Current Research (1993) Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 93-1, pages 17-34

GEOLOGY OF THE UPPER ST. LEWIS RIVER MAP REGION, SOUTHEAST LABRADOR

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ABSTRACT

The upper St. Lewis River map region is broadly divided into two areas. The northern part is characterized by a northeast structural trend and is provisionally assigned to the Mealy Mountains terrane. It is underlain by moderately recrystallized monzonite, syenite and anorthosite that collectively are grouped as part of the Upper Paradise River pluton, mapped farther north. Megacrystic granitoid and associated rocks in the northeast corner of the region correlate with similar (Labradorian) rocks mapped to the north and east. The southern part of the map region has east-trending structures, although these are commonly deflected around younger plutons. The area is provisionally assigned to the Pinware terrane. The rock types are recrystallized alkali-feldspar granite and syenite, and minor monzonite. The north and south regions are separated by a previously unknown, deformed layered mafic intrusion dominated by troctolite, norite and gabbro, but also include ultramafic and anorthositic rocks. Following deformation and metamorphism, all the above units were intruded by 966 to 956 Ma, late- to post-Grenvillian, coarse-grained, massive to weakly foliated monzonite to granite plutons. Post-pluton events include brittle faulting and emplacement of mafic dykes belonging to the Long Range (615 Ma) swarm.

INTRODUCTION

The upper St. Lewis River map region is located in the Grenville Province in southeastern Labrador (Figure 1). It includes NTS 1:50 000 map areas 13A/3 to 6, collectively embracing an area of about 3,800 km². Mapping in the region was undertaken as part of the Canada–Newfoundland 1990-1994 Cooperation Agreement on Mineral Development.

The region is a gently undulating plateau consisting of vast areas of swamp and small lakes, separated by low, rounded, wooded hills. Over the whole area, outcrops are sparse, occurring at hilltops, on hillsides or, sporadically, in the intervening swamps. There are no roads or trails in the area and the only means of year-round access is by air. Numerous lakes are large enough for use by fixed-wing float-equipped aircraft, but, as many of the lakes are shallow and strewn with boulders, not all are suitable for landing. The area is uninhabited, and the area is visited mainly by transient hunters, trappers, sports fishermen, and natural-resources personnel.

PREVIOUS WORK

The area is included in the 1:500 000 scale map of Eade (1962). Aeromagnetic maps at 1:250 000 scale and 1:63 360 scale were published in 1974 (Geological Survey of Canada, 1974a, b, c, d, e). The data have been compiled into a coloured magnetic anomaly map (Cartwright, Map NN-21-M) at 1:1 000 000 by the Geological Survey of Canada (1985), and coloured-shaded-relief aeromagnetic maps at 1:100 000 scale have been produced by Kilfoil (1992). Bouguer anomaly maps at 1:500 000 scale that include the area are also available (Thomas, 1974).

The area has also been included as part of the National Geochemical Reconnaissance Lake Sediment and Water Geochemical Survey (Geological Survey of Canada, 1984) and reconnaissance mapping of surficial deposits has been carried out by Fulton *et al.* (1980) for NTS 1:250 000 map area 13A.

Geological mapping at 1:100 000 scale by the Newfoundland Department of Mines and Energy has been completed for the Alexis River map region to the north (van Nostrand, 1992; van Nostrand *et al.*, 1992), for the Port Hope Simpson map region to the northeast (Gower *et al.*, 1987, 1988a) and for the St. Lewis River map region to the east (Gower *et al.*, 1988b, c). The area to the southeast has been mapped at 1:125 000 by the Geological Survey of Canada (Bostock, 1983).

Some geochronological work has also been carried out in the area. It was initiated to test the hypothesis that circular anomalies depicted on aeromagnetic maps are linked to 'Grenvillian' plutons. These were unknown at that time in the Grenville Province in Labrador, although their existence had been predicted by Gower and Owen (1984). Gower and

This project is funded by the Canada–Newfoundland Cooperation Agreement on Mineral Development (1990-1994); project carried by Geological Survey Branch, Department of Mines and Energy, Government of Newfoundland and Labrador.

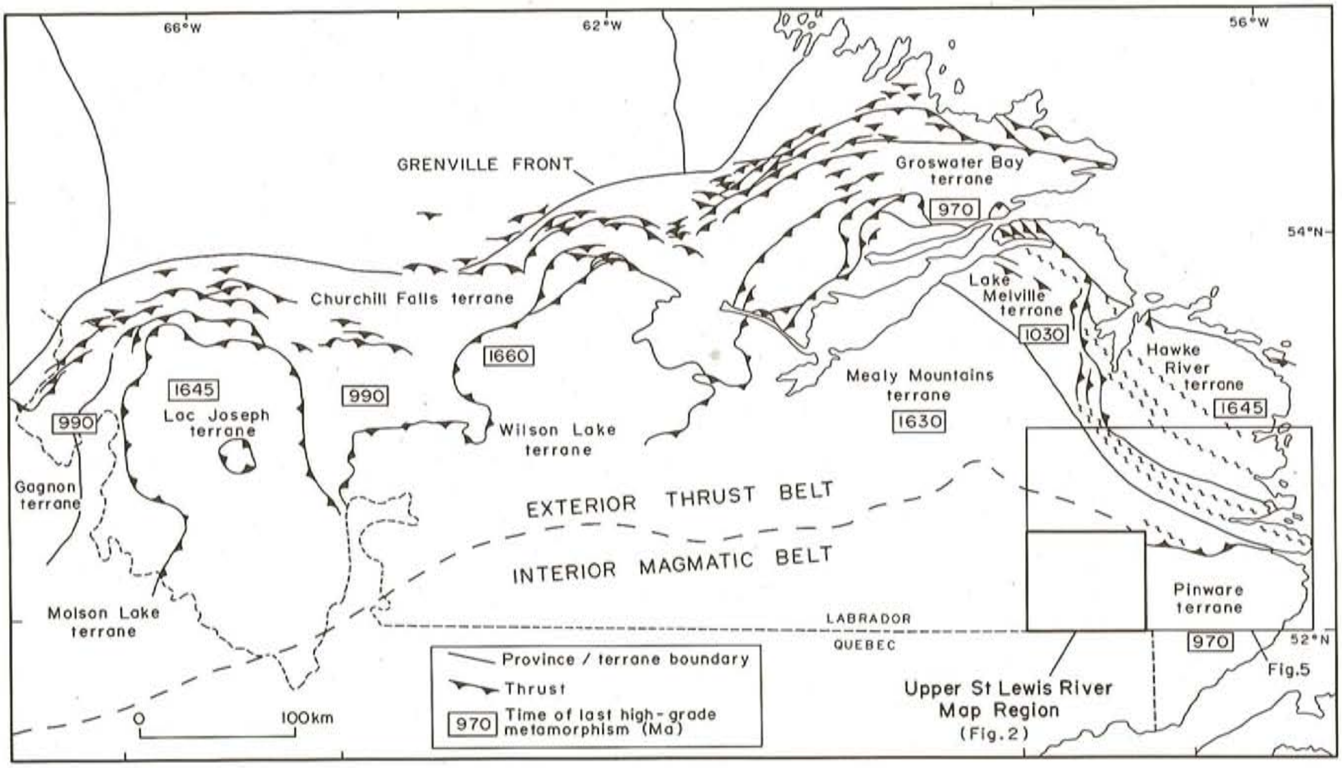

Figure 1. *Location of the upper St. Lewis River map region with respect to major structural features of the eastern Grenville Province.*

Loveridge (1987) sampled and dated an outcrop of monzonite from the centre of one of the anomalies. The rock yielded a U–Pb zircon age of 966 $\pm$ 3 Ma, confirming the hypothesis in that instance. Outcrops at the centre of two other anomalies were subsequently sampled and similar ages obtained (Gower *et al.*, 1991).

REGIONAL GEOLOGICAL SETTING AND SUBDIVISION OF MAP REGION

The area is situated within the Interior Magmatic Belt (Gower *et al.*, 1991), within the Grenville Province (Figure 1). The Interior Magmatic Belt is characterized by Grenvillian (ca. 1000 Ma) granitoid magmatism, which is largely absent in the Exterior Thrust Belt.

The northern part of the upper St. Lewis River map region largely comprises large bodies of moderately deformed and recrystallized monzonite, syenite and granite, whereas the southern part is composed of more strongly deformed granite and syenite (Figure 2). The two parts are separated by an east–northeast-trending layered mafic intrusion, and both regions are intruded by late- to post-Grenvillian granitoid plutons. The northern part is provisionally assigned to the Mealy Mountains terrane, and the southern part to the Pinware terrane. As yet, no structural features have been identified that are of sufficient magnitude or continuous enough to be regarded as a terrane boundary marker between the north and the south; nevertheless, as exposure is poor, such a boundary may be present.

Figure 2 is based on observations collected from nearly 1000 data stations. Samples were collected from most localities, and slabbed and stained (specifically for K-feldspar) during field work.

DESCRIPTION OF UNITS

Apart from age data for three late- to post-Grenvillian plutons, the ages of rocks in the map region are unknown. Descriptions of units, therefore, largely follow a geographical rather than chronological organization. Descriptions start with recrystallized rocks in the northern part (from west to east), continue with recrystallized units in the southern part, and then address unrecrystallized granitoid rocks in both the north and the south. Simple granitoid rock names (granite, syenite, monzonite and diorite) have been used throughout, but these will require re-evaluation after petrographic studies have been completed. In particular, the terminology for pyroxene-bearing equivalents (charnockite, farsundite, mangerite and jotunite) may prove more appropriate for many of the recrystallized rocks.

RECRYSTALLIZED UNITS IN THE NORTHERN HALF OF MAP REGION

Monzonite to Quartz Monzonite in the Northwest

Monzonite to quartz monzonite underlies about 130 km² in the northwest part of the area. The unit is a continuation of similar rocks in the Alexis River area to the north mapped

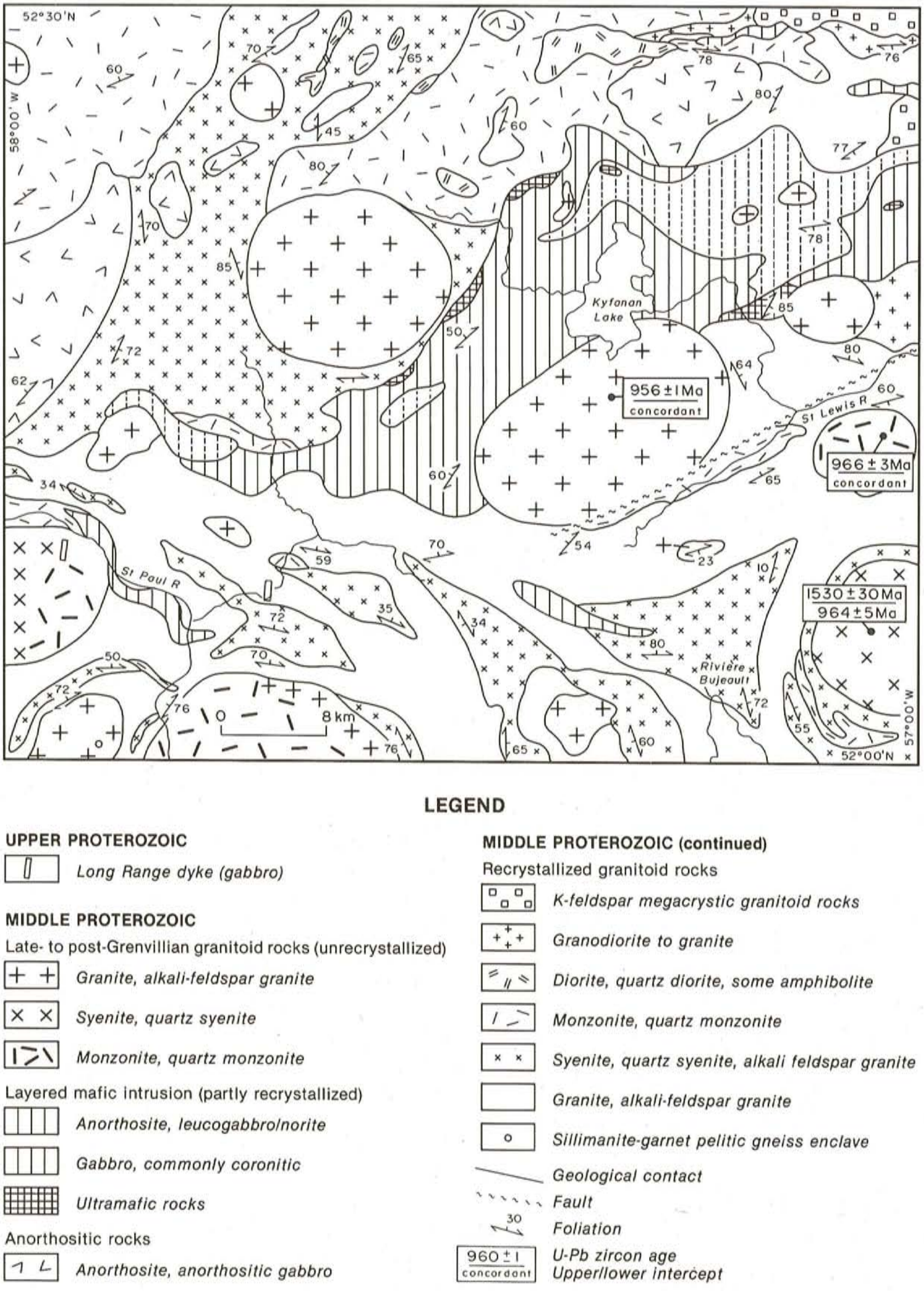

Figure 2. *Simplified geological map of the upper St. Lewis River map region.*

by van Nostrand *et al.* (1992). The unit is honey-, pink-, grey-, or brown-weathering, medium to coarse grained, partially recrystallized and massive to weakly or moderately foliated. It is remarkably homogeneous over the whole area. Mafic minerals include orthopyroxene, clinopyroxene, amphibole, biotite and an opaque phase. Amphibole commonly mantles clinopyroxene cores. K-feldspar occurs as primary grey or purplish primary grains mantled by recrystallized aggregates. Primary plagioclase is much less common and, where found, is mantled by recrystallized K-feldspar aggregates. Quartz is a minor, interstitial mineral in most samples. Locally, a very minor fine-grained variant, possibly forming dykes and/or cognate enclaves, is present (Plate 1).

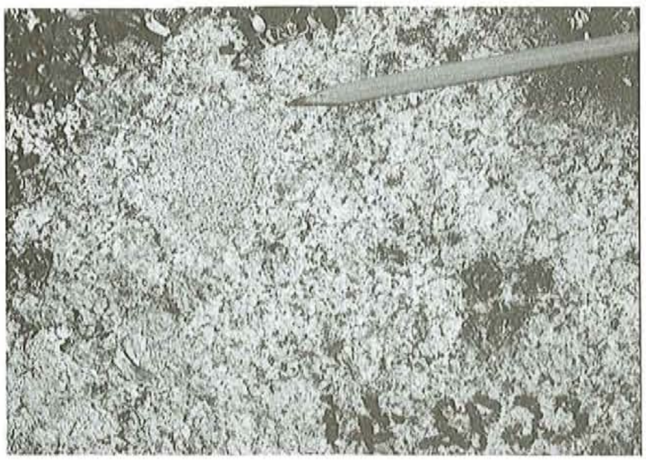

Plate 1. *Monzonite from the northwest part of the map region; note (cognate?) enclave near tip of pencil.*

Syenitic Rocks in the Northwest to North Centre

Syenitic rocks in the northwest to north-central area are much more variable than the above described monzonite and grade from syenite to minor alkali-feldspar granite. The syenite is texturally similar to the monzonite adjacent to their mutual contact, suggesting a genetic link between the two units.

The rocks are pink-, pale-pink-, orange, buff, or rusty-brown-weathering, medium to coarse grained, and moderately to strongly foliated (locally mylonitic). Many initially coarse-grained rocks have been recrystallized to fine-grained aggregates. Relict large K-feldspar crystals give some of the rocks a pseudomegacrystic appearance, and it is possible that many of the rocks were originally megacrystic, as described by van Nostrand *et al.* (1992) for equivalent rocks to the north.

Many of the syenites are extremely leucocratic, having less than 2 percent mafic and opaque minerals. Relict kernels of primary K-feldspar are surrounded by fine-grained recrystallized K-feldspar aggregates. The outlines of recrystallized former large K-feldspar grains can be identified by seams of green-black mafic mineral aggregates in quartz-poor syenite; by sugary-white fine-grained mosaics of quartz and sodic? feldspar in granite; and by recrystallized quartz envelopes in alkali-feldspar granite. Large primary grains of plagioclase or recrystallized aggregates outlining former grains of plagioclase occur sporadically, but are rare. The mafic minerals form interstitial, recrystallized clusters and include dark-green clinopyroxene, black amphibole and biotite.

Monzonitic Rocks in the North Centre

Monzonitic rocks underlie a northeast-trending area in the north-central part of the map region, and have been given the same symbol as those in the northwest area. The rocks are texturally diverse and their grouping should not be taken to imply they necessarily have a common origin. The rocks are buff-, grey- or rusty brown-weathering, medium or coarse grained, generally homogeneous within individual outcrops, massive or weakly to moderately foliated, and lack minor intrusions or enclaves. In the west, some rocks contain large, recrystallized K-feldspar aggregates, giving them a seriate or megacrystic appearance. These typically have some exsolved sodic feldspar. Most of the rocks are quartz-poor, but grade locally into quartz monzonites. Hornblende, biotite, pyroxene and an opaque phase are the mafic minerals. Sporadic outcrops of fine-grained, strongly foliated syenite associated with amphibolite occur locally. The possibility exists that these are enclaves in the regionally extensive monzonite, but this interpretation must be regarded as speculative.

Anorthositic Rocks

Anorthositic rocks in the map region were previously unknown. They occur in two areas; on the western side of the map area and in the northeast quadrant.

The anorthosite in the western part of the area is well exposed (in contrast to most of the granitoid units in the area), although outcrops are isolated and unevenly distributed. The rock is dominantly pale-grey- to white-weathering, but it may be locally pinkish, creamy, dark-grey or black. Some outcrops are completely homogeneous and massive or weakly foliated; elsewhere an indistinct layering (interpreted as primary) is present or the rock exhibits a moderate to strong foliation due to subsequent deformation. Grain size varies from medium to very coarse and is partly linked to recrystallization, which ranges from slight to extensive. In general, there seems to be an increase in deformation and recrystallization from north to south across the body. At one locality, some fine-grained enclaves were seen; as these have the same composition as the host rock we suggest that they are cognate. Primary plagioclase, orthopyroxene and clinopyroxene (all up to 2-cm long), are commonly preserved. Some clusters of mafic minerals have orange-brown cores, thought to be pseudomorphed olivine. The dominant mafic silicates are metamorphic amphibole and biotite (partially coronal), but, in the south, retrogressed garnets up to 2 cm in diameter were also observed. Generally, the garnet is now only preserved as residual kernels in the core of grain clusters (Plate 2).

Plate 2. *Anorthosite from the western part of the map region. A partially retrograded garnet is present in the lower central part of the photograph.*

The roughly triangular-shaped anorthosite body in the northeast consists of brown-, mauve-, white- or grey-weathering anorthosite. The body has a homogeneous composition and is medium to coarse grained. It is massive to weakly (locally moderately) foliated, and variably recrystallized. The mafic mineral content varies from about 5 to 20 percent and consists mostly of hornblende and biotite. Minor pyroxene is present in the cores of some mafic silicate mineral aggregates. Of the felsic minerals, noteworthy features are that the plagioclase is commonly mauve and that rounded blebs of quartz (about 0.5 cm in diameter) occur in the western part of the intrusion. The body appears to be less deformed and recrystallized than the surrounding rocks. This may mean that it is younger or that its anorthositic composition made it less susceptible to strain.

Several smaller bodies of anorthosite or leucogabbro were mapped in the northern part of the map area. In the case of the two ovoid bodies in the northwest part of the map region, given the poor outcrop control, it would be equally legitimate to include them as part of the large body of anorthosite farther west. Some of the rocks weather to honey-brown, characteristic of the monzonitic and syenitic variants, but stained slabs show that they do not contain K-feldspar or quartz. Rather, the rocks are anorthositic gabbro, leucogabbro and leucogabbronorite. Minor amphibolite is also present. Well-developed coronas of amphibole around primary pyroxene are present in many rocks.

Megacrystic Granitoid and Associated Rocks in the Northeast Half of the Map Region

Rocks obviously derived from a K-feldspar megacrystic granitoid protolith are confined to the northeast corner of the map area, where they represent a continuation of a unit previously mapped to the east (Gower *et al.*, 1988b,c) and north (van Nostrand *et al.*, 1992) that is interpreted to have been emplaced during Labradorian orogenesis. The rocks are white- to pink-weathering, medium to coarse grained, recrystallized and weakly to strongly foliated. The K-feldspar megacrysts are anhedral to subhedral, partly polygonized and are up to 3 cm long. Biotite and amphibole are both present. Amphibolite layers and lenses are common, and are interpreted as boudinaged mafic dykes (Plate 3). The unit is intruded by granitic dykes and quartz veins discordant to the foliation.

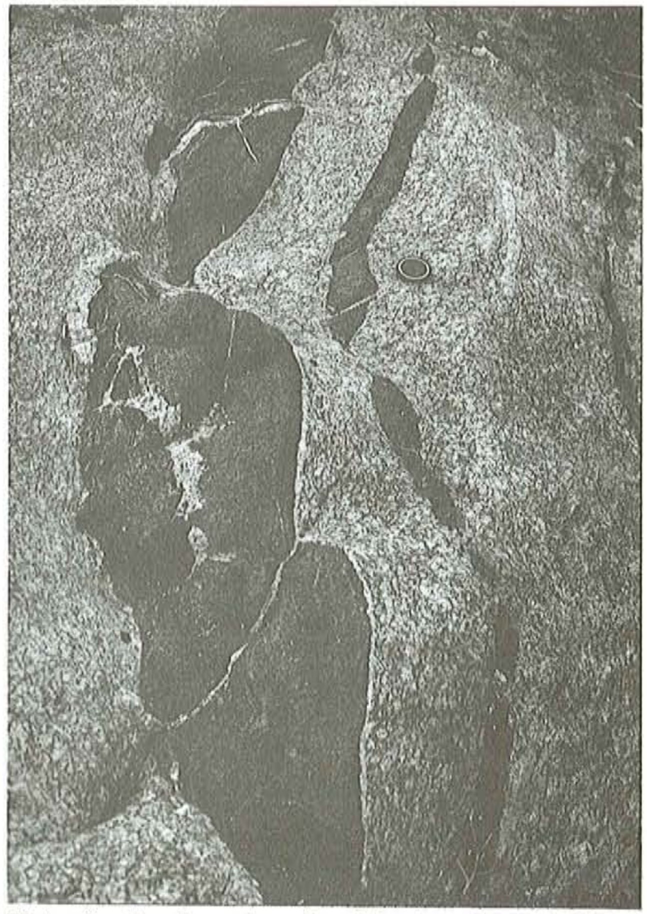

Plate 3. *Boudinaged mafic dyke intruding K-feldspar megacrystic granite in the northeast corner of the map region.*

Non-megacrystic, two-feldspar granite to granodiorite in the area is mineralogically similar to the megacrystic granitoid rocks described above and the two units are considered to be related. Rocks mapped as granite in the northeast corner have diverse textures and compositions and, although grouped together, it should not be assumed that all members of the unit are necessarily cogenetic. Included are pink-, white- and cream-weathering, fine-, medium- and coarse-grained rocks, either lacking in fabric or weakly to strongly foliated. Typically, individual outcrops are uniform, but textural and compositional granite types differ between data stations. Some examples of distinctive rock types include: (i) very quartz-rich alkali-feldspar granite, (ii) coarse-grained (2 to 3 cm diameter), very leucocratic alkali-feldspar granite showing recrystallized, ragged, incomplete mantles of plagioclase, (iii) medium- to coarse-grained, strongly foliated syenogranite, and (iv) medium-grained, strongly foliated, amphibole-bearing monzogranite. After a forest fire, this would be a rewarding area to map in more detail.

Dioritic Rocks in the Northern Half of the Map Region

A few small areas have been mapped as diorite in the northern part of the map area. These rocks are grey- to buff-weathering, homogeneous, equigranular, recrystallized rocks, lacking minor intrusions or enclaves. Mafic minerals include orthopyroxene and clinopyroxene, in addition to amphibole. Some may have jotunitic affinities, others could be metamorphic derivatives of leucogabbro and leucogabbronorite.

Miscellaneous Mafic Rocks in the Northern Half of the Map Region

Mafic rocks are scattered throughout the northern half of the map area, but are most common in the northeast. Their sporadic occurrence and compositional and textural variability makes interpretation of their significance difficult. The diversity of rock types is comparable to that seen in the Kyfanan Lake layered mafic intrusion (see below), and it is possible that these rocks are dismembered tectonic outliers of that intrusion. The rocks are white-, brown-, grey-, green-, black- and rusty-weathering, medium- to coarse-grained, massive to strongly foliated, recrystallized metagabbro, leucogabbro, anorthositic gabbro, ultramafic rocks and meladiorite. The metagabbroic rocks are typically equigranular and homogeneous, and show relict ophitic texture. Some of the leucogabbroic to anorthositic gabbroic rocks exhibit euhedral cumulate laths of plagioclase associated with interstitial pyroxene. At the other end of the colour-index spectrum, the ultramafic rocks contain orthopyroxene, mostly pseudomorphed by amphibole associated with minor interstitial plagioclase.

Mafic rocks in the remainder of the northern half of the map region are brown-, grey-, greyish-black-weathering, massive or weakly to moderately foliated, medium- to coarse-grained, recrystallized gabbro, leucoamphibolite, amphibolite and diorite. Some of the metagabbroic rocks show relict subophitic texture, and partially retrograded garnet was observed in one amphibolite. It is not known whether the variation in appearance reflects two or more ages of mafic intrusive rock, or spatial variation in the effects of metamorphism and deformation. The less-recrystallized metagabbro resembles some of the mafic rocks, known to be dykes, reported by van Nostrand *et al.* (1992).

RECRYSTALLIZED UNITS IN THE SOUTHERN HALF OF MAP REGION

Recrystallized and deformed, fine- to medium-grained granite, alkali-feldspar granite, syenite, quartz syenite and alkali-feldspar syenite (together with subsidiary monzonite and mafic rocks) underlie most of the southern half of the map area. The granitoid rock types are intergradational, but, for the purposes of mapping, most can be divided by quartz content into granite and syenite. Both rock types weather white, pink, cream, buff, grey, orange, brick red or brown, have sugary textures and are typically leucocratic. A strong foliation is characteristic, although moderately foliated or even massive rocks are found in places.

Granite, Alkali-Feldspar Granite

The dominant granitic rock type is alkali-feldspar granite, in which plagioclase is either a minor constituent or is absent. Many rocks are very quartz rich, even for granites. Biotite, commonly chloritized, is the dominant mafic mineral, but amphibole is present locally. The granites commonly display inhomogeneity in outcrop, having a poor- to well-banded appearance. The banding may be due to: (i) subtle grain-size variations, (ii) streaked out 1- to 3-cm-wide coarser granitic or pegmatitic patches and layers, or irregular incipient melt pods, or (iii) alternation of felsic and mafic layers. The mafic layers range from thin (0.2 to 0.4 cm) wispy, irregular laminae of amphibole- and biotite-rich material to amphibolite bands 1 to 2 m wide. Where amphibolite is present, some of the layers are dioritic and probably formed as a result of partial assimilation of amphibolite. Locally, multiple layers of amphibolite give the rock a crudely layered appearance (Plates 4 and 5). The amphibolite may represent dismembered remnants of pre-deformation mafic dykes, but, as the amphibolite layers are everywhere concordant to the foliation in the adjacent granite, this interpretation could not be proved.

Plate 4. *Outcrop view of interbanded recrystallized granite and amphibolite; St. Paul River area.*

Syenite, Alkali-Feldspar Syenite

The syenites are fine grained, completely recrystallized and fairly homogeneous. The rocks are extremely potassic (over 95 percent K-feldspar is not unusual), commonly lacking quartz, and having only accessory mafic and opaque minerals. Quartz occurs as: (i) an interstitial anhedral mineral, (ii) uncommon spherical grains that resemble amygdules, (iii) euhedral grains that resemble phenocrysts, and (iv) flattened slivers. Mafic minerals are amphibole, biotite and pyroxene (locally as cores to amphibole), occurring as interstitial minerals or narrow stringers or lenses (Plate 6). Garnet is a rare additional mineral, but, in an exceptional case, makes

Plate 5. *Detail of the same outcrop as Plate 4. The occurrence of thinly interbanded recrystallized granite and amphibolite raises the possibility that the rocks are supracrustal in origin.*

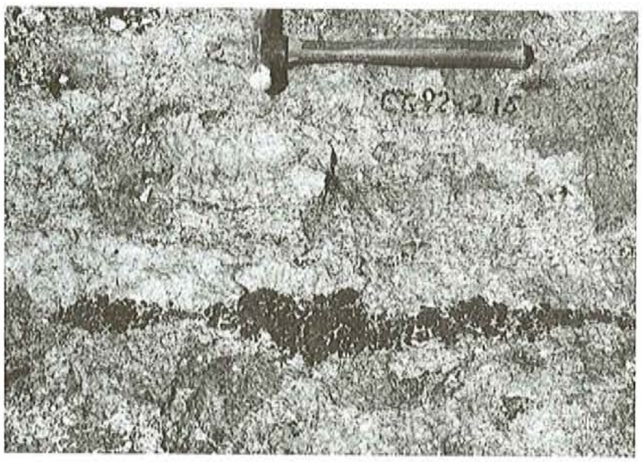

Plate 6. *Recrystallized and deformed syenite from the southwest part of the map region. The syenite is interpreted to have been derived from a coarse-grained plutonic rock.*

up to 3 percent of the rock and occurs as euhedral crystals up to 10 cm in diameter.

Fabric is variably developed; in places the rocks are homogeneous and lack mineral alignment, elsewhere the rocks are moderately to strongly foliated. A gneissic fabric is attained locally, the subtle layering being defined by grain size or mineralogical variations, flattened quartz grains, or stringers of mafic minerals, especially hornblende. A minor proportion of the syenites are massive to weakly foliated, partially recrystallized and medium to coarse grained, having K-feldspar grains up to 2 cm long showing relict perthitic texture. In a few outcrops, there is a gradation from a coarse-grained, fairly massive rock to a fine-grained, deformed equivalent. One syenite shows a crude layering, which might be primary.

A distinctive 'crazy paving texture' is fairly common in the syenitic rocks, although rarely seen unless the rock is stained. Irregular branching seams (about 1 mm wide) of sugary, recrystallized felsic minerals (albite and quartz?) separate patches of K-feldspar and is interpreted to be an exsolution phenomenon, formed after the peak of deformation. The texture is common in a belt of rocks about 10 km wide, extending from St. Paul River in the west to Rivière Bujeault in the east.

The protolith of the granite and syenite remains uncertain. Local gradations from rocks containing relict coarse grains of perthite to fine-grained compositional equivalents, suggest that most were derived originally from plutonic rocks. On the other hand, many of the fine-grained rocks lack a fabric, some have subtle compositional banding (Plate 5), and a few of the syenites have spherical or euhedral quartz grains. These features could be interpreted as indicating derivation from porphyries or extrusive volcanic rocks, followed by subsequent static recrystallization. If this interpretation is valid, one might expect to find associated supracrustal rocks, especially fragmental units, which, even in a deformed state are commonly still recognizable; none were recognized.

Monzonite, Quartz Monzonite

Monzonite occurs in several places in the southern part of the map area. It should probably be regarded as a plagioclase- and mafic-mineral-rich lithological variant of the dominant syenitic and granitic rocks, rather than an unrelated unit.

The largest area of monzonite mapped is along the southern branch of the upper St. Lewis River. The rocks weather to various shades of red and brown (mainly because of later hematitic alteration due to faulting), are fine to medium grained, moderately to strongly foliated, and contain amphibolite enclaves. The rocks are compositionally varied and include minor quartz diorite, granodiorite, syenite and granite.

Monzonitic rocks elsewhere in the southern part of the map region have the same broad features in terms of weathering colour (but lacking the colouring effects of hematite alteration), grain size and foliation. In the southwest several small occurrences of monzonite are slightly more hornblende rich and finer grained than is typical elsewhere, and it is possible that these outcrops are related. The monzonite on St. Paul River in the extreme west of the area is texturally quite distinct; it is coarse grained and only weakly deformed. These rocks may be a foliated border phase of the younger monzonite pluton to the south, but as the foliation is truncated by minor granitoid dykes (which could be coeval with the younger pluton), the foliated monzonites could predate the pluton.

In the southeast, the only monzonite of note is an outcrop (not shown on Figure 2) 10 km northwest of a late/post-syenite pluton. Outside the northeast quadrant, it is the only obviously megacrystic rock in the map region. As a result of strong deformation, the K-feldspar megacrysts are completely recrystallized and drawn out to lenticular aggregates 4 to 5 times their width.

Other Granitoid Units

A mappable granitic rock type occurs north of St. Lewis River and south of the Kyfanan Lake layered mafic intrusion near the eastern margin of the map area. The rock is pale-pink to grey-weathering and extensively recrystallized, but was originally a coarse-grained, strongly foliated hornblende–biotite granite. The rock lacks enclaves, but is commonly intruded by massive microgranite and pegmatite dykes that clearly truncate the foliation in the host granite.

At the eastern margin of the map region, the rocks have been mapped as granodiorite. The unit has been modified by both ductile and brittle deformation, so determination of protolith composition is not unequivocal. A miscellany of rock types is present, including K-feldspar megacrystic granodiorite, equigranular granodiorite, monzodiorite, various textural varieties of amphibolite and some late-stage minor granitic intrusions. Some of the mafic rocks may be synplutonic dykes (Plate 7).

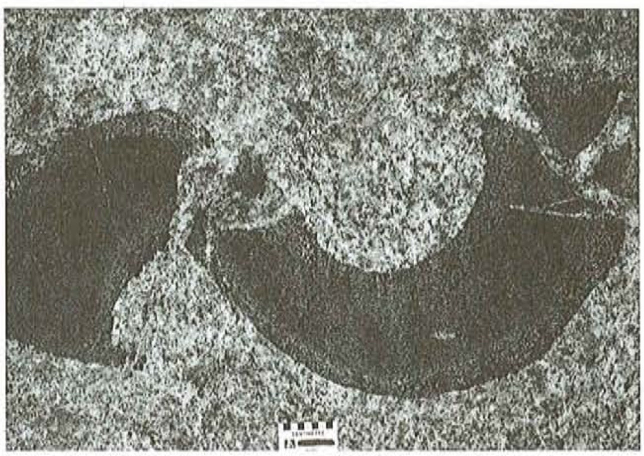

Plate 7. *Segmented mafic layer in recrystallized granite. The presence of granite between the mafic segments that is identical to the enveloping granite suggests synplutonic emplacement.*

Mafic Rocks in the Southwest

A northwest-trending body of mafic rock, about 15 km long and 1 to 2 km wide, is present in the St. Paul River area (Figure 2). The original body may only be preserved as discontinuous deformed and metamorphosed remnants and there may not be much continuity between individual outcrops. The rocks are white-, grey-, brown- or black-weathering, medium to coarse grained and massive to strongly foliated. Compositions include ultramafic rocks, gabbro–norite and their leucocratic variants, and monzogabbro. Some of the leucogabbro–norite and monzogabbro retain primary minerals and textures, such as layering and cumulate textures, and evidence of magma-mingling. More commonly, these rocks have been thoroughly recrystallized to inhomogeneous leucocratic to melanocratic amphibolite. Metamorphic grade was sufficient for minor leucosome to have developed locally. Garnet is found in amphibolite in outcrops north of St. Paul River and, along strike, on the major tributary draining from the northeast. The garnets are partially retrogressed and are generally less than 3 mm in diameter. In ultramafic units, primary features are rarely preserved; instead, the rocks are extensively or completely recrystallized and composed almost entirely of hornblende with some biotite. Further complexities result from alternation with granitoid rocks and injection by younger granitic veins.

Mafic Rocks in the South Centre

Part of the south-central part of the map area is inferred to be underlain by an east–southeast-trending, 10-km-long, lenticular mafic intrusion. Its existence is largely conjectural and inferred from a distinct aeromagnetic anomaly in the area, except for one outcrop of gabbro mapped at the northwestern end of the anomaly. The gabbro is dark honey-brown-weathering, coarse grained and partly recrystallized. Relict primary pyroxene is present.

Other Mafic Rocks

On the St. Lewis and St. Paul rivers and their major tributaries, amphibolite is a common associate of foliated granitoid rocks. Amphibolite was rarely recorded from the lichen- or moss-covered outcrops away from riverside exposures, but it is suspected that it is everywhere associated with foliated granitoid rocks. The amphibolite is white- to black-weathering, medium grained, and moderately banded in places (defined by concordant felsic veins). It is generally a homogeneous, hornblende-plagioclase rock, but some rocks have larger recrystallized plagioclase grains, which may indicate former phenocrysts. Biotite, and accessory K-feldspar and quartz are additional minerals. It occurs as narrow concordant layers, lenses, pods and boudins (ranging from about 1 cm to 1 m wide), concordant to the foliation in the enveloping granitoid rocks. In places, the lenses grade into wispy schlieren. On a few large outcrops, amphibolite can be traced across the outcrops as semi-continuous bands. The fabric in the amphibolite is everywhere parallel to that in the granitoid host rocks, and no earlier structures are truncated. Our preferred interpretation is that the amphibolite represents metamorphosed mafic dykes, and that the dykes were emplaced into homogeneous rocks prior to deformation.

KYFANAN LAKE LAYERED MAFIC INTRUSION

The Kyfanan Lake layered mafic intrusion is a new informal name given to an east–northeast-trending layered mafic intrusion that underlies much of the central part of the map area. The extent of this body was previously unknown; a small area of mafic rocks now known to be part of the intrusion is shown on the map of Eade (1962) and mafic rocks mapped by Gower *et al.* (1988b,c) in the St. Lewis River map area are now considered to be its eastward extension. The body is about 75 km long and up to 12 km wide.

The intrusion has been divided into three units on Figure 2: these are (i) ultramafic rocks, (ii) gabbroic rocks, and (iii) leucogabbro–norite grading into anorthositic gabbro and anorthosite.

Ultramafic Rocks

Ultramafic rocks show the full spectrum from those having primary minerals and textures to those having completely metamorphic mineral assemblages. A noteworthy example of a rock having primary minerals and texture is a dark-brown-weathering dunite exposed 8 km west of Kyfanan Lake. The overall rock is layered (defined by fracture parting coupled with mineralogical contrasts, and better seen on weathered than fresh surfaces), but within individual layers the rock is homogeneous and massive. Olivine is present as stubby, euhedral, cumulate grains with pyroxene. The mineralogically modified rocks are black-, green-, or brown-weathering, medium grained, weakly to strongly foliated, recrystallized and, in places slightly schistose. They are now mainly composed of amphibole, commonly associated with some biotite and minor interstitial plagioclase.

Gabbro

The gabbroic unit, which includes troctolite and norite, weathers dark green, brown or grey, is medium to coarse grained and massive to moderately foliated. Subophitic textures are commonly preserved. Plagioclase crystals are equant to acicular. Primary olivine, orthopyroxene and clinopyroxene occur as brown grain cores mantled by coronas of green amphibole (Plate 8).

Plate 8. *Coronitic leucotroctolite from the Kyfanan Lake layered mafic intrusion; central part of map region.*

Leucogabbro–Norite and Anorthosite

The leucocratic variants of the gabbroic unit have similar overall field characteristics, except that they are lighter weathering (to white, dark grey or brown) and are more variable in appearance. Layering was observed in many outcrops (Plate 9). A mottled textural variant is interpreted to be the result of recrystallization of large primary pyroxene grains to anhedral clusters of amphibole in an originally more leucocratic matrix. Coronitic textures are also common in this unit.

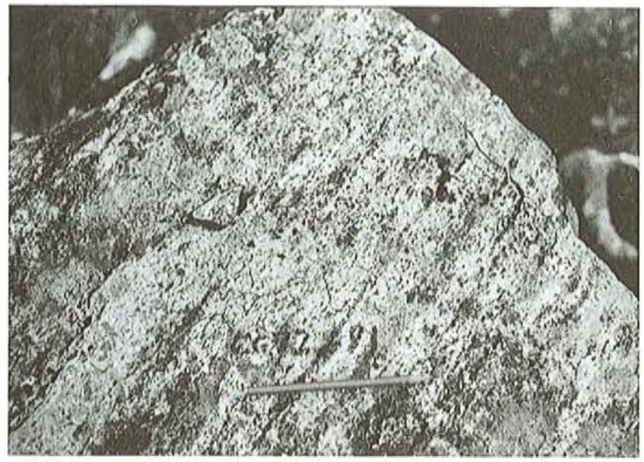

Plate 9. *Primary layering in anorthositic gabbro in the Kyfanan Lake layered mafic intrusion.*

Anorthositic rocks can be simply regarded as the end member of a lithological continuum in the layered mafic intrusion. The rocks are white-, or grey-weathering, medium, coarse or very coarse grained, partially recrystallized and locally moderately to strongly foliated. Fabric is defined by narrow mafic-mineral-rich zones, or aligned amphibole aggregates, within the overall plagioclase-dominant rock.

Metamorphic Derivatives

Metamorphic derivatives of the above units are all amphibolitic rocks of one sort or another, including typical amphibolite and leucocratic and melanocratic variants. The rocks are white-, dark-grey-, black-, orange-grey- or rusty-brown-weathering, homogeneous, recrystallized, weakly to markedly foliated, and fine to medium grained. Although the typical minerals are amphibole and plagioclase, some residual pyroxene or olivine is locally present. A fine-grained, 10-cm-wide amphibolite, which could be a mafic dyke, occurs within one coarser grained amphibolite.

Age of Intrusion

The age of the Kyfanan Lake layered mafic intrusion is unknown. Preservation of primary textures and minerals (including cumulate-textured dunites) at the edge of the layered mafic intrusion, is taken to mean that the emplacement of the layered intrusion postdates the enveloping granitoid rocks (which are thought to have an emplacement age of ca. 1500 Ma). The minimum age of the intrusion is constrained by the timing of metamorphism and deformation to which it has been subjected. These are demonstrated by fabric development, partial to complete recrystallization, and the formation of amphibolite-facies mineral assemblages. Folding is indicated by variation in layering attitudes. We surmize that the metamorphism and deformation occurred during Grenvillian orogenesis, known to have taken place farther east at 1000 Ma (cf. Tucker and Gower, *in press*).

UNRECRYSTALLIZED LATE- TO POST-GRENVILLIAN GRANITOID PLUTONS

Unrecrystallized, late- to post-Grenvillian granitoid plutons occur throughout the map region. The rocks are pink-weathering, homogeneous, coarse grained and massive to weakly foliated, unless stated otherwise below. They are generally characterized by distinctive circular aeromagnetic patterns. Each intrusion has some unique aspects, hence they are described individually below. They have been given informal names, some of which were previously used by Gower *et al.* (1991). These names are indicated on Figure 3.

St. Lewis River Headwaters Granite

The St. Lewis River headwaters granite is a very poorly exposed body west of Kyfanan Lake. The aeromagnetic pattern suggests three nested intrusions having their centres progressively displaced toward the west, but, as only six outcrops were located in the area inferred from aeromagnetic anomalies to be underlain by the pluton, this could not be established in the field.

The granite is pale pink- to brown-weathering and contains both K-feldspar and plagioclase (K-feldspar > plagioclase). Biotite is the mafic silicate mineral. A few feldspar crystals have plagioclase cores and K-feldspar rims, but the granite does not have the distinctive mantled feldspar textures shown by the more southerly intrusions. It is somewhat similar to the two-feldspar granite in the upper St. Lewis River (west) pluton. One pegmatite was recorded, but no enclaves were seen.

Upper St. Lewis River (West) Granite and Alkali-Feldspar Granite

The upper St. Lewis River (west) granite has yielded an almost concordant U–Pb zircon age of 956 ± 1 Ma and a K–Ar biotite age of 911 ± 10 Ma (Gower *et al.*, 1991). The 956 Ma U–Pb zircon age makes this the youngest known pluton related to Grenvillian orogenesis in the Grenville Province. At the time that Gower *et al.* (1991) published the age, the pluton had not been mapped and its outline was inferred from aeromagnetic patterns. Therefore, this report updates their field information.

The pluton consists of two-feldspar granite in the northeast and centre (the dated rock type), and alkali-feldspar granite in the southwest. This rock-type contrast is reflected in, (i) magnetic patterns, which are much more pronounced in the northeast than in the southwest, and (ii) in weak foliations, which are east–northeast in the two-feldspar granite and north–northwest in the alkali-feldspar granite. In the two-feldspar granite, textures are seriate or, rarely, megacrystic. Biotite is the dominant mafic mineral and accessory minerals include titanite, allanite, apatite, opaque minerals and zircon. A modal analysis reported by Gower *et al.* (1991) included 33 percent quartz, 26.5 percent plagioclase and 34.5 percent K-feldspar. Rare mantled feldspar textures are present in the south; both 'plagioclase mantled by K-feldspar' and 'K-feldspar mantled by plagioclase with a K-feldspar rim' textures are present. The alkali-feldspar granite has an equigranular texture and low mafic mineral (biotite) content.

Enclaves and minor granitic intrusions are present as subsidiary rock types in the two-feldspar granite. The enclaves consist of fine-grained, foliated granitoid rocks similar to those surrounding the pluton. The minor granitic intrusions are mainly aplite dykes, but pegmatite is locally present. Given that the two-feldspar granite is the phase containing enclaves of pre-Grenvillian rocks, has minor granitoid intrusions and the east–northeast foliations are regionally truncated by the north–northwest directions, it would seem likely that it is older than the alkali-feldspar granite.

Upper St. Lewis River (North) Granite

Although an elliptical pluton has been outlined near the eastern border of the map north of the St. Lewis River, its existence as depicted is far from certain. The rocks are fine- to medium-grained two-feldspar biotite granite, typical of that seen in microgranite–aplite dykes elsewhere in the map area. Given the very poor exposure, it is possible that all outcrops are minor intrusions intruding unexposed host rocks (which, most likely, would be the foliated, recrystallized granitoid rocks seen in river sections to the south). Alternatively, the outcrops could be the roof of a pluton, or dykes within it.

Upper St. Lewis River (East) Monzonite

The upper St. Lewis River (east) monzonite is situated near the eastern border of the map area. The body, originally described by Gower and Loveridge (1987), was the first late- to post-Grenvillian pluton to be dated in the eastern Grenville Province. Gower and Loveridge (1987) reported a concordant U–Pb zircon age of 966 ± 3 Ma for a sample taken near the centre of the body. Subsequently, Gower *et al.* (1991) reported a K–Ar hornblende age of 946 ± 13 Ma and a K–Ar biotite age of 914 ± 13 Ma for the same sample.

The monzonite is grey-weathering, coarse grained and massive. The percentage mineral proportions in the dated sample are as follows: quartz 1.2, plagioclase 46.1, K-feldspar 37.5, biotite 3.3, amphibole 5.0, clinopyroxene 2.6, apatite 1, opaque minerals 3.1 and traces of titanite and zircon (Gower and Loveridge, 1987, who also give other petrographic details).

The monzonite contains enclaves of the surrounding foliated granitoid rocks and is intruded by two phases of mafic to intermediate dykes (observed on a tributary of the St. Lewis River), both of which contain euhedral plagioclase phenocrysts. Because similar dykes were not observed

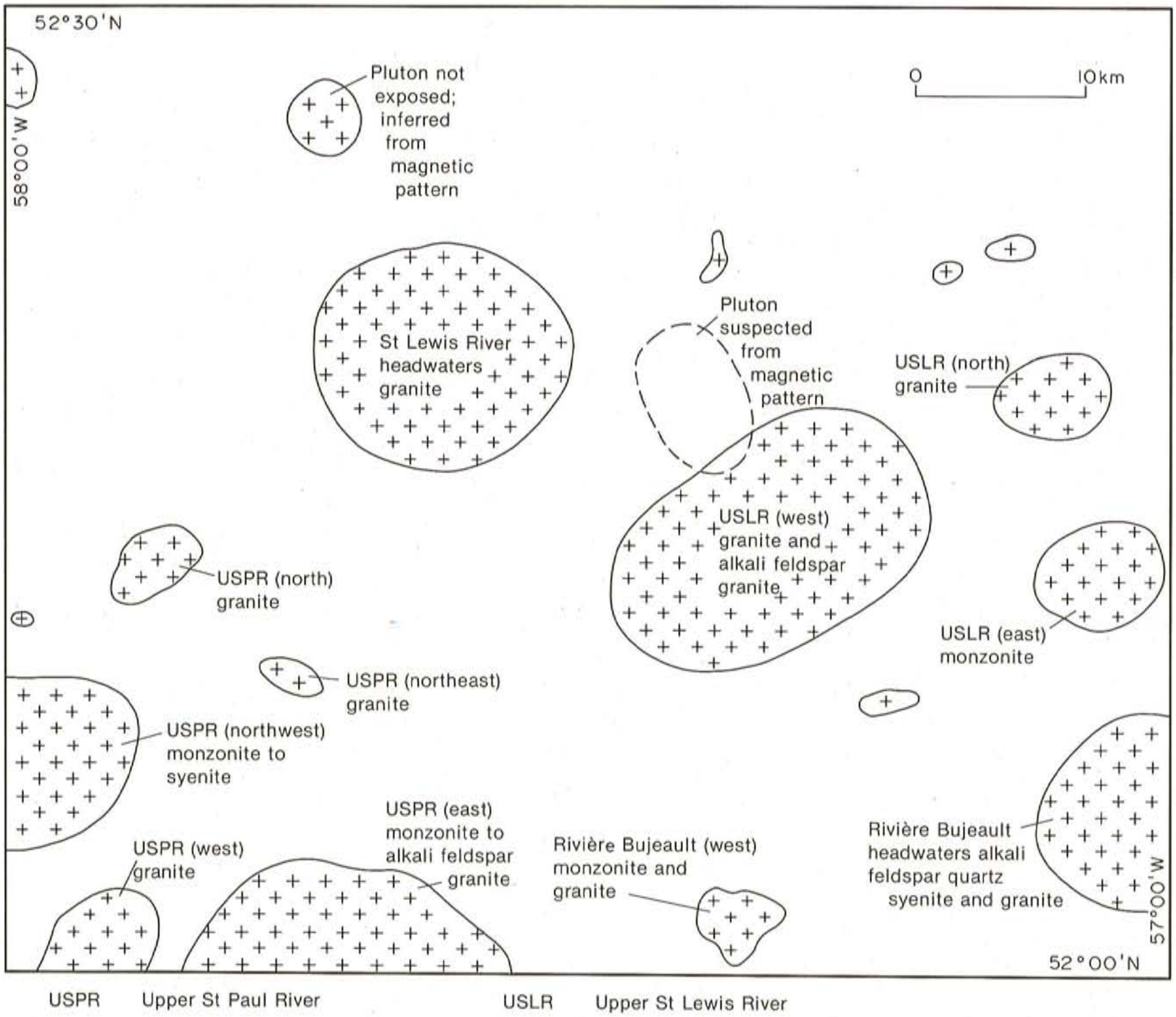

Figure 3. *Names used in the text for late- to post-Grenvillian plutons.*

elsewhere in the map area, we regard them as being genetically related to the monzonite pluton. Pink- to cream-weathering aplite dykes are also present.

Rivière Bujeault Headwaters Alkali-Feldspar Quartz Syenite and Granite

Part of the Rivière Bujeault headwaters alkali-feldspar quartz syenite to granite (Plate 10) was first mapped by Gower *et al.* (1988b,c), although Eade (1962) had earlier hinted at its existence by identifying arcuate bedrock trends from airphotos and noting that foliations wrap around massive granite bodies in the region. The pluton was named by Gower *et al.* (1991) who reported ages based on several methods for two samples collected near the centre of the intrusion. The emplacement age was interpreted to be 964 ± 5 Ma based on lower intercept U–Pb zircon data. The upper intercept of 1530 ± 30 Ma was inferred to reflect inherited zircon. In addition, K–Ar hornblende ages of 953 ± 12 Ma and 926 ± 16 Ma, a K–Ar biotite age of 927 ± 18 Ma and Rb–Sr biotite ages of 888 ± 12 Ma, 811 ± 9 Ma and 822 ± 9 Ma were obtained (Gower *et al.*, 1991).

The Rivière Bujeault pluton is almost circular in plan, measuring 12 km across (slightly smaller than estimated by Gower *et al.* (1991) from aeromagnetic patterns). Two modal analyses reported by Gower and Loveridge (1987) give some indication of the compositional range present in the pluton. The felsic minerals show the following percentage modal values: quartz 12.8 and 35.5, plagioclase 6.1 and 12.5 and K-feldspar 75.5 and 48.6. The mafic minerals are biotite, amphibole and clinopyroxene, collectively less than 3 percent. Accessory minerals include apatite, zircon, titanite, and opaque minerals (Plate 10). Scattered enclaves of foliated granitoid rocks and a few aplite dykes also characterize the pluton.

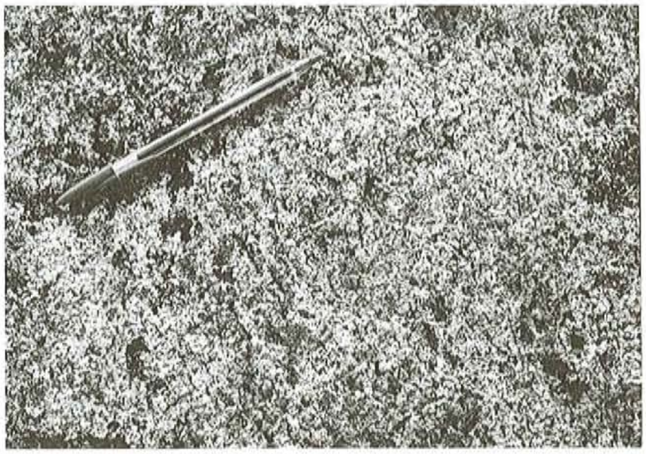

Plate 10. *Field appearance of the Rivière Bujeault headwaters quartz syenite, emplaced at 964 ± 5 Ma; southeast part of map region.*

Rivière Bujeault (West) Quartz Monzonite to Granite

This irregular-shaped pluton is subdivided into two parts, dominantly monzonite to quartz monzonite in the south and granite in the north. Both rock types contain hornblende and biotite, and differ mainly in colour index. Garnet was noted in a sample near the northeastern margin of the body. Enclaves and minor granitoid intrusions are scarce. A melanocratic monzonite in the centre of the pluton is tentatively interpreted as a border facies of the quartz monzonite to the south. Pegmatite dykes that intrude it may have emanated from the granite to the north, which would therefore be the younger intrusive phase.

Upper St. Paul River (East) Monzonite to Alkali Feldspar Granite

The upper St. Paul River (east) monzonite and alkali-feldspar granite straddles the Labrador–Quebec border in the southwestern part of the map area. Assuming it is circular in plan, the pluton is estimated to be 20 km in diameter. Foliations in the surrounding rocks are conformable with the border of the intrusion and mostly dip toward the body.

The monzonite is pink-, brown- or buff-weathering. Both biotite and amphibole are ubiquitous, but relict clinopyroxene is locally evident in hand specimen. Quartz is interstitial. A distinctive feature of the pluton is the presence of subhedral mantled feldspars up to 3 cm long (Plate 11). Two types dominate; those having a core of plagioclase and rimmed by K-feldspar, and those having a K-feldspar core, an intermediate layer of plagioclase and an outer border of K-feldspar. Commonly the intermediate plagioclase layer is discontinuous, suggesting incomplete precipitation or partial resorption of plagioclase before the outer layer was formed.

Granite to alkali-feldspar granite was mapped close to the centre of the body and along its northeast margin. The granite near the centre of the body is sufficiently texturally distinct (for example, lacking mantled feldspar textures) that it might belong to a separate emplacement phase, in contrast to that in the northeast part, which is probably simply a compositional variant.

Plate 11. *St. Paul River (east) monzonite; note well developed mantled feldspar texture.*

Enclaves, varying from a few centimetres to several metres long, are common in the pluton, especially in its outer part, and are well exposed on the shore of St. Paul River (Plate 12). All those seen are foliated granitoid rocks similar to the rocks present outside the pluton. They are generally tabular and are mostly aligned parallel to the pluton's margin. Pegmatitic and aplitic veins, less than 10 cm wide, intrude the monzonite, but they are not common.

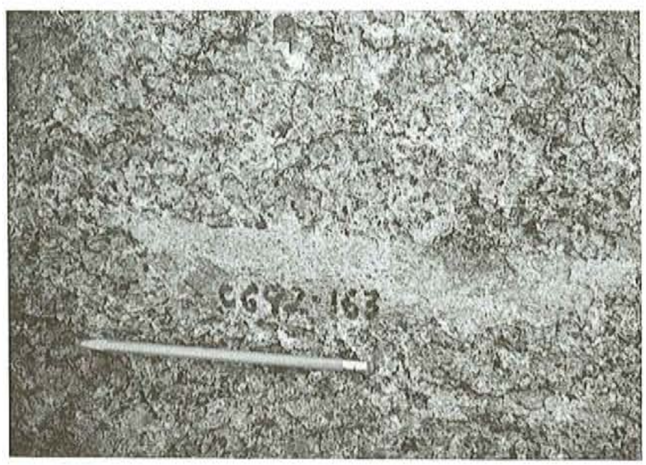

Plate 12. *Enclave of fine-grained, foliated, recrystallized granite in the St. Paul River (east) monzonite.*

Upper St. Paul River (West) Granite

The upper St. Paul River (west) granite is an alkali-feldspar granite intrusion in the southwest corner of the map area. If, as is the case with most of the other posttectonic intrusions, it is roughly circular or elliptical, then the diameter of the body is roughly 7 km. Based on a few structural observations, both the northwest and east sides of the pluton dip to the southeast.

Biotite is the main mafic mineral, but minor hornblende is present also. Zoning and exsolution textures are locally evident in K-feldspar crystals. The granite lacks minor intrusions. A particularly noteworthy feature of the pluton is the presence of an enclave of leucosome-bearing biotite–sillimanite–garnet metasedimentary gneiss measuring approximately 2 m wide and 3 m long. This is the only example of a rock derived from a metasedimentary protolith found throughout the whole map region. An enclave (2 by 1 m) of a pink, medium-grained, strongly foliated granite, similar to that found surrounding the pluton, was also observed at the same outcrop and enclaves of the same rock are present near the eastern margin of the body.

Upper St. Paul River (Northwest) Monzonite to Syenite Pluton

The upper St. Paul River (northwest) monzonite to syenite pluton is situated in the southwestern part of the map area. Assuming it is approximately circular in plan, its diameter is about 10 km.

The monzonite is very similar to the upper St. Paul River (east) monzonite. It is pale-pink- to white- or buff-weathering. Amphibole and biotite are the mafic minerals and quartz is interstitial. As in the case of the upper St. Paul River (east) monzonite, mantled feldspars are characteristic and show the same patterns of mantling. These two intrusions are so texturally similar that they are almost certainly cogenetic.

Along the western border of the map area, syenite is present, although mantled-feldspar textures are not so well developed as in the monzonite. Relationships between the monzonite and syenite are unknown, but we consider both rock types to belong to a single pluton.

Other rock types mapped within the pluton include fine-grained, foliated syenite and coarse-grained metagabbro containing amphibole crystals up to 2 cm across. In neither case, were relationships to the surrounding monzonite seen, but, as the rocks are recrystallized, they are assumed to be enclaves. The metagabbro may have been derived from the remnants of the layered mafic intrusion immediately to the northeast.

Upper St. Paul River (North) Granite

The boundaries of this pluton are not precisely known because of poor exposure and lack of clear expression on aeromagnetic maps. It is shown as an elliptical 6 by 4 km body having a northeast trend, but it could underlie at least twice the area shown and be circular, or even elliptical in a northwest direction.

The granite is pink- to grey-weathering, seriate-textured and biotite-bearing. Mantled feldspars are present, but the texture is not identical to that in the monzonites to the southwest. In this granite, the feldspars commonly have an anhedral core of K-feldspar and a plagioclase mantle, resulting in grains having an overall subhedral shape. One anomalous rock, a recrystallized monzonite, was mapped within the pluton and is assumed to be an outcrop-scale enclave.

Upper St. Paul River (Northeast) Granite

It is assumed that the boundary of the granite intrusion coincides with the base of a hill that forms a very distinct feature above the surrounding swampland plain in the area. By this reasoning, the pluton is elliptical, measuring roughly 4 by 2 km having an east–southeast-long axis. The granite is biotite-bearing. No enclaves were seen and, apart from two 20-cm-wide pegmatite dykes, no minor intrusions were recorded.

Other Late- to Post-Grenvillian Intrusions

Isolated outcrops of fine- to coarse-grained, unrecrystallized granitoid rocks are scattered throughout the map region. Like their more extensive counterparts, they are pink-weathering, homogeneous and massive. In some instances, where there are surrounding outcrops of contrasting rock types, it is clear that the occurrences cannot represent major bodies, but outcrop control is so poor that it is conceivable that sizable intrusions could exist beneath the surficial deposits.

North and east of Kyfanan Lake, three small granitoid bodies are shown on Figure 2, and represent the largest of many small bodies in the area. The rocks are mostly aplite/microgranite or pegmatite. In several outcrops, the pegmatite and aplite/microgranite are closely associated as irregular patches of one rock type in the other. The pegmatites locally contain biotite books up to 6 cm across, and locally contain garnet and muscovite. One intrusion is graphic-textured and contains garnet and muscovite.

An example of an outcrop that may represent a sizable body is a single exposure of two-feldspar biotite granite in the northwest corner of the area. It has been depicted as a pluton about 3 km in diameter, but it could easily be 3 to 4 times this size.

Unexposed Plutons

The correlation between circular aeromagnetic anomalies and late- to post-Grenvillian plutons is consistent enough to suggest areas where unexposed comparable plutons may be located. The most likely example is in the northwest part of the map area where a distinctive 6-km-diameter anomaly is present, and this has been indicated as a pluton on Figures 2 and 3. Another possibility is on the west side of Kyfanan Lake, where a similar-sized anomaly is present (outlined on Figure 3). We have chosen not to show this as a late- to post-

Grenvillian pluton on Figure 2 because the anomaly is not so well defined and the high values could equally be related to the layered mafic intrusion that is exposed to the north, east and west.

Long Range Dykes

Two outcrops of white- to pale-grey-weathering, medium- to coarse-grained, massive, unrecrystallized gabbro were found, both in the southwest part of the map area. One outcrop is located on a tributary of the St. Paul River and the other forms an isolated hill within the upper St. Paul River (northwest) monzonite (Figure 2). Lack of recrystallization, and presence of subophitic texture and interstitial K-feldspar clearly distinguish these rocks from other mafic intrusions in the area. The gabbro is olivine and pyrite-bearing, the latter mineral locally giving the rock a rusty-brown-weathering appearance. A fine-grained, fresh-looking mafic dyke about 1.5 m wide was also recorded on the shore of St. Paul River. As this dyke has chilled margins and a north–northeast trend, it is considered to belong to the Long Range swarm.

STRUCTURE

A feature that supports the division of the map region into two parts is a change in structural trend from north to northeast in the north, to east to east–northeast in the south. Excluded is a small area in the extreme northeast of the map region, which shows northwest trends more characteristic of the Lake Melville terrane and flanking Mealy Mountains terrane. Also excluded from the above generalization are modifications to the regional trends that result from the emplacement of the late- to posttectonic Grenvillian plutons. Foliations in the country rocks marginal to these plutons, are invariably parallel to the pluton margins. Away from pluton margins, dip directions are variable but generally steep.

Although local shear zones and patches of massive rocks occur sporadically over the whole area, the impression is that intensity of deformation regionally increases toward the south. Major shear zones may also exist, but the exposure is too sparse to detect their presence.

Fault breccia is present at many localities along the southern St. Lewis River. It occurs as a pink, red or purple, aphanitic to fine-grained, hard and brittle rock composed of angular fragments of mainly severely altered granitic rocks in a matrix of similar composition. The various shades of red are due to extensive hematization and the hard, brittle nature results from pervasive silicification. Brittle deformation is assumed to be late Precambrian and linked to rifting preceding the formation of Iapetus Ocean.

METAMORPHISM

Apart from a few equivocal, minor examples of incipient melting there is no indication that conditions were suitable for partial melting and migmatization within the region. The notable exception is in a sillimanite-bearing metasedimentary enclave within the late- to post-Grenvillian pluton in the southwest part of the region.

As the majority of the rocks in the map region are granitoid, it is difficult to gain a well-constrained field estimate of metamorphic conditions. Hornblende–plagioclase assemblages in mafic rocks imply lower to middle amphibolite-facies conditions were attained. Garnet was found sporadically in several rock types, including anorthosite, amphibolite, syenite, pegmatite, and the above mentioned metasedimentary enclave. In anorthosite, it is clearly retrogressed, only 1- to 2-mm-diameter cores remaining in the centre of pseudomorphed garnets that were originally up to 2 cm across. Garnet is similarly partially retrogressed in some amphibolite.

In the layered mafic rocks, there is common evidence of subsolidus mineralogical modification. Most common are amphibole coronas around pyroxene, but coronas mantling pseudomorphed olivine are also present.

The only other major metamorphic effect seen is greenschist-facies alteration associated with brittle fault brecciation, mainly along the southern branch of the St. Lewis River. Hematization, chloritization and silicification are pervasive.

Geochronological data presented by Gower *et al.* (1991) can be used to estimate a cooling rate after emplacement of the late- to post-Grenvillian plutons. The data tabulated by Gower *et al.* (1991) are shown graphically in Figure 4. Apart from one aberrant K–Ar biotite age from the Rivière Bujeault headwaters quartz syenite (interpreted by Gower *et al.* (1991) to indicate excess ^{40}Ar due to the pre-Grenvillian component in the pluton), the ages vary systematically with estimated closure temperatures. From the data, the cooling rate is ca. 11°C/Ma. Although Heaman and Parrish (1991) take 10°C/Ma as common for metamorphic terranes, it is distinctly higher than most cooling rates (ca. 4°C) inferred for the southwest part of the Grenville Province (summarized by Easton, 1992). One explanation for the high cooling rate in the upper St. Lewis River region is rapid passage of the granitoid magmas through the crust, and crystallization in relatively cold rocks, perhaps coupled with tectonically driven uplift.

ECONOMIC POTENTIAL

There are several potential targets for mineralization, although little evidence of its presence. In particular, the highly potassic rocks in the southern half the area must be regarded as extremely fertile for granophile mineralization. The rocks probably have an age of ca. 1500 Ma but may have been partly crustally derived from ca. 1650 Ma rocks. The initial assessment is that they probably formed in an anorogenic tectonic setting, and were not deep-seated intrusions; some rocks may even have been derived from extrusive or hypabyssal protoliths. Such rocks are prime targets to concentrate such elements as Cu–Mo–Au–Ag–Sn–W. Furthermore, the ca. 1500 Ma(?) rocks most likely acted as the source for the 966–956 Ma granite plutons, in which the opportunities for concentrations of these elements would have been further enhanced. The large, late pegmatites that are common north of Kyfanan Lake should be considered

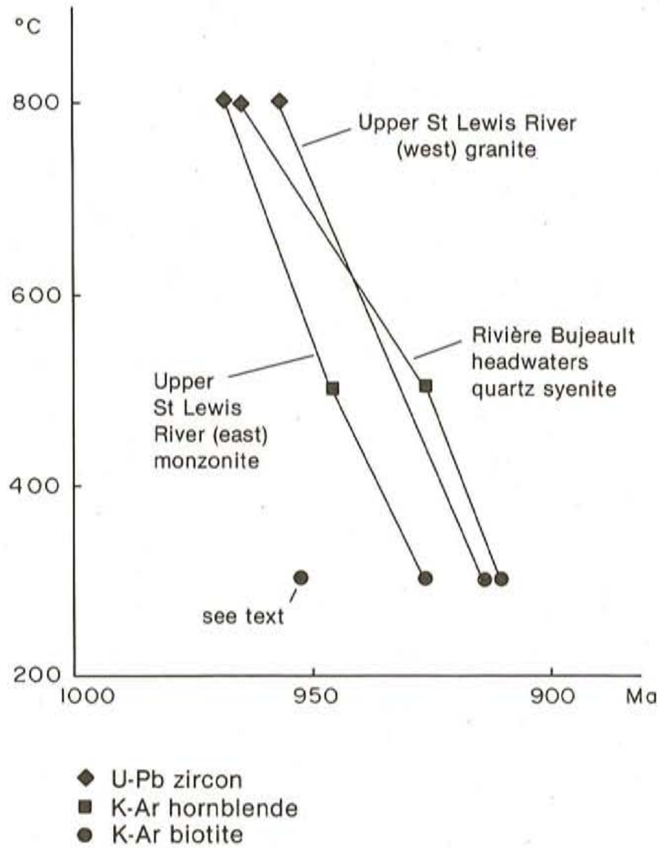

Figure 4. *Post-Grenvillian cooling in late to post-Grenvillian plutons. Closure temperatures assumed are 800°C for zircon, 500°C for hornblende and 300°C for biotite. Geochronological data taken from Gower* et al. *(1991).*

for their potential to host mineralization characteristic of extreme differentiation (U–Mo–Li).

The large layered mafic intrusion crossing the central part of the area must be regarded as highly favourable for PGE, oxide (Fe–Ti) and base-metal sulphide mineralization (Ni–Cu–Cr–V–Co). Particular attention is drawn to high elemental abundances for Ni, Cu and V reported in two lake-sediment samples collected about 7 km northwest of Kyfanan Lake. The lakes coincide with outcrops of ultramafic rock mapped in the area.

REGIONAL CONTEXT FOR MAP REGION

Figure 5 includes the upper St. Lewis River map region as the southwest quadrant of a compilation of NTS 13A. The principle tectonic subdivision of this region is into four terranes. In the upper St. Lewis River map region, the boundary between the Mealy Mountains and Pinware terranes is taken as the Kyfanan Lake layered mafic intrusion, without assigning the intrusion to either terrane. Indeed, one can speculate that its emplacement was controlled by a pre-existing terrane boundary.

Several features merit comment. Especially noteworthy is the presence of large areas of high-grade, mainly pelitic gneiss in the Hawke River, Lake Melville and Mealy Mountains terranes, and the dearth of comparable rocks in the Pinware terrane (including the sillimanite-bearing enclave described above, only three localities of aluminosilicate-bearing metasedimentary gneiss are known in the Pinware terrane). The comparatively large area of metasedimentary gneiss in the Mealy Mountains terrane at the centre of Figure 5 is of interest, in that the structures are west-trending, rather than northwest-trending as is the case for other parts of the map area. The overall outcrop pattern for these metasedimentary gneisses is suggestive of control by the surrounding plutons, rather than subsequent shearing, as is the case in the Lake Melville terrane.

The association of K-feldspar megacrystic granitoid rocks with the metasedimentary gneisses is also clearly evident in Figure 5. Those in the Mealy Mountains terrane seem to belong to a large northwest-trending pluton that also includes diorite, granodiorite and granite. These plutons most likely formed during Labradorian orogenesis, as they closely resemble similar rocks dated in the Lake Melville terrane (cf. Gower *et al.*, 1992).

A large pluton comprising syenite, monzonite and anorthosite (upper Paradise River pluton) occupies much of the Mealy Mountains terrane in Figure 5. Preliminary geochronological data indicates that this was emplaced during the (1500–1470 Ma) Pinwarian event (T. Krogh, unpublished data). It remains unproven that this pluton has intrusive contacts into Labradorian rocks, although regional map patterns suggest this to be the case.

Geochronological evidence for the 1500–1470 Ma Pinwarian event is reported by Tucker and Gower (1990, *in press*), and is based on three ages determined from coastal samples. The bulk of the rocks in the Pinware terrane (unpatterned on Figure 5) are currently assumed to belong to the Pinwarian event. If this is the case, one can then ask, 'What is the justification for assigning the upper Paradise River pluton to the Mealy Mountains terrane?'. The alternative tectonic concept that the upper Paradise River pluton be grouped more closely with the Pinware terrane is acknowledged, but, nevertheless, the current configuration is preferred. The terranes should be treated as Grenvillian features (without denying their origin as separate earlier tectonic entities), and our current hypothesis is to regard the more pervasive deformation evident in the southern half of the upper St. Lewis River map region as Grenvillian (ca. 1000 Ma).

Figure 5 also shows the extension of the Kyfanan Lake layered mafic intrusion eastward, to include mafic rocks mapped by Gower *et al.* (1988b,c). It is interesting to speculate that the intrusion may have originally extended even farther, to include mafic rocks to the east, but north of the Pinware–Mealy Mountains terrane boundary. Genetic linkage would then imply a 20-km dextral displacement along the northwest-trending segment of the Pinware–Mealy Mountains terrane boundary.

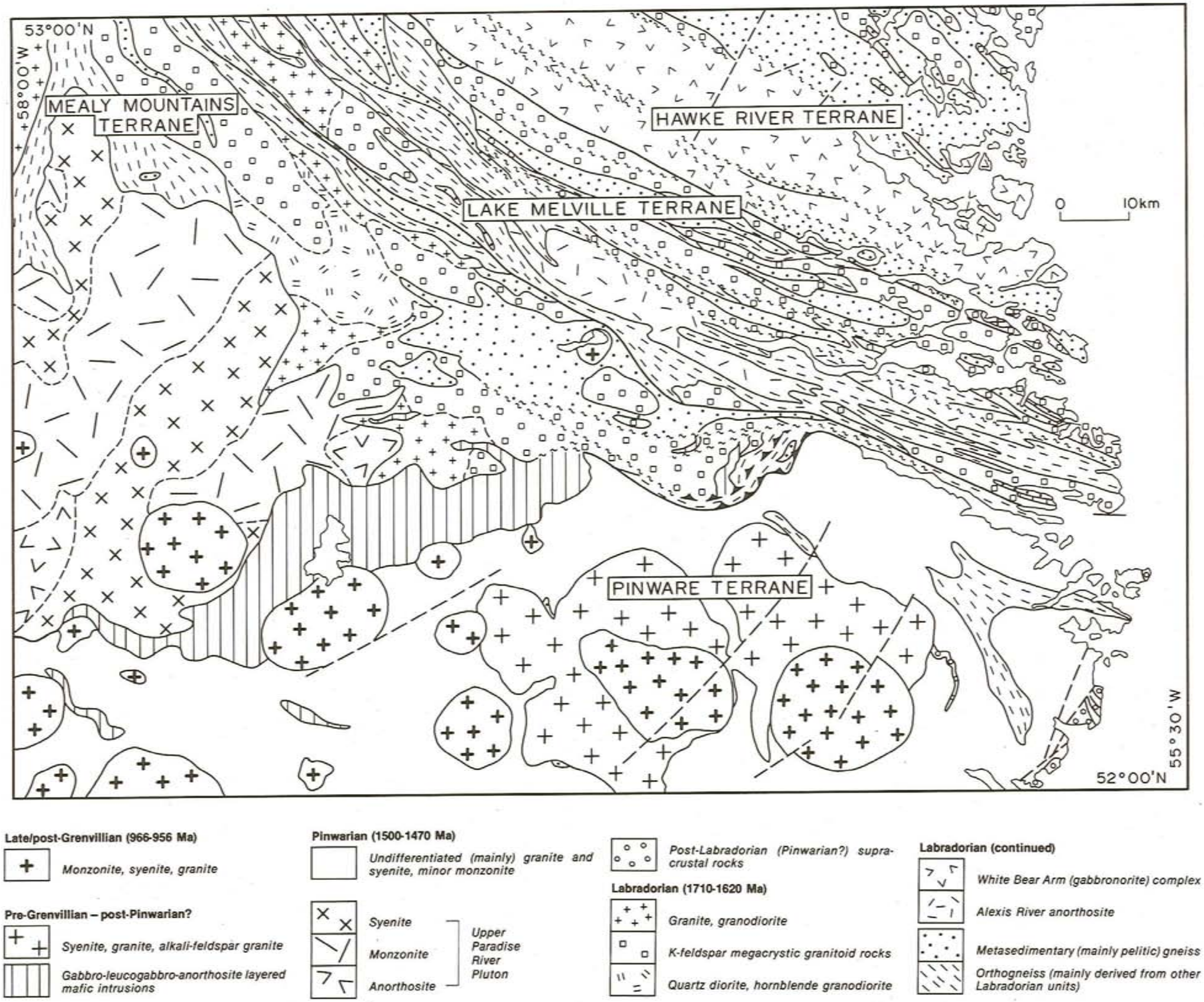

Figure 5. *Regional geological map of part of the Grenville Province in southeast Labrador (NTS map 13A).*

The presence of late- to post-Grenvillian (966 to 956 Ma) plutons in the upper St. Lewis River map region extends the mapped distribution of these rocks. Plutons of this age are unknown in other parts of the Grenville Province, but coeval counterparts exist in Grenvillian inliers in the Appalachians (e.g., Vermont; Karabinos and Aleinikoff, 1990). Interpretation of the plutons as post-collisional granites is compatible with widespread evidence for thrusting in the Exterior Thrust Belt that ceased between 995 and 970 Ma.

ACKNOWLEDGMENTS

Thanks are due to enthusiastic and capable field assistants Dean Fraser and Craig Scott. Gratitude is expressed to Canadian Helicopters, through its pilots Gary Brasil and his relief Sean Tucker who provided excellent service during the season. The residents of Port Hope Simpson, especially our host Reg Russell, are thanked for their hospitality during our stay. Logistical support was expedited from Goose Bay by Wayne Tuttle and Richard White. The manuscript was reviewed and improved by Don James and Ges Nunn.

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Note added in proof

During petrographic investigations, the syenite—alkali-feldspar syenite unit in the southern half of the map area, has been discovered to contain nepheline locally. This is the first report of nepheline in the southern part of the eastern Grenville Province. The presence of undersaturated alkaline rocks in the Pinware terrane serves to emphasize the distinctive lithological character of this region with respect to the Labradorian terranes farther north.