Current Research (1999) Newfoundland Department of Mines and Energy
Geological Survey, Report 99-1, pages 59-70

GEOLOGY OF THE GRENVILLE PROVINCE, KENAMU RIVER AREA (NTS 13C/NE), SOUTHERN LABRADOR: PRELIMINARY OBSERVATIONS OF LABRADORIAN AND PRE-LABRADORIAN(?) INTRUSIONS

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ABSTRACT

Two suites of intrusions, both dominated by monzonite and containing lesser amounts of quartz monzonite, gabbro, gabbronorite and granite, make up the Grenville Province in the Kenamu River area of southern Labrador. The most northern of the two suites is not metamorphosed or penetratively deformed, and is considered to be the western part of the Labradorian-aged Mealy Mountains Intrusive Suite. In significant contrast, the southern suite of intrusions includes variably recrystallized and deformed rocks that are presumed to predate emplacement of the Mealy Mountains Intrusive Suite, and may be pre-Labradorian (i.e., >1720 Ma).

The western Mealy Mountains Intrusive Suite is dominated by monzonite containing clinopyroxene ± orthopyroxene and magnetite. The monzonite, and related quartz monzonite and granite, are interpreted to be intruded by bodies of gabbro and gabbronorite that are locally layered. Anorthosite, which is a volumetrically important component of the Mealy Mountains Intrusive Suite in regions to the east, does not occur in the Kenamu River area. Some mafic intrusions and layered monzonite, which contain high concentrations of oxides may potentially host Ni–Cu sulphide and Ti (Fe) oxide deposits, respectively.

The Paleoproterozoic igneous rocks are deformed by a set of southwest-striking normal faults of Neoproterozoic age. These faults produced half-graben structures, which controlled deposition of sandstone and arkose of the Neoproterozoic Double Mer Formation.

INTRODUCTION

The geology of the Grenville Province in southern Labrador, including large parts of NTS map areas 13B, 13C and 13D (*see* Figures 1 to 3), is known mainly from 1:250000- or smaller scale reconnaissance mapping completed by the Geological Survey of Canada more than 30 years ago (cf., Stevenson, 1967). As part of a continuing and systematic program by the Geological Survey of Newfoundland and Labrador to upgrade the geological database for this region, the northeastern quadrant of NTS map area 13C, including map areas 13C/9, C/10, C/15 and C/16, were mapped at a scale of 1:100 000 in an eight-week field season in 1998. Mapping was mainly accomplished using ground traverses; survey crews were positioned by helicopter from a base camp at Brennan Lake, located 42 km south of Goose Bay. Some of the mapping was completed by making helicopter landings on isolated outcrops. The work in map area NTS 13C/NE was carried out simultaneously and in collaboration with 1:100 000-scale mapping in map area NTS 13B/NW by Gower (*this volume*, and *see* Gower, 1998). Preliminary findings of this project were reported by James and Lawlor (1998).

Bedrock in the study area is, in general, very poorly exposed, with the exception of the northwestern part of the study area (NTS map area 13C/15), and on hills south and west of the Kenamu River (southern part of NTS map area 13C/16). The area is thickly forested and is covered by extensive areas of bog making ground traversing arduous. The lakes and rivers in the area are shallow, rocky, and are generally lacking in shore-line outcrops.

Definitive contact relations between units were not observed. To some extent, the locations of contacts and faults shown on the map (Figure 4) were interpreted using regional magnetic data (Figure 5).

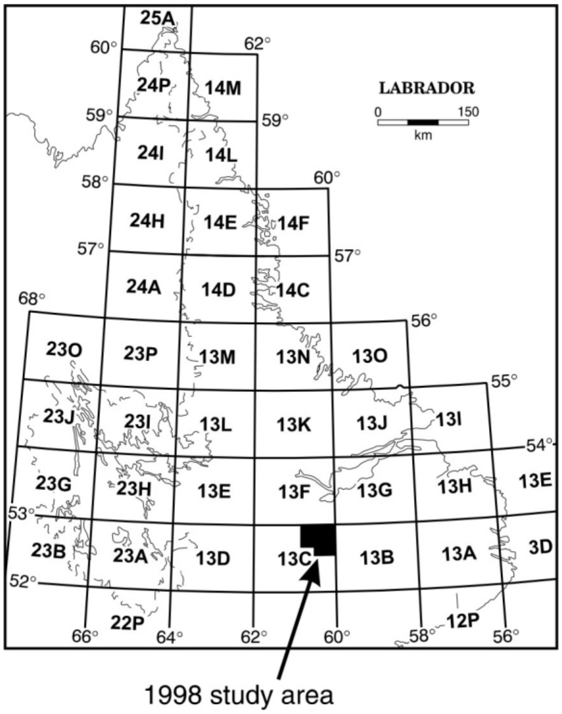

Figure 1. *NTS index map of Labrador showing location of the 1998 study area.*

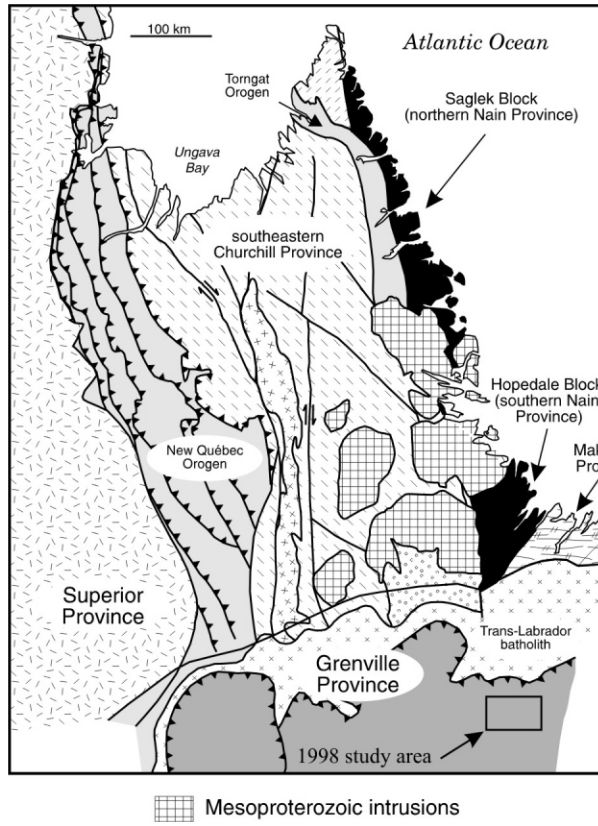

Figure 2. *Generalized geological map of Labrador and adjacent areas in Québec showing principal tectonic subdivisions and location of the 1998 study area.*

REGIONAL SETTING

The study area is situated in the Mealy Mountains terrane (MMT) of the northeastern Grenville Province (Figure 3; and *see* Gower and Owen, 1984). The MMT consists primarily of Labradorian-age crust of the Mealy Mountains Intrusive Suite (MMIS; *see* Emslie, 1976; Emslie and Hunt, 1990; Krogh *et al.*, 1996), minor amounts of Paleoproterozoic pre-Labradorian crust, and Pinwarian (1510 to 1450 Ma) and Grenvillian (ca. 980 to 950 Ma) intrusions. The MMT is one of several thrust-stacked terranes that make up the Grenville Province in Labrador.

The MMIS consists mainly of an older group of anorthositic, leucogabbroic and leucotroctolitic rocks, and a younger group of pyroxene-bearing monzonite and quartz monzonite. A pyroxene monzonite and pyroxene granite, inferred to be from the younger group of rocks, have emplacement ages of 1646 ± 2 Ma and 1635 +22/-8 Ma (Emslie and Hunt, 1990), respectively. The MMIS is not an anorogenic AMGC suite because emplacement ages are approximately coeval with regional high-grade Labradorian metamorphism and attendant deformation, and the intrusion of the Trans-Labrador Batholith. The latter has been interpreted as a subduction-related continental magmatic arc (Kerr, 1989). On the basis of age and tectonic setting, the MMIS is correlated with other mid- to late-Labradorian mafic intrusive suites in northeastern Laurentia (e.g., with the Ossok Mountain intrusive suite in western Labrador; *see* James, 1994).

The southern part of the study area (Figure 4) is underlain by a variety of metamorphosed, recrystallized, foliated and gneissic rock types, including monzonite, granite, monzodiorite, diorite, gabbro and gabbronorite (Units 1 to 3). In contrast, the northern two-thirds of the study area is underlain by units of monzonite, gabbro, gabbronorite, and lesser amounts of quartz monzonite, and granite (Units 4 and 5). The latter units are inferred to correlate with the younger group of MMIS rocks. This conclusion is based entirely on correlation of rock types; there are no geochronological data from rocks in the study area. MMIS rocks in the study area are remarkably consistent in texture and composition over large areas. Of note, the MMIS in the study area lacks anorthosite, leuconorite or leucotroctolite, but these form a significant component of the MMIS in regions to the east (i.e., in NTS map area 13B/NW; *see* Gower, *this volume*).

On the basis of the textural and structural differences, rocks in the southern part of the study area (Units 1 to 3) are inferred to be older than MMIS rocks. Consistent with this hypothesis is the presence of an inclusion of foliated monzogranite, inferred to be a Unit 1 rock, contained in massive monzonite (Unit 4) typical of the MMIS. To test this interpretation U-Pb geochronological studies are in progress.

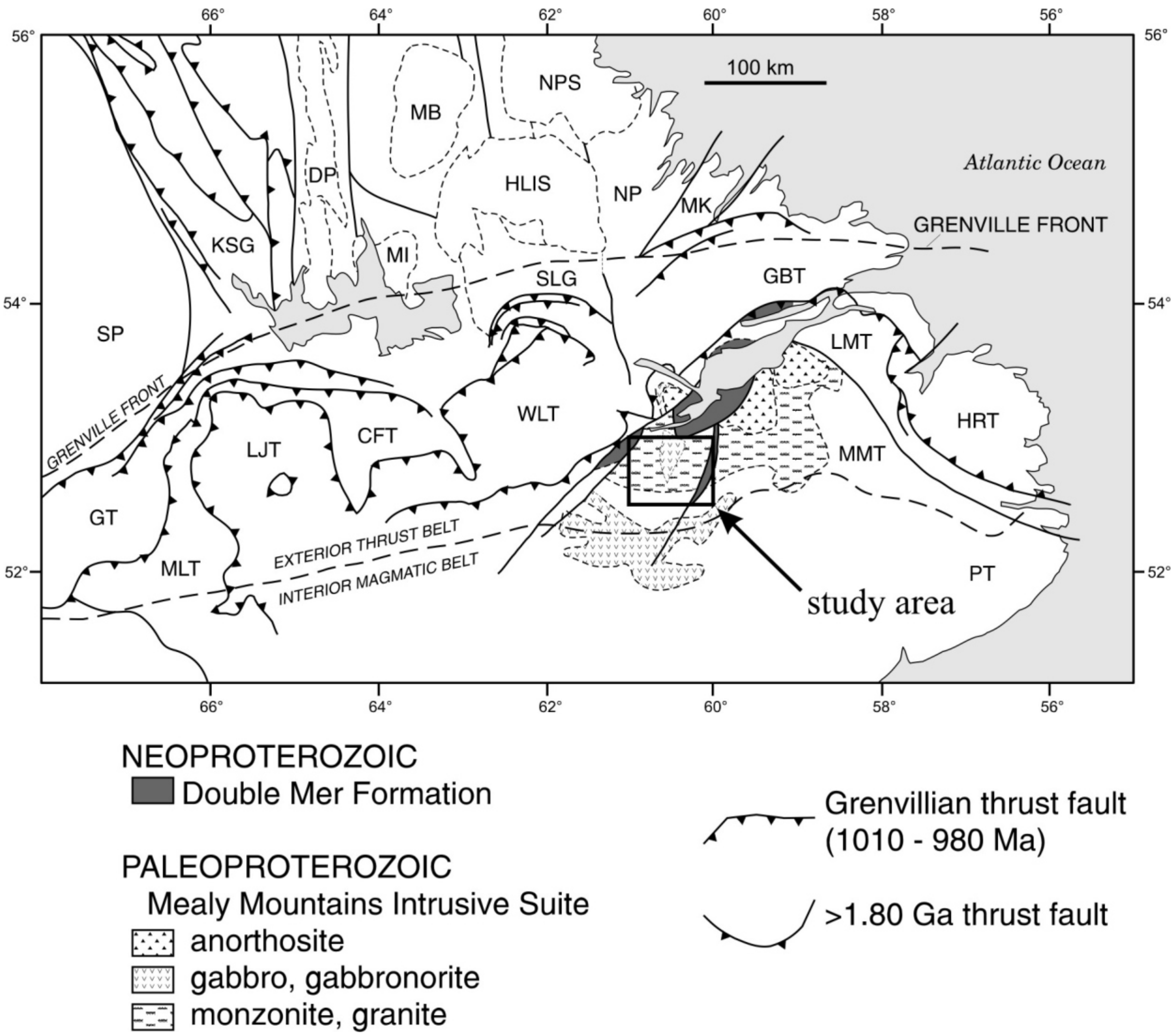

Figure 3. *Tectonic and major lithotectonic units of southern Labrador. Grenville Province: MMT - Mealy Mountains terrane, PT - Pinware Terrane, HRT - Hawke River terrane, LMT - Lake Melville terrane, GBT - Groswater Bay terrane, WLT - Wilson Lake terrane, CFT - Churchill Falls terrane, LJT - Lac Joseph terrane, MLT - Molson Lake terrane, GT - Gagnon terrane. Archean divisions: SP - Superior Province, NP - Nain Province (Hopedale Block). Archean and Paleoproterozoic divisions: MP -Makkovik Province, KSG - Kaniapiskau Supergroup (2.25n1.86 Ga), DP - De Pas batholith. Mesoproterozoic units: MI -Michikamau Intrusion, HLIS - Harp Lake Intrusive Suite, MB - Mistastin batholith, NPS - Nain Plutonic Suite, SLG -Seal Lake Group. Generalized geology of the Mealy Mountains Intrusive Suite modified after Wardle* et al. *(1997).*

Units 1 to 3 may represent early intrusions of the MMIS (ca. 1720 to 1650 Ma ?) that are synchronous with, or predate, regional metamorphism and attendant deformation, or they may be Paleoproterozoic rocks that significantly predate intrusion of the MMIS (i.e., >1720 Ma).

In the Kenamu River valley, the Paleoproterozoic igneous rocks are unconformably overlain by conglomerate, arkose and sandstone of the Neoproterozoic Double Mer Formation (Unit 6).

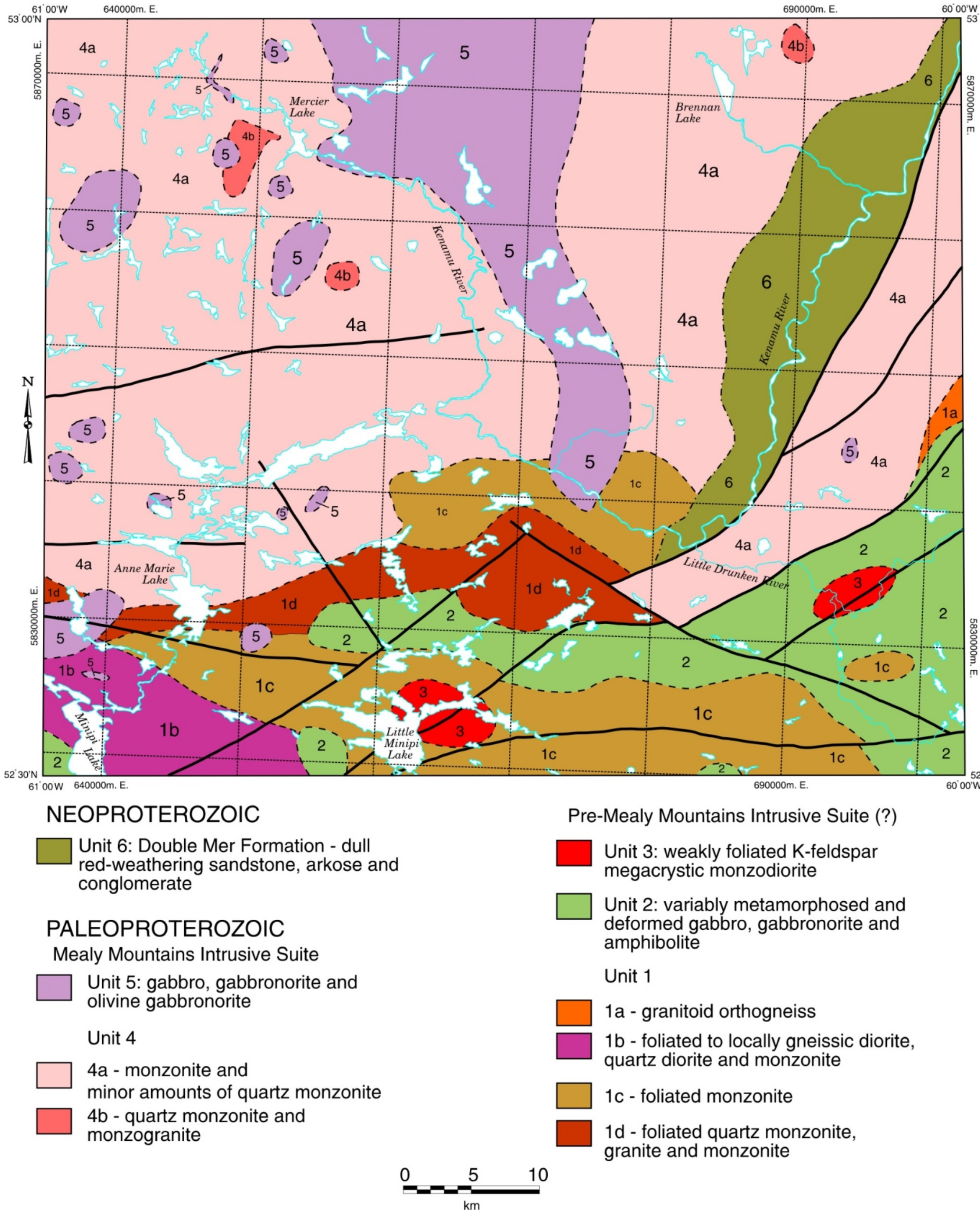

Figure 4. *Geological map of the Kenamu River study area.*

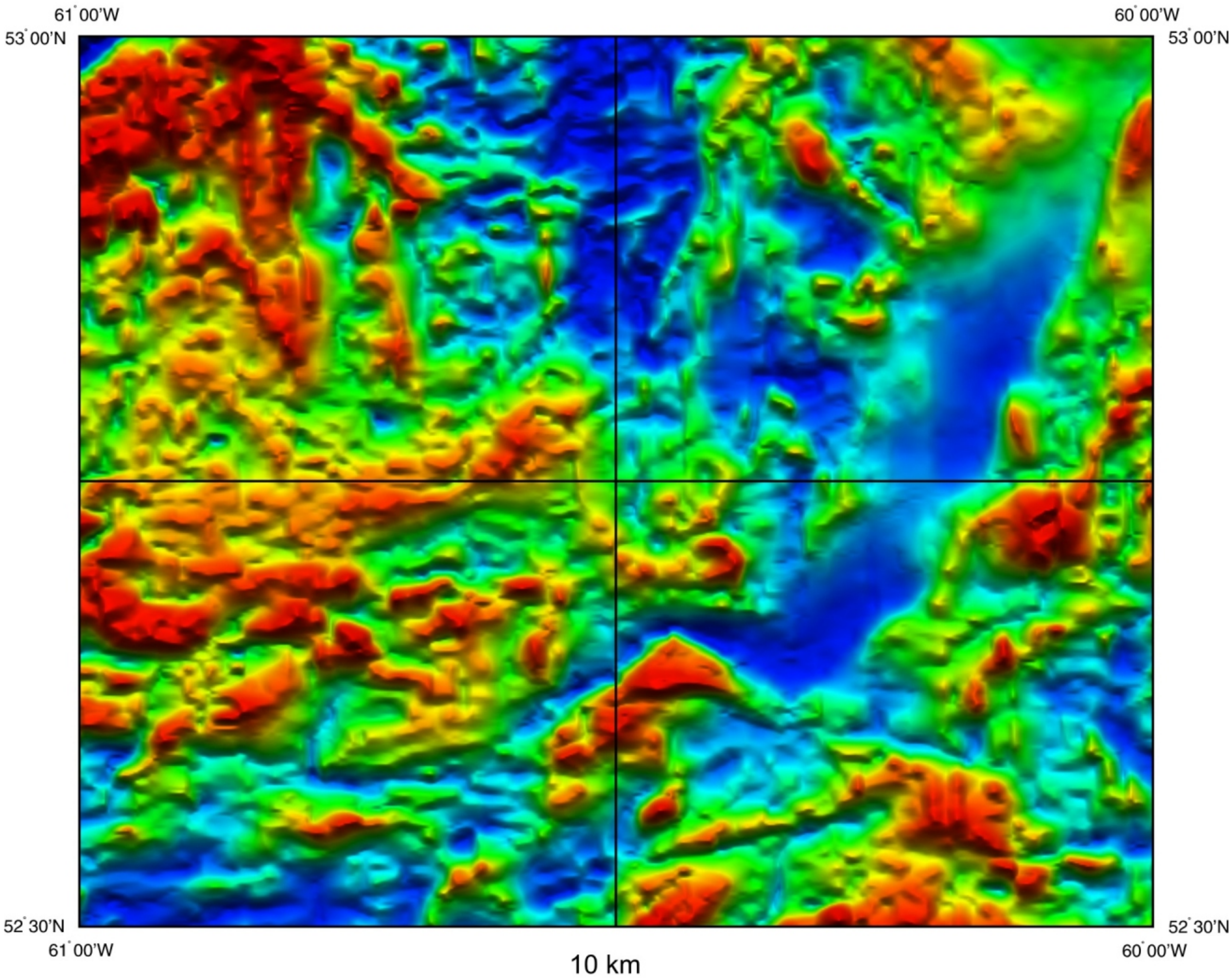

Figure 5. *Shaded-relief magnetic anomaly map of the Kenamu River area (NTS map area 13C/NE). False illumination: azimuth - 315°, inclination - 45°. Red end of the spectrum - magnetic highs; blue end of the spectrum - magnetic lows. (Map prepared courtesy of G. Kilfoil, Geochemistry, Geophysics and Terrain Sciences Section, Geological Survey of Newfoundland and Labrador).*

DESCRIPTION OF ROCK UNITS

PALEOPROTEROZOIC INTRUSIONS OF UNCERTAIN AFFINITY (PRE-MEALY MOUNTAINS INTRUSIVE SUITE ?)

Unit 1

Unit 1 (Figure 4) is a heterogeneous division that has been provisionally subdivided into four subunits, although age relations between, and within, these subdivisions are unknown. Rocks having similar compositional variations, textures and structures can be found within more than one of these subunits; thus the contacts between the subunits are open to re-interpretation. The unit is also poorly exposed, which adds to the uncertainty in the location of internal contacts. There are no field relations that constrain relative age relations between Units 1, 2 and 3. However, the contact between Unit 1 rocks and presumed younger rocks of the MMIS (Units 4 and 5), which broadly subdivides the study area into two parts, is relatively well defined and is inferred to be of regional importance.

Subunit 1a: Granitoid Orthogneiss

There are very few occurrences of granitoid orthogneiss in the study area, which are apparently restricted, in occurrence, to the eastern margin of the map area. Subunit 1a rocks are light pink to grey on the fresh and weathered surfaces. They are fine grained and granoblastic, having a gneissosity defined by layers of leucogranite alternating with a more melanocratic granite containing <10 percent fine-grained biotite.

Subunit 1b: Quartz Diorite, Diorite, Monzodiorite, Monzonite and Gneissic Equivalents

Subunit 1b occurs in the southwestern part of the study area. It consists of foliated quartz diorite, diorite, monzodiorite, minor amounts of monzonite, and their lesser gneissic equivalents (Plate 1). By definition, all rocks in subunit 1b are foliated, although most are not gneissic. These rocks are white, grey and black on weathered surfaces, and white, grey, black and locally pink on fresh surfaces. They are medium- to fine-grained rocks and have granoblastic textures; locally they contain a few percent relict K-feldspar phenocrysts. They contain variable amounts of clinopyroxene (up to 15 percent), hornblende and biotite. Gneissosity is variably developed and is defined by alternating layers, up to 10 cm thick, of leucocratic and melanocratic rocks. In some outcrops, the darker layers may represent thin mafic dykes, which were emplaced prior to metamorphism and deformation.

Plate 1. *Foliated and weakly gneissic monzodiorite (subunit 1b) containing deformed and metamorphosed mafic dyke (grey layer in the centre of the photograph). Photograph DJ-98-1176.*

Subunit 1c: Foliated Monzonite and Quartz Monzonite

Subunit 1c consists of pink and grey monzonite and quartz monzonite. The rocks are variably foliated and recrystallized, and textures range from granoblastic to phaneritic. They are fine to medium grained, commonly have medium- to coarse-grained relict K-feldspar phenocrysts, and contain clinopyroxene, magnetite, and local, minor amounts of biotite. Typically, outcrops have a homogeneous texture and composition, and do not contain inclusions or dykes. Relict igneous layering, defined by thin (<1 cm) mafic layers, is rare.

The subunit locally includes light-pink-weathering, extensively recrystallized, and very fine-grained quartz monzonite that has an indistinct, thin (<0.5 cm) layering defined by magnetite and clinopyroxene (Plate 2). The layering may be an entirely metamorphic feature, or it may be a modified relict of igneous layering.

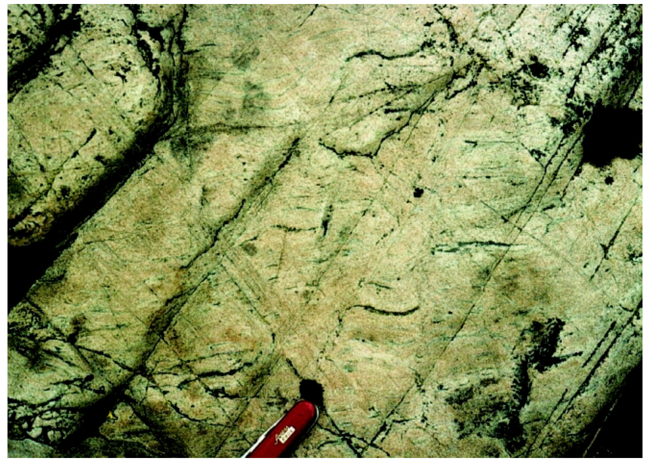

Plate 2. *Diffuse layering, defined by thin pyroxene and magnetite layers, contained in extensively recrystallized monzonite (subunit 1c). The origin of the layering is uncertain. It could be entirely metamorphic or modified igneous layering. Photograph DJ-98-1165.*

Subunit 1d: Foliated Granite, Quartz Monzonite and Monzonite

Subunit 1d is a heterogeneous division consisting mainly of monzogranite, syenogranite, quartz monzonite and lesser amounts of monzonite. Subunit 1d monzonite, which is identical to the monzonite in subunit 1c, is included with subunit 1d because of its field association with the granitic rocks and the quartz monzonite.

The granitic rocks and quartz monzonite are pink to grey on the weathered surfaces and pink on fresh surfaces. Rocks are medium to fine grained, variably foliated and recrystallized, and the textures range from granoblastic to phaneritic. Medium- to coarse-grained K-feldspar phenocryst relicts occur locally. Granitic rocks contain minor amounts of biotite; the quartz monzonite contains clinopyroxene, magnetite and local biotite. Foliation, which is locally well developed, is defined by quartz plates.

Xenoliths in subunit 1d granitic rocks are uncommon, although one outcrop of syenogranite contains abundant, long (>30 m) and thin (1 to 2 m) inclusions of foliated metagabbro. The inclusions are aligned parallel to the foliation in the host syenogranite.

Unit 2: Metamorphosed Gabbro and Gabbronorite

Unit 2 consists of metamorphosed gabbro, gabbronorite and lesser leucogabbronorite. It also includes a very minor amount of amphibolite, which is presumed to be derived from mafic intrusive rocks. The rocks are black, dark green, grey and white on fresh and weathered surfaces. In general, rocks are medium grained and have granoblastic, metamorphic textures. They are variably foliated, but locally appear undeformed. They consist of variable amounts of plagioclase, clinopyroxene, hornblende, and local, minor amounts of orthopyroxene. Biotite is a common accessory mineral and some rocks contain a minor amount (<10 percent) of K-feldspar. Trace amounts of disseminated pyrite occur locally.

Unit 3: Monzodiorite

The southern part of the study area includes two bodies of K-feldspar megacrystic monzodiorite. There are very few outcrops of this unit and the contacts, which define the intrusions, are very poorly constrained; the easternmost body is defined by only one outcrop.

The monzodiorite is white to grey to locally pink on the weathered surface, and grey and pink on the fresh surface. It contains 10 to 15 percent, medium- to coarse-grained (to 1.5 cm) subhedral K-feldspar phenocrysts in a finer grained groundmass consisting of plagioclase, quartz, and minor amounts of clinopyroxene, biotite and magnetite. All rocks are variably recrystallized and weakly foliated; the foliation defined by biotite, and locally, by alignment of the K-feldspar phenocrysts. Preferred orientation of the phenocrysts may be a relict of primary igneous lamination. Locally, outcrops of Unit 3 rocks contain abundant, thin (<10 cm) and undeformed granitic veins, and gabbro xenoliths.

MEALY MOUNTAINS INTRUSIVE SUITE (MMIS)

Unit 4

The northern two-thirds of the study area is underlain mainly by undeformed monzonite, quartz monzonite and minor amounts of granite, collectively defined as Unit 4, which form part of a >3500 km^2 monzonite-dominated zone comprising the western part of the MMIS. In the study area, Unit 4 has been subdivided into two subunits on the basis of composition. Subunit 4a consists of monzonite and very minor amounts of quartz monzonite and granite. Subunit 4b consists of quartz monzonite and granite. Contact relations between the subunits are poorly constrained, and it is unclear if the different rock types that make up Unit 4 represent minor and somewhat local variations in quartz content, or if they represent distinct and separate intrusive phases. It is possible, if not probable, that the extensive areas underlain by Unit 4 rocks in the study area include several coalesced intrusions, although individual intrusions are not possible to identify on the basis of the present mapping or interpretation of regional magnetic anomaly patterns.

Unit 4 is compositionally analogous to subunit 1c, but Unit 4 rocks are not penetratively deformed and mainly have phaneritic textures. In significant contrast, subunit 1c rocks are variably foliated and recrystallized. Subunit 1c does include some undeformed rocks that have fresh igneous textures, although the close field association of these undeformed rocks with their foliated equivalents, and the fact that they occur in an area with significant compositional variations, relative to Unit 4, indicate that they should probably be mapped as subunit 1c and not Unit 4.

Subunit 4a: Monzonite

Subunit 4a is dominated by monzonite, which has a remarkably monotonous composition over very large areas, but it also includes very minor amounts of quartz monzonite and granite. The rocks are light-pink- to grey-weathering, and pink on fresh surfaces. They are texturally varied and can be uniformly fine to coarse grained (to 1.5 cm, Plate 3), or K-feldspar porphyritic; they can have subhedral granular to recrystallized or "granular" textures. The textural variations occur regionally; individual outcrops are texturally consistent. Locally, the rocks have an igneous layering, defined primarily by thin (<1 cm) concentrations of magnetite. Some of the rocks have an igneous lamination defined by alignment of K-feldspar phenocrysts. The rocks contain up to 15 percent (combined), fine- to medium-grained clinopyroxene, orthopyroxene, and magnetite. Orthopyroxene is not present in all rocks but magnetite is ubiquitous. The latter mineral probably accounts for defining a very prominent regional magnetic high (*see* Figure 5).

Plate 3. *Typical field aspects of isotropic, medium- to coarse-grained monzonite (subunit 4a). The rock contains clinopyroxene, orthopyroxene, and several percent magnetite. Photograph DJ-98- 1106.*

Outcrops of subunit 4a rocks rarely contain xenoliths. One notable exception is an outcrop in the southwestern part of the study area (UTM 658610E, 5837048N; and *see* Plate 4), located approximately 1 km north of the contact between subunit 4a rocks and subunit 1d rocks. The host rock is a massive, K-feldspar porphyritic monzonite; it contains abundant xenoliths of fine-grained, recrystallized and weakly foliated monzogranite correlated, on the basis of composition and texture, with subunits 1c or 1d.

Plate 4. *Inclusion of weakly foliated monzogranite, correlated with Unit 1 (subunit 1c or 1d), contained in massive, coarse-grained monzonite of subunit 4a. This outcrop is discussed in the text. Photograph DJ-98-1223.*

Subunit 4b: Quartz Monzonite and Monzogranite

At the current level of mapping, three bodies of subunit 4b quartz monzonite and monzogranite have been defined. The rocks are light pink on the fresh and weathered surfaces. They contain the same textural variations as observed in subunit 4a rocks. Individual outcrops have a consistent texture and composition.

Unit 5: Gabbro and Gabbronorite

In the study area, the MMIS includes bodies of gabbro and gabbronorite defined as Unit 5. These are inferred to intrude Unit 4 and Unit 1 rocks, although definitive contact relations have not been observed. There are rare occurrences of mafic dykes, which are observed to cut Unit 4 rocks, but correlation of the dykes with gabbro and gabbronorite of Unit 5 is uncertain.

As with all rock units mapped, the contacts defining Unit 5 bodies are poorly constrained. Of particular note, the 35-km-long, north–south-trending body of Unit 5 rocks in the central part of the study area is very poorly exposed; the area is covered by an extensive network of string bogs. Contacts around this body are largely inferred from the magnetic anomaly pattern. In general, Unit 5 rocks are less magnetic than Unit 4 rocks. Unit 5 gabbro and gabbronorite have primary igneous textures and are undeformed whereas Unit 2 rocks are metamorphosed and commonly have a tectonic fabric.

Unit 5 includes a range of compositions. It consists mainly of gabbro and gabbronorite, but also includes minor amounts of leucogabbro, leucogabbronorite, and olivine-bearing rocks. Typically, rocks are medium grained and have subhedral granular textures and the plagioclase grains are mainly equant, as opposed to having lath forms. The rocks are variably recrystallized but they do not contain tectonic fabrics; igneous layering, defined by alternating plagioclase-rich and pyroxene-rich layers occurs locally (Plate 5). One of the most spectacular occurrences of layered olivine gabbronorite occurs northwest of Anne Marie Lake (at UTM 638135E, 5844457N).

Plate 5. *Relict igneous layering defined by concentration of pyroxene and magnetite (black layers) in Unit 5 gabbronorite. Photograph DJ-98-1167.*

MESOPROTEROZOIC AND NEOPROTEROZOIC

Mafic Dykes

Minor occurrences of unmetamorphosed and undeformed mafic dykes are not shown on Figure 4. Northeast- to east–northeast-striking dykes, having an ophitic texture and containing fine- to medium-grained bladed and fork-shaped plagioclase grains, are inferred to be part of the ca. 1250 Ma Mealy dyke swarm (*see* Hamilton and Emslie, 1997). North–northeast-striking dykes may be equivalent to the ca. 615 Ma Long Range Dykes (*see* Kamo *et al.*, 1989). Correlations are based entirely on orientation.

NEOPROTEROZOIC

Unit 6: Double Mer Formation

Paleoproterozoic to Neoproterozoic igneous rocks (Units 1 to 5, and the mafic dykes) are unconformably overlain by the Neoproterozoic Double Mer Formation (*see* Kindle, 1924; Gower *et al.*, 1986). The Double Mer Formation was not a focus of the mapping and only a few exposures were given a cursory examination. Along the Kenamu River, in NTS map area 13C/16, the formation consists of flat-lying to gently east-dipping beds of mauve- to brown- to dull red-weathering arkose, sandstone, and pebbly sandstone. Quartz, K-feldspar and lithic (monzonite) clasts are angular to rounded; some of the pebble-size clasts are coarse-grained K-feldspar derived from individual megacrysts. The clast population indicates detritus is primarily derived from proximal Unit 4 monzonite.

METAMORPHISM AND STRUCTURE

Units 1 and 2 are variably recrystallized, locally gneissic and commonly foliated. However, some rocks, especially in subunits 1c and 1d, have retained their phaneritic textures and do not have tectonic fabrics. Gneissosity is defined by quartzofeldspathic or feldspathic layers alternating with mafic-rich layers or thin, discontinuous mafic lenses. Rocks contain the metamorphic assemblage plagioclase–clinopyroxene–hornblende; they commonly contain biotite, and orthopyroxene occurs locally. The metamorphic minerals suggest recrystallization occurred at upper-amphibolite to granulite-facies conditions.

Unit 3 rocks are partially recrystallized and weakly foliated. The subtle differences in intensity of recrystallization and foliation between Unit 3 rocks and rocks in Units 1 and 2, suggest emplacement of Unit 3 monzodiorite may have been late syntectonic with respect to the tectonothermal event that overprinted Units 1 and 2. This tectonothermal event is presumed to predate intrusion of Units 4 and 5 (i.e., pre-1650 Ma?) because these units lack tectonic fabrics. However, the possibility exists that rocks in the southern part of the study area have also been overprinted by Pinwarian (1510 to 1450 Ma) and/or Grenvillian (1000 to 960 Ma) metamorphism. U–Pb geochronological studies may help to resolve this problem.

Rocks in Units 1 to 3 are not highly strained, and although there are local strain variations across several metres in some outcrops, there are no occurrences of rocks having an intense foliation. In the Minipi and Anne Marie lakes area, planar tectonic fabrics are mainly northwest striking (Figure 6), roughly parallel to the contact between Units 1 and 2 and the internal contacts in Unit 1. East of the area containing the northwest-striking fabrics, planar tectonic fabrics in Units 1 to 3 are mainly east–northeast striking.

The study area is dissected by regionally persistent southwest-, west- and northwest-striking Neoproterozoic faults. The faults are not exposed; they are recognized mainly by lineaments in the magnetic pattern and by topographic lineaments. An outcrop of subunit 1c monzonite occurring along the Kenamu River (UTM 676658E, 5839131N) contains thin (<1 m wide) breccia zones (orientation: 230°/69° NW) consisting of angular monzonite fragments (to 10 cm) and extremely fine-grained matrix. The brecciation in this outcrop may be related to the southwest-striking faults. The southwest-striking faults are presumed to be normal faults, which define half-graben structures, and which controlled deposition of the Double Mer Formation (Gower *et al.*, 1986). The Neoproterozoic faulting is inferred to be related to the opening of Iapetus.

EXPLORATION POTENTIAL

The mafic intrusive rocks (Units 2 and 5) have some potential for hosting Ni–Cu–Co sulphide deposits. Gossanous rocks were not observed, although some outcrops contain trace amounts of pyrite. Layered monzonite (subunit 4a), containing anomalous (up to 10 percent) oxide concentrations (mainly magnetite?), may have some potential for Ti (Fe) oxide deposits. The study area is lacking in significant lake-sediment geochemical anomalies of economic metals.

DISCUSSION: AGE AND SIGNIFICANCE OF THE INTRUSIVE ROCKS

It is premature to speculate extensively on the possible ages of the two suites of compositionally similar intrusions in the Kenamu River area in light of the fact that reconnaissance-level U–Pb geochronological studies to determine emplacement ages of some of the major units is in progress. However, three possible scenarios and their implications are worthy of some discussion. These are: 1) that Units 1 to 3 are pre-Labradorian (>1720 Ma) and significantly older than

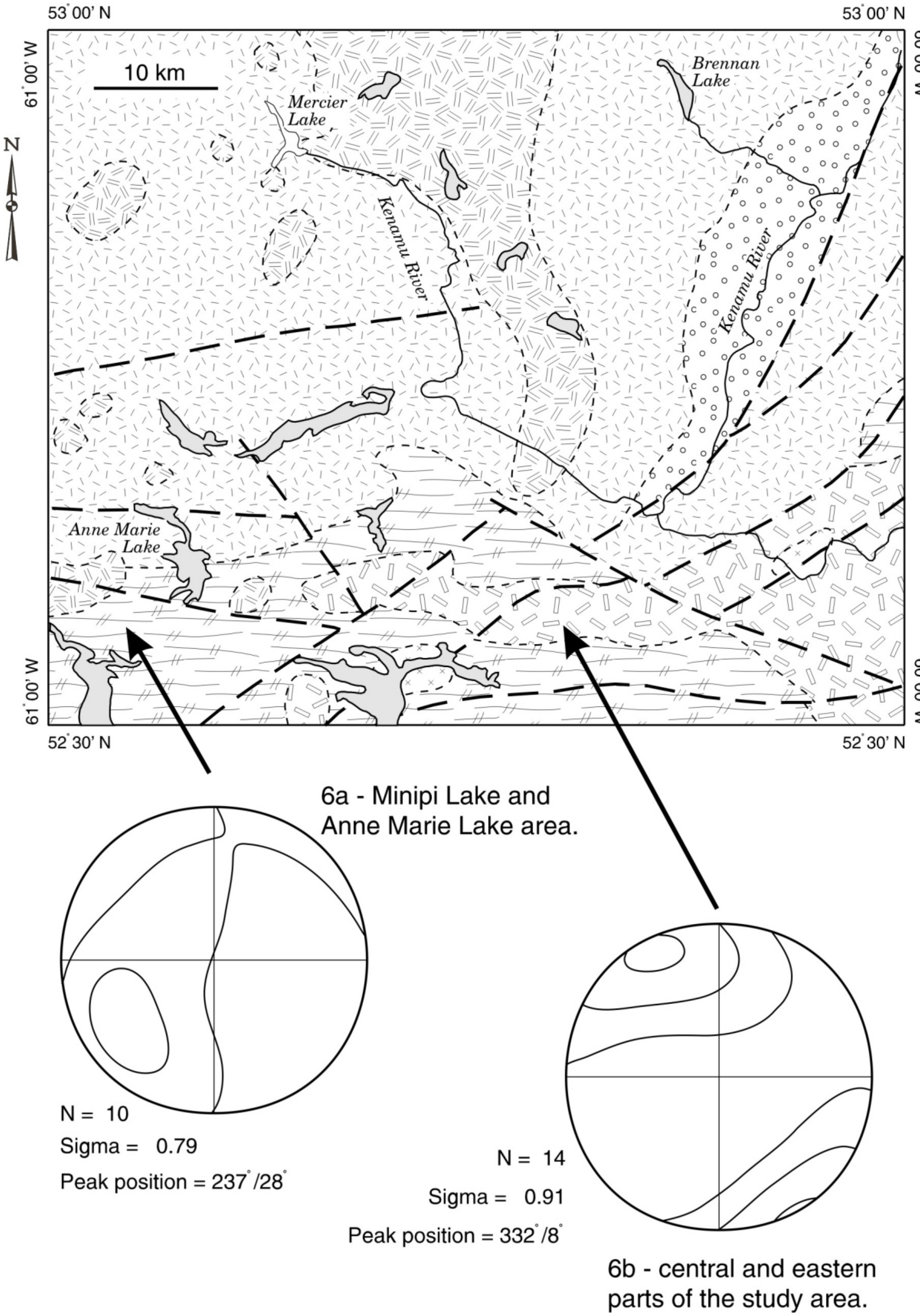

Figure 6. *Generalized geological map and lower hemisphere equal-area projections of poles to foliation and gneissosity for Units 1 to 3 in the Minipi and Anne Marie lakes area (6a), and in areas to the east (6b).* See *Figure 4 for rock units. (Units 1 and 4 are not subdivided on this map.)*

the MMIS rocks (Units 4 and 5), 2) that Units 1 to 3 are early Labradorian (1720 to 1660 Ma) and only slightly predate emplacement of the MMIS rocks, and 3) that Units 1 to 3 are the same age as, and part of, the MMIS. Geochronological data confirming either scenario 1 or 2 would provide an example of plutonic episodes that are separated in time but which share significant compositional, genetic (?) and spatial similarities. One example of this type includes the repetitive "anorogenic-type" basic and silicic magmatism in the Nain area of Labrador (*see* Ryan and Connelly, 1996; Hamilton *et al.*, 1997; Ryan *et al.*, 1998), which occurred several times between 2124 to 1860 Ma and 1350 to 1318 Ma. A second example of this type comes from the Grenville Province in Québec, and includes episodic AMGC suite plutonism at ca. 1153 Ma and between ca. 1076 and 1056 Ma (Corrigan and van Breemen, 1997). Factors controlling these repetitive episodes of similar magmatism are uncertain, but may imply the persistence of a fundamental tectonic environment, or long-lived mantle anomaly, as suggested by Ryan and Connelly (1996). If scenario 1 or 2 are apropos, it would suggest, but not necessitate, that intrusion of Units 1 to 3 and the MMIS are separated in time by a tectonothermal event

Available data suggests that scenario 3 is the least likely of the three, although this hypothesis and the possibility that the tectonothermal event, which overprinted Units 1 to 3, postdates the MMIS, cannot be discounted entirely. It could be the case that the principal differences between the southern and northern parts of the region are metamorphic and structural. This would imply that a post-MMIS metamorphic and structural front, either Pinwarian or Grenvillian, separates the southern units from MMIS rocks in the north. If this is the case, the deformed and metamorphosed rocks in the southern part of the study area could be coeval with the MMIS. The geochronological data should resolve this problem.

ACKNOWLEDGMENTS

Our sincere thanks to Memorial University students Shawn Furlong, Jeff Pollock, Karen Puddester, and Craig Rowe for their assistance in the field, culinary expertise and good company. Special thanks to Charlie Gower for his cooperation and significant contributions to this project. Charlie Gower, Steve Colman-Sadd, Frank Blackwood and Tom Krogh made visits to the field area. Wayne Tuttle of the Geological Survey Field Office in Goose Bay provided expediting assistance. Helicopter pilots Lorne Pike, Jim Watson, Ron Lethbridge, Greg Baikie, and Universal Helicopters of Goose Bay, gave us safe and reliable helicopter support. Bruce Ryan is thanked for his critical and thorough review of an earlier version of this report.

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