimum thickness of approximately 200 m is exposed on the west bank of the Mira River. Lack of outcrop makes it impossible to give a maximum thickness.

Contacts

Neither contact is exposed in the Giant Lake area. Hutchinson (1952, p. 24, 45) states that the lower contact is a disconformity based on an abrupt lithological change and a faunal break. He postulates a disconformity for the upper contact also.

Age

A single cephalon of an agnostid trilobite was found on the west bank of the Mira River approximately 500 metres north of the Salmon River junction. This single specimen was identified by M. H. Fritz of the Geological Survey of Canada (Report No. C-9-1977-WHF):

> "The material consists of a single agnostid cephalon with a pointed anterior lobe and possibly a preglabbellar median furrow. Agnostids of this type, such as *Ptychagnostus*, are most common in the Middle Cambrian, particularly in the upper part of the medial Middle Cambrian and late Middle Cambrian."

Hutchinson reports abundant fossils at the type section which indicate a Late Cambrian age.

Correlation

Lithological similarities between the strata on the west bank of the Mira River around the Salmon River junction and the type section of the MacNeil Formation of Hutchinson (1952) suggest direct correlation. Weeks (1954) included these rocks in the Kelvin Glen Group while Hutchinson (1952) mapped them as part of the Trout Brook Formation. However, neither author made reference to the interbedded limestone or presence of fossils at that locality.

INTRUSIVE IGNEOUS ROCKS

Monzonite, diorite, granodiorite, granite, syenite, felsic and diabasic rocks (Fig. 1, Appendix) occur in the area. These intrusive rocks are divided into two groups, those of probable Devonian age and others of unknown but presumed Late Precambrian Age.

UNKNOWN AGE (?LATE PRECAMBRIAN)

Diorite

Dioritic bodies occur on the Victoria Bridge to Framboise Road just north of Giant Lake; on the newly constructed Caledonia Road about 2.5 km northwest of Giant Lake, and on Kelvin Glen Brook about 0.9 km north of the end of the new Caledonia Road. In all cases the contacts are not exposed. All exposures show prominant internal fracturing.

In thin section (see Appendix) the diorite on Kelvin Glen Brook consists of plagioclase, pyroxene, chlorite and opaque minerals. Plagioclase is altered to chlorite and saussurite and no accurate plagioclase composition could be obtained. The grain size averages 2-3 mm but abundant alteration gives it a slightly porphyritic texture.

The age of the diorite bodies is uncertain. Diorite was not observed cutting the Palaeozoic rocks in the Giant Lake area but dicrite does form part of the Gillis Mountain pluton which cuts Cambrian rocks east of the Mira River (Weeks, 1954). The association with Late Pre-cambrian volcanic rocks may indicate a possible Late Precambrian age.

Monzonite

One small isolated exposure of monzonite crops out on a tributary running into Kelvin Glen Brook located approximately 2.1 km northwest of the end of the new Caledonia Road. This small isolated exposure does not show any contact relationships. Nearest exposures are of Giant Lake Complex.

In thin section (see Appendix) the rock consists of plagioclase, alkali feldspar, minor quartz, chlorite, calcite, epidote and opaques. The plagioclase is almost entirely altered to saussurite. Average grain size is about 1 cm, with grains having sharp crystal boundaries.

The age of this rock is uncertain but it may be part of the larger Loch Lomond pluton (Weeks, 1954) for which Cormier (1972) recorded a Rb/Sr isochron age date of 551±24 m.y. using a 1.42×10^{-11} yr. decay constant for ^{87}Rb.

DEVONIAN ?

Granite

The granitic rocks occur at two localities; one on and near Miller's Brook about 1 km west of McDougall Lake, and the other near the northern end of the newly constructed Caledonia Road (Fig. 1). No contacts are exposed on the Caledonia Road exposures and no evidence of contact metamorphism is present. Shearing is observed at the exposures on the new Caledonia Road so faulted contacts are assumed. However, the granite exposed on Miller's Brook has an intrusive contact with green siltstones of the Kelvin Lake Formation. Bedding is truncated perpendicularly by the granite. A gradational chilled margin 1 m thick rims the intrusive. Diabase chill rocks form the periphery of the intrusion, and no appreciable change in grain size is noted throughout the rest of the pluton. Air photo interpretation indicates that this granite is a small intrusive stock.

In thin section the Miller's Brook granitic stock consists of crystals of plagioclase with an optical composition of An_{40}, alkali feldspar and interstitial quartz, biotite, chlorite and opaque minerals. The feldspars are highly altered to saussurite and biotite is partly replaced by chlorite. The average grain size is about 1.5 mm and equigranular textures are predominant. The granitic rocks exposed on the new Caledonia Road have the same composition with a larger grain size and a porphyritic, phaneritic texture. Minor graphitic texture is noted throughout the matrix of the rock.

A post-Early Cambrian age is indicated for the Miller's Brook granite because it is intrusive into the Kelvin Lake Formation. A Devono-Carboniferous age is most likely because most Phanerozoic granitoid plutons in Nova Scotia are of this age.

Granodiorite

Two granodiorite exposures occur in close association with the granitic rocks on the new Caledonia Road. Contacts are not exposed. The rock types are very similar to the granite exposures on the new Caledonia Road excepting for slightly higher ratios of plagioclase to alkali feldspars in the granodiorite.

In thin section, the granodiorite consists of plagioclase (An_{20}, Oligoclase), alkali feldspar, quartz and minor biotite, chlorite, calcite, epidote and opaque minerals. The plagioclase is saussuritized. As with the granites on the new Caledonia Road, the age of the granodiorite is uncertain, but possibly is Devono-Carboniferous.

Syenite

Only one exposure of syenite occurs 0.6 km due north of the northern end of the new Caledonia Road on a tributary of Kelvin Glen Brook. This rock type crops out for only a few metres along the stream and contacts are not exposed. There is no evidence of contact metamorphism in the conglomeratic host rock. Fracturing is common and faulting is a possibility.

In thin section the syenite is very similar to the granite and granodiorite. However, it has a higher ratio of alkali-feldspar to plagioclase feldspar and is almost totally devoid of quartz. A plagioclase compositiou of An_{35} (andesine) was determined optically. Biotite and opaque minerals are prevalent throughout the medium-grained equigranular syenite. Chlorite and calcite are common alteration products.

The age of this syenite is uncertain, however it occurs within the Kelvin Lake Formation outcrop area and so may be Devono-Carboniferous.

Felsic and Diabasic Dykes

Felsic and diabasic dykes occur sporadically throughout the Early Cambrian Kelvin Lake Formation and Late Precambrian Giant Lake Complex (Fig. 1). Exposures are generally small and contacts are rarely exposed, but when found, chilled margins can be seen. All dykes are fine-grained, green to black in colour and usually less than one metre thick. No visible tectonic fabric was seen in any of the dykes although joints and brittle fracture were locally observed.

In thin section the felsic dykes are porphyritic, with phenocrysts of plagioclase having an optical average composition of An_{15-30}. Some plagioclase is zoned. There is extensive recrystallization to quartz and chlorite with minor amounts of calcite also present. The matrix is aphanitic and has recrystallized to chorite. The diabasic rocks contain phenocrysts of plagioclase too badly altered to obtain an optical composition, and pyroxene in a dark aphanitic matrix which has been partly recrystallized to quartz and chlorite. Ophitic texture is common and parallel alignment of plagioclase laths is noted in some specimens.

The age of these dyke rocks is uncertain. They intrude Late Precambrian to Early Cambrian strata throughout the area, but were not observed cutting the Miller's Brook Formation or younger strata. However, Weeks (1954) describes diabase intrusive into Middle Devonian strata in the Boisdale Hills to the northwest of the Giant Lake area. Their age could therefore range from Middle Cambrian to Devonian.

STRUCTURE

STRUCTURE IN THE GIANT LAKE COMPLEX

Minor Structure

Bedding (So) attitudes have variable orientations (Fig. 3a) and no obvious regional trend can be determined from the stereographic projection of poles to bedding. Only one fold was observed in the Giant Lake Complex, west of Giant Lake, and the great circle between the fold limb bedding poles is constructed. The horizontal fold axis is derived (Fig. 3a). Two possible reasons are given for the random plot of the bedding poles. First, pyroclastics being deposited around a volcanic vent will assume an initial dip with variable attitudes for any one vent. Second, two foliations are present in the Giant Lake Complex implying that refolded folds are present. At the fold locality foliated lithic tuffs display open fold geometry with an upright axial plane fracture cleavage. Well developed cleavage is often lacking in field exposures although thin section examination reveals the presence of two sericitic foliations in the matrix material of tuffaceous rocks and in fine-grained volcanogenic sedimentary rocks. Poles to cleavage and fracture cleavage (Fig. 3b) from the Giant Lake Complex show a strong concentration in the northwest and southeast sectors.

Pebbles of Giant Lake Complex affinity occur in the Cambrian rocks. These pebbles possess a foliation unrelated to any in the host rocks. This implies that at least one of the foliations in the Giant Lake Complex is Precambrian in age. Helmstaedt and Tella (1973) recorded that two foliations in equivalent Late Precambrian rocks in the Boisdale Hills predate the Middle Cambrian. Keppie (in press) has recorded a similar situation east of the Mira River and has referred these events to the Late Hadrynian Wapnakian Orogeny.

STRUCTURE IN CAMBRIAN ROCKS

Minor Structure

Poles to bedding attitudes (Fig. 3c) show a wide dispersion about a northwest-southeast trending (125°) π-circle indicating a northeast trending fold axis plunging at 030° northeast. More widely dispersed bedding poles are attributed to taulting. Fold shape is open, with an interlimb angle of 60°-120°. Folds are not common in the Cambrian sediments. Several small folds with amplitudes of several metres have been observed in the Kelvin Glen Group and a great circle is constructed between fold limb bedding poles (Fig. 3c, C-D, E-F) allowing their associated fold axis to be derived. They correspond closely with the average fold axis orientation.

Cleavage development in the Cambrian rocks is scarce and in only one case was noted to be present in a fold. However, the purple conglomerate member does have a well defined foliation, but in all cases is juxaposed to major faults. A plot of poles to cleavage and fracture cleavage (Fig. 3d) in the Cambrian sediments shows no obvious structural trend and is thought to be in part or wholly a fault-related cleavage

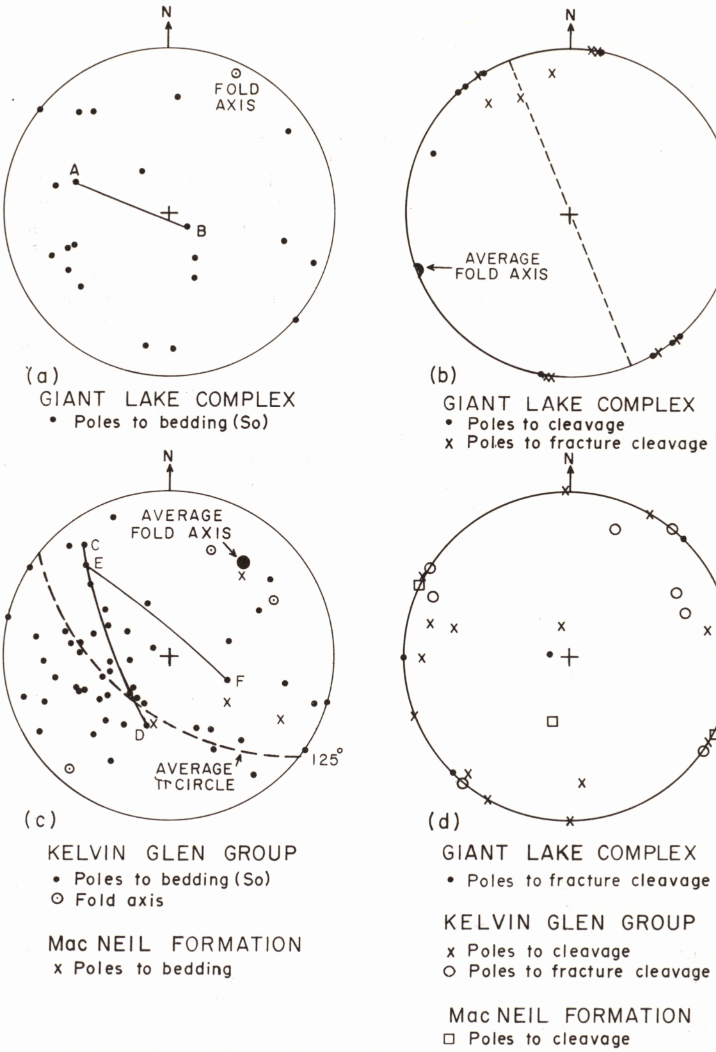

Figure 3. Stereographic projections for Giant Lake area. (a) poles to bedding (S_o) for Giant Lake Complex, AB are bedding poles of a single fold. (b) poles to cleavage and fracture cleavage for the Giant Lake Complex. (c) poles to bedding for the Kelvin Glen Group and the MacNeil Formation. ¶ circle trends 125° and has fold axis pluging 30° NE. CD + EF are bedding poles of folds with their associated fold axes. (d) fault related cleavage and fracture cleavage poles in the Giant Lake area.

pattern. In thin section some sediments do have a bedding plane cleavage and locally metamorphic grade reaches greenschist facies. No evidence of small scale folds, or cleavage development was found in the Gillis Brook Formation, although in the above MacNeil Formation a crenulation cleavage was observed south of Salmon River.

The deformation of these Cambrian rocks is at least post-Cambrian, but is most likely to be Acadian (Devonian) in age.

Major Structure

The major structure in the Cambrian sediments consists of a northeasterly plunging upright syncline extending from Giant Lake to Mira River and a parallel anticline near Miller's Brook (Fig. 1).

STRUCTURE IN INTRUSIVE IGNEOUS ROCKS

All igneous exposures show some internal brecciation and locally a slight fracture cleavage may be developed. Generally the rocks are massive but alteration and weathering has made them somewhat friable. In thin section, no fabric was noted in any of the intrusive igneous rocks.

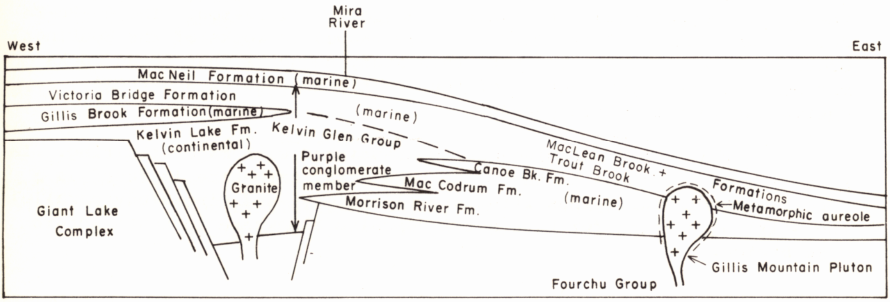

Figure 4. Restored cross section of the Cambrian rocks prior to deformation for the area west and east of the Mira River.

DISCUSSION

This project has lead to a redefinition of the stratigraphy in the Giant Lake area (Table 1) previously described by Weeks (1954). The rocks he assigned to the Middle Cambrian Bourinot Group in the Giant Lake area are here assigned to the Lake Precambrian Giant Lake Complex. A slightly redefined Kelvin Glen Group has been subdivided into three formations: the Eo-Early Cambrian Kelvin Lake Formation having a purple conglomerate member present near the base; the Middle Cambrian Gillis Brook Formation; and the (?)Middle Cambrian Victoria Bridge Formation forming the upper unit. The rocks which Weeks (1954) mapped as the Middle River Group are shown to be part of the Kelvin Lake Formation. A restored cross-section (Fig. 4) depicts how the Cambrian sediments may have been distributed spatially prior to deformation. A facies equivalence model is proposed for the coarse lower clastics west of the Mira River and fine grained clastics east of the Mira River. Middle Cambrian volcanic rocks of the Miller's Brook Formation die out before they reach the Mira River and are not exposed east of the river.

Two phases of intrusive igneous rocks are recognized. One of probable Devono-Carboniferous age and the other of unknown age but probably latest Precambrian age. These are probably associated with the two periods of orogenic activity, the Late Precambrian Wapnakian Orogeny and the Devonian Acadian Orogeny (Keppie, in press).

ECONOMIC GEOLOGY

Although no encouraging mineral showings were discovered in the area, the potential is high for the following reason. The Cu-Pb-Zn deposit at Mindamar Mine, Stirling, was mapped in rocks of the Bourinot Group by Weeks (1954). However, this study suggests that these rocks may be a western continuation of the Giant Lake Complex and hence equivalent to the Fourchu Group.

The deposit at Mindamar is associated with major faulting. In several mylonite zones in the Giant Lake area, carbonate is found as a replacement mineral. Thus structure, lithology, and mineralogy parallel the Stirling setting for base metal deposits elsewhere in Southeastern Cape Breton.

ACKNOWLEDGEMENTS

I would like to thank Dr. J. D. Keppie for his help both in the field and in the office. The manuscript was critically read by Dr. J. D. Keppie and Dr. P. S. Giles who provided many useful suggestions for improvement. Thanks are also due to D. H. Bernasconi, P. Belliveau and R. Morrison for preparing the figures, to J. MacGillivray for editing the manuscript, and to J. Fahie and K. Crowell for typing the manuscript.

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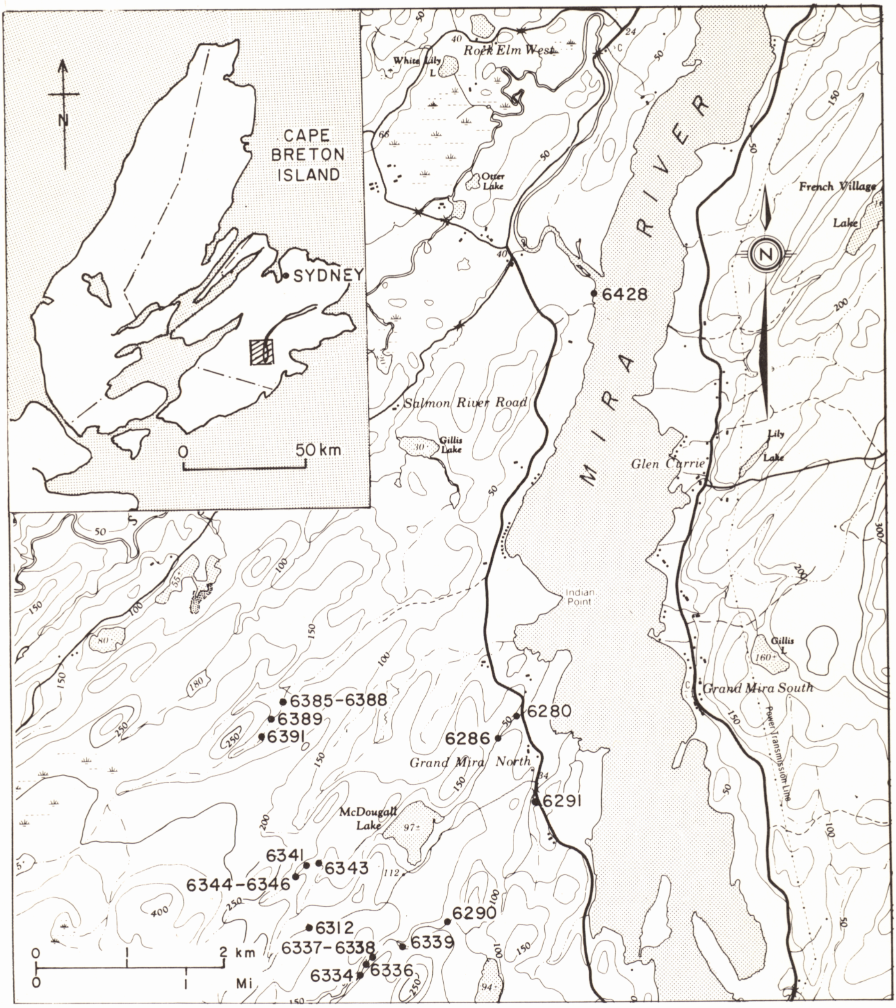
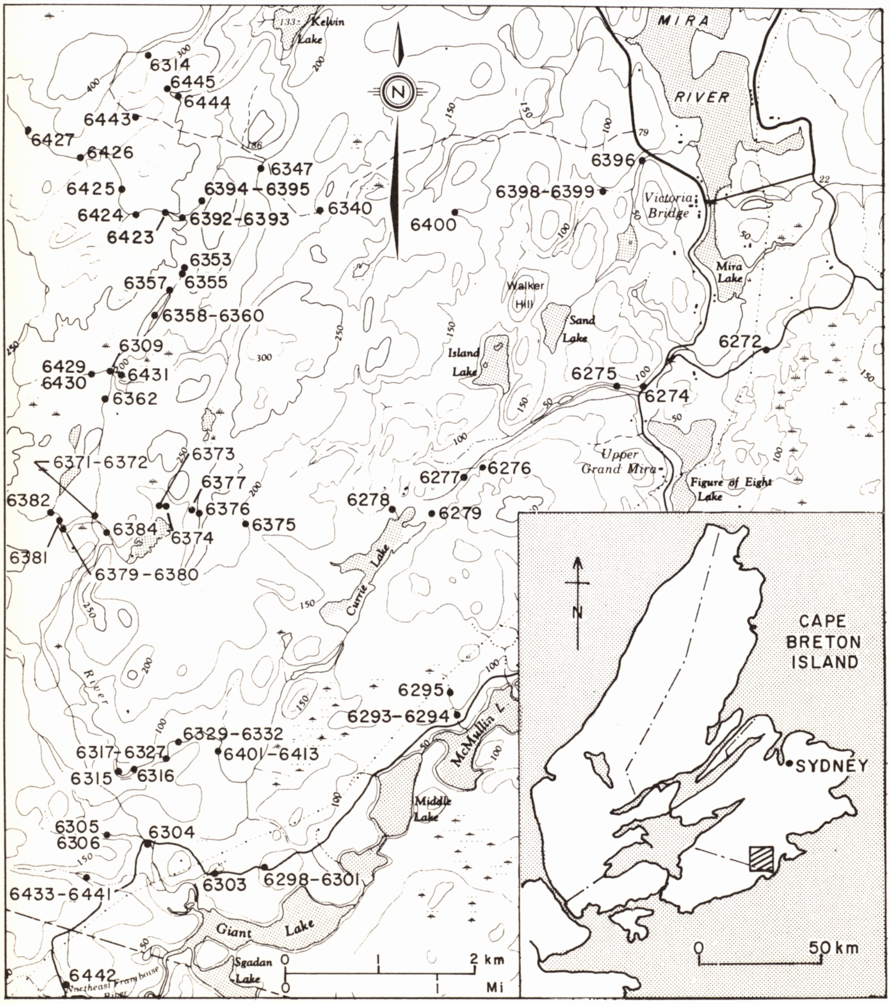
APPENDIX

Petrographic description of selected samples from the Giant Lake area, with location map.



Location map for samples in Appendix describing petrography (north half).



Location map for samples in Appendix describing petrography (south half).

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
		F16-6344	basalt, diabase	.	X	?		0				X		.	0			extensive recrystallization, chilled zone of intrusion.
		F16-6345	granite	0	X	40	0	0				0			.			extreme alteration of feldspars, biotite and chlorite.
		F16-6353	granodiorite ?	0	0	?	X	.				0		.	.	.		medium grained intrusive, highly altered.
		F16-6355	granitic ?	0	.	?	X		.			.						highly sheared, slight recrystallization in feldspar.
	Intrusive	F16-6357	felsic dyke	0	X	15						0			.			zoned plagioclase phenocrysts, high alteration
?Devonian		F16-6359	granite	0	X	35	O	.				0			.			porphyritic phaneritic, minor graphitic texture.
	Rocks	F16-6360	diabase	0	X							X	0		0			ophitic texture, plagioclase completely altered to sericite.
		F16-6392	syenite	.	0	35	X	0				0		.	.			medium grained and highly altered.
		F16-6393	diabase		X	?		.				0		.			0	(flow alignment in plagioclase laths).
		F16-6412	felsic dyke	0	X	15-25						X		.	.			quartz recrystallization, mafic minerals going to chlorite.
		F16-6431	granodiorite	X	X	20	0					0	.		.			some zeolite present; resorption of quartz, high degree of alteration.
Late Cambrian	MacNeil Formation	F16-6428	siltstone	X				0	0			0		.	.			bedding plane foliation, angular grains.
		F16-6280	siltstone ?	X								X			.			almost totally gone to chlorite.
		F16-6286	rhyolite	0	X	10	X					.		0				slightly porphyritic, orange, moderate alteration.
		F16-6291	rhyolite	0	X	20	X					.		0				slightly porphyritic, moderate alteration.
	Gillis	F16-6385	basalt		X	65						0		0	0			amygdaloidal, ophitic texture
Middle		F16-6386	siltstone	X				0				0			.			fine grained, ripple marks.
Cambrian	Brook	F16-6388	sublitharenite	X				.			.				.			subrounded grains, pebbles all quartz sandstone
	Formation	F16-6389	siltstone	0				.	X			0	.		.			angular quartz grain, mica rich, red colour.
		F16-6391	diabase-basalt		X	?		.				0		0	.			amygdaloidal, microlites of plagioclase.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
Middle Cambrian	Gillis Brook Formation	F16-6398	rhyolite	X	0	25	0					.			.			slightly porphyritic, orange colour, no flow alignment.
		F16-6399	rhyolite breccia	X	0	?	0					.			.			slightly porphyritic, abundant exsolution.
Eo-Early Cambrian	Kelvin Lake Formation	F16-6274	siltstone	X					.			0	X		.			foliated sandy lenses.
		F16-6275	sublitharenite	X	.	?			0		0	.			0			fine grained, unfoliated, red colour.
		F16-6278	litharenite	X				.	.		.	.		.	.			fine grained, irregular grain boundaries.
		F16-6290	conglomerate	X					0		X		.		.			fine grained, sedimentary and volcanic pebbles, irregular grain boundaries.
		F16-6304	conglomerate	X	0	20	.				0	.	.	.	.			angular fragments, highly stretched, irregular grain boundaries.
		F16-6306	litharenite	X	.	?	.		.		0		0	.	.			subangular medium-fine grained, moderate brecciation.
		F16-6309	siltstone	X					0			.	.		.			red and laminated, fine grained, minor cross laminations.
		F16-6312	siltstone	X					0			.	.		.			red and laminated, fine grained, two muscovite orientations.
		F16-6314	conglomerate	X					.		X	.	.		.			medium grained, mostly volcancic pebbles, subrounded, well indurated.
		F16-6321	mylonized sandstone	X								.	0	X	.			fine-medium grained, irregular grains moderate straining and shearing.
		F16-6322	siltstone	0								.	.	.				abundant iron staining, foliated.
		F16-6324	litharenite	X							X	.	0	.	.			pebbles, mostly sedimentary, fine-medium grained, shearing minor.
		F16-6329	pebble conglo-merate	X							X	.	0	X	.			moderately deformed, pebbles are silt-stone with minor volcanics.
		F16-6330	slate	X				.	.			0			.			crenulation cleavage, cross-laminations.
		F16-6331	siltstone	X					.			0		.	.			red with graded bedding, fine grained, slight fabric.
		F16-6332	claystone	0								0	X		.			green colour with two fabrics in sericite.
		F16-6334	siltstone	X				.	X			0			0			red and green colours with one mica orientation.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
		F16-6336	cataclasticized sandstone	X	0	15					.	.	.	0	.			broken grain boundaries, moderately altered.
		F16-6337	sandstone	X	.	?	.		.		X	.	.	.	.			equal amount cf sedimentary and volcanic pebbles, medium-fine grained.
		F16-6338	conglomerate	X	0	20					X	0	.	.	.			both sedimentary and volcanic pebbles, sericite confined to pebbles, sub-rounded grains.
		F16-6339	sublitharenite	X					.		X	0			.			majority of pebbles are rhyolite composition, sub angular grains.
Eo-Early Cambrian	Kelvin Lake Formation	F16-6341	siltstone ?	X								X		0	.			about 60% chlorite altering from ? volcanic detritus.
		F16-6343	siltstone with claystone	X				0	X			0			.			crenulation cleavage poorly developed.
		F16-6346	siltstone	X				.	0			.			.			poorly developed mica foliation.
		F16-6347	litharenite	X	.	15	.	.	.		0		0		.			subrounded fragments, mostly volcanic fragments.
		F16-6358	sublitharenite	X	.	?	.				.	0	0		.			medium grained, sheared, fluid inclusions in quartz.
		F16-6362	siltstone	X					.			0	.		0			very angular quartz fragments.
		F16-6394	litharenite	X	.	?	0				0	.	0		.			medium grained, subangular grains, minor shearing.
		F16-6395	litharenite	X							0	.	.					undulatory extinction in quartz, catactastized.
		F16-6396	shale	X				.	X			0			.			no prefered mica orientation, subangular grains.
		F16-6400	conglomerate	X	.	15	.				X	0	0	.	.			no prefered mica orientation, 50% well rounded pebbles.
		F16-6405	volcanic pebble conglomerate	0	.	10					X	0	0	.	.			immature, 80% well rounded volcanic pebbles.
		F16-6406	siltstone	X								X	.	.	.			one good fabric seen by chlorite.
		F16-6407	siltstone	X	0							0		X	.			abundant Fe staining, wispy looking texture.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
Eo-Early Cambrian	Kelvin Lake Formation	F16-6410	quartz pebble conglomerate	X							.	0	.	.				siltstone pebbles, quartz shows extreme undulatory extinction.
		F16-6411	conglomerate	X							X		X	.	.			two sericite fabrics caused by shearing.
		F16-6429	litharenite	X					.		X	.	.		.			subangular grains, most of pebbles are volcanic, fine grained.
		F16-6430	conglomerate	X			0				0	.	0		.			undulatory extinction in quartz.
		F16-6442	litharenite	X	.	?					X	.			0			medium grained, rhyolite, basalt, silt, sand pebbles.
		F16-6444	litharenite	X							0		.		0			volcanic ash, rhyolite, quartz sandstone pebbles, red colour.
		F16-6445	litharenite	X	.	20			.		0	.			.			fine grain size.
		F16-6445	litharenite	X	.			.	0		0	0		.	.			subrounded-subangular grains, pebbles are grain size and sedimentary.
Early Cambrian	Purple Conglomerate Member	F16-6327	mylonized conglomerate	X	.	?					0	0	X					highly deformed and altered, strained quartz, pebbles are sedimentary.
		F16-6340	purple conglomerate	X							X	.	X		.			pebbles 2/3 siltstone with rest volcanic, siltstone pebbles have more chlorite than matrix.
		F16-6375	purple conglomerate	X	.						X	0			.			volcanic and sedimentary pebbles, some siltstone pebbles with early foliation.
		F16-6408	green-purple conglomerate	X							X	0	.		.			strong foliation, mostly sedimentary pebbles.
		F16-6409	purple conglomerate	X							X	.	X	.	.			pebbles, both volcanic and siltstone, highly foliated.
		F16-6413	purple conglomerate	0							X		X	.	.			silt and volcanic pebbles, deformed pebbles, fabric.
		F16-6433	purple	0	.	?				X	.	0		0	.			abundant Fe stain, close to volcanic source.
		F16-6435	siltstone	X			.				.	X			.			2 mica foliations at low angles to each other, subangular grains.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
Unknown	Intrusive Rock	F16-6427	monzonite	.	X	?	X					0		.	.	.		Plagioclase almost entirely altered, 1 cm grains.
		F16-6423	diorite		X	?						0			0		X	plagioclase almost completely altered, 2-3 mm grain size.
Lower Cambrian	MacCodrum Formation	F16-6272	slate	0					0				X		.			good foliation with crenulation cleavage.
Protero-zoic	Giant Lake Formation	F16-6276	lithic tuff		X	10				X		.			.		.	fine grained, abundant lithic fragments.
		F16-6277	felsic lithic tuff	X	0	?				X		.			.			recrystallized rhyolitic tuff.
		F16-6279	lithic tuff		X	10				X		.		.	.			fine grained, mostly basic fragments, recrystallized.
		F16-6293	lithic tuff	0	X	15				X		0		0	.	.		fine grained, highly sheared, altered, green colour.
		F16-6294	rhyolite	0	X	15	0					.		.	.			abundant microliths, porphyritic, red colour.
		F16-6295	lithic tuff		X	?				X		0			.			mostly dark matrix, lithic fragments have abundant albite.
		F16-6298	ash fall tuff	0	X	20				X		.	0	.	0		.	direct volcanic source, fine grained, very angular fragments.
		F16-6299	ash fall tuff	0	X	30	?			X		.	.	.	.			direct volcanic source, fine grained, very angular fragments.
		F16-6300	tuff breccia	X	X	?				0		.		X	.			extreme recrystallization, in or close to mylonite zone, fine grained.
		F16-6301	litharenite	0	0						0	.		.	0			direct volcangenic source, pebbles are mafic volcanic fine grained.
		F16-6303	felsic lithic crystal tuff	X	X	35	?			0		.			.			mostly quartz plagioclase crystals in recrystallized matrix, medium grain size.
		F16-6305	basalt	X	X	20						0		X	.			abundant recrystallization to quartz and calcite, slightly porphyritic.
		F16-6315	mylonite	0	0	?				.		.	X		.			2 sercite orientations, extremly fine grained with broken laminations.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
		F16-6316	mafic lithic tuff		X	20				0		0		0	0			medium grained with abundant plagioclase all volcanic fragments.
		F16-6317	mylonite	0	0	15						.	X	X	.			volcanic affinity but all altered and sheared.
		F16-6318	tuff breccia	.	X	30				.		0	0	X	.			highly deformed and altered, going toward mylonite.
		F16-6319	mylonite or/ cataclastite	X	X	?						.		X	.			highly deformed and altered, going toward mylonite.
	Giant	F16-6371	mylonite	0						.		.	X		.			extremely sheared and altered to quartz and sericite.
		F16-6372	conglomerate	0	.						X	0		.	.			grains well rounded, pebbles are all volcanic.
Protero-zoic	Lake	F16-6373	tuff ?	X	0	20				.		.		0	.			highly sheared, volcanic affinity.
		F16-6374	lithic tuff	.						X		0		.	.			rounded fragments and questionable amygdales.
	Complex	F16-6376	tuff	.	X	20	.			0		0		.	.			moderate alteration, fine grained.
		F16-6377	siltstone	X								0		0	.			laminated with high percentage matrix material.
		F16-6379	mylonite	X	.	30						.	0	.				highly deformed and recrystallized.
		F16-6380	? silt or ash	0							0		0	0	.			highly deformed with calcite alteration.
		F16-6381	lithic tuff ??	.	.	?				.		.		X				relique tuffaceous texture.
		F16-6382	basalt		X	?						.		0	.			feldspar altered, amygdaloidal
		F16-6382	litharenite	0							X	.	.		.			sitting on basalt, abundant volcanic fragments.
		F16-6384	? volcanic ash	.						.		.	.	X				laminated? originally an ash layer.
		F16-6401	tuff		X	?				X		0		.	0			3 cm basic lithic fragments, abundant Fe opaque-minerals.
		F16-6402	tuff	?	X	20				X		.		.	0			3 cm felsic lithic fragments, feldspars altered.
		F16-6403	litharenite	X	0		.		.		0	.			.			subrounded medium sized grains, fragments recrystallized.
		F16-6404	tuff	.	.	?				.		X		0	0			almost complete alteration, fine grained, fragments are volcanic.

Age	Complex or Formation or Member	Sample #	Rock Type	Quartz	Plagioclase	An-content	Alkali Feldspar	Biotite	Muscovite	Lithic Fragments	Pebbles	Chlorite	Sericite	Calcite	Opaques	Epidote	Pyroxene	Comments
		F16-6423	diorite		X	?						0			0		X	plagioclase almost completely altered 2.3 mm grain size.
		F16-6424	felsic lithic tuff	0	0	10				X		.	0		.			70% lithic fragments, primary fabric.
		F16-6425	andesite ??		?		?					0		.	.			porphyritic aphanitic, feldspar completely altered.
		F16-6426	tuff		X	?				X		0		0	0			high degree of alteration, porphyritic matrix.
		F16-6436	tuff		X	15-30				.		0		0	.		0	moderate alteration, fine grained matrix.
Proterozoic	Giant Lake Complex	F16-6437	mylonite	X								0		X	.			calcite mineralization is post mylonization (?volcanic affinity).
		F16-6438	tuff	.	X	?		.		0		0	.		.			plagioclase altered to calcite, sericite and chlorite, minor quartz recrystalized.
		F16-6439	felsic lithic tuff	.	0	15				X		0			.			>90% lithic fragments, up to 2 cm diameter.
		F16-6440	lithic tuff	X	?					X		0	.	0	.			moderate alteration throughout, slight foliation.
		F16-6441	lithic tuff	X	?					X		0	.		.			high degree of alteration, reaction rim on quartz
		F16-6443	lithic tuff	0	X	?				X		0			0			pebble of coarse tuff in fine tuff, extreme alteration.

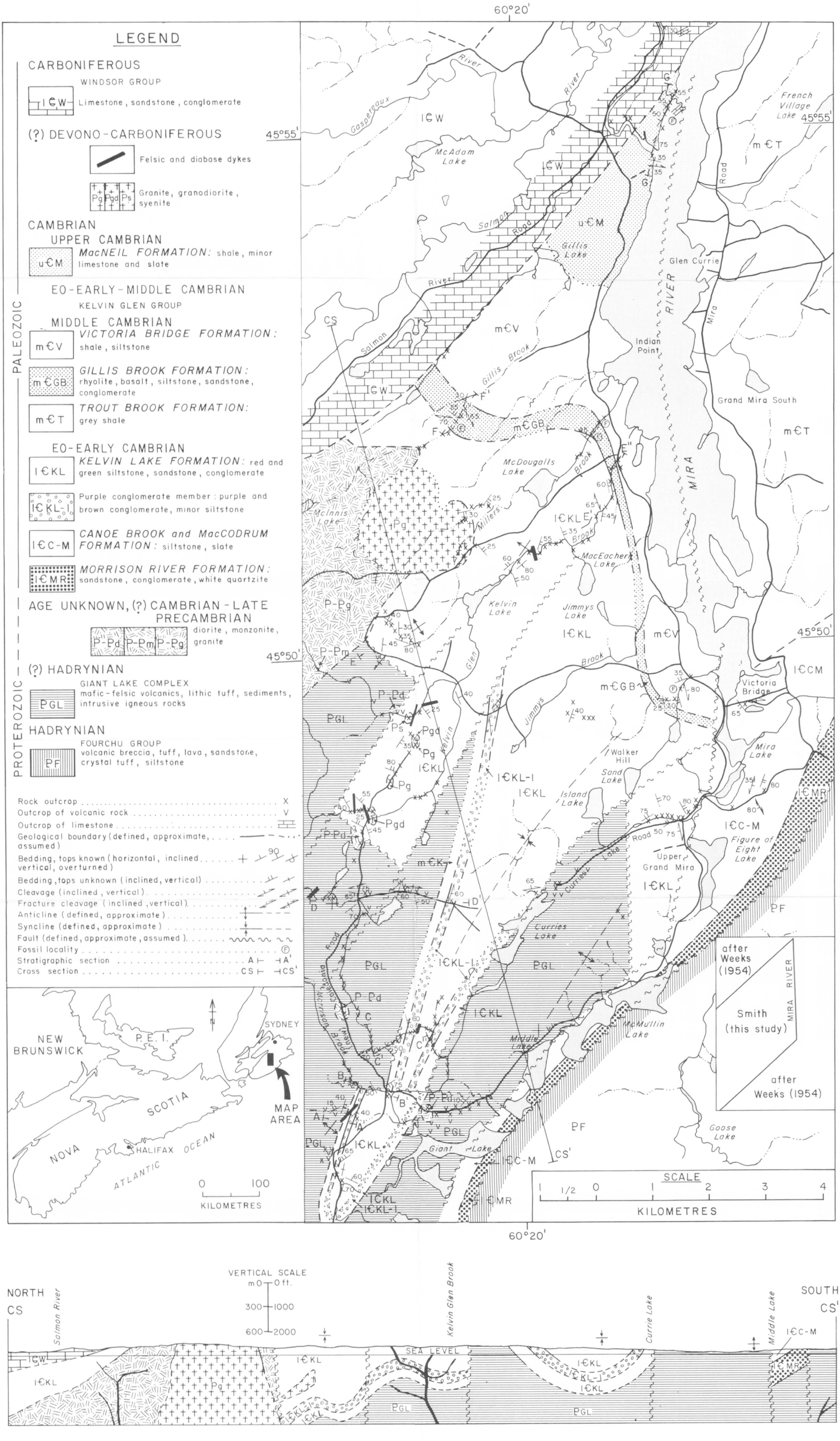


Figure 1. Geological map and cross section of the Giant Lake area, southeastern Cape Breton.