Current Research (2002) Newfoundland Department of Mines and Energy
Geological Survey, Report 02-1, pages 79-97

GEOLOGY OF THE NATASHQUAN RIVER (NTS 13D/SE) AND SENÉCAL LAKE (NTS 13D/SW) AREAS, GRENVILLE PROVINCE, SOUTHERN LABRADOR

D.T. James, L. Nadeau[1], and G.A.G. Nunn[2]
Regional Geology Section

ABSTRACT

The Natashquan River (NTS 13D/SE) and Senécal Lake (NTS 13D/SW) map areas, southern Labrador, include parts of the western Mealy Mountains and Mecatina terranes of the Grenville Province. The terranes are Grenvillian (ca. 1000 Ma) tectonic divisions, although they consist mainly of late Paleoproterozoic to late Mesoproterozoic (> 1120 Ma) crust. The Mealy Mountains terrane includes granulite-facies metasedimentary rocks, orthogneiss, and rocks of the middle Labradorian (ca. 1660 to 1630 Ma) Mealy Mountains intrusive suite. The Mealy Mountains intrusive suite, consisting of intrusions ranging from gabbro to gabbronorite, minor ultramafic rocks, anorthosite and granitoid rocks, is variably overprinted by the Labradorian orogeny. The Mealy Mountains terrane also includes late Mesoproterozoic (ca. 1130 Ma) intrusions of anorthosite, gabbro and granite of the Atikonak River massif. Early Mesoproterozoic (ca. 1500 Ma), Pinwarian rocks, including foliated and gneissic K-feldspar porphyritic granite, granitic orthogneiss, and minor pre-1500 Ma metasedimentary rocks make up the Mecatina terrane. The Mecatina terrane is interpreted to be pervasively overprinted by Grenvillian upper amphibolite-facies metamorphism and attendant deformation. Affects of Grenvillian overprinting on the Mealy Mountains terrane are uncertain. The boundary between the Mealy Mountains and Mecatina terranes is not exposed and is undefined.

Late- to post-Grenvillian plutons intrude the Mealy Mountains and Mecatina terranes. The plutons consist of clinopyroxene-bearing syenite, monzonite, and biotite granite. The rocks are mainly undeformed, although weakly foliated and recrystallized rocks also occur.

Gabbro, gabbronorite and minor ultramafic rocks of the Mealy Mountains intrusive suite, and gabbro and anorthosite of the Atikonak River massif have potential to host PGE and Ni–Cu–Co sulphide mineralization. A sample from an outcrop of gossanous ultramafic rocks from the Mealy Mountains intrusive suite of the Senécal Lake map area contains 1.38 g/t combined Pt, Pd and Au. In addition, the Atikonak River massif anorthosite has potential for hosting Ti-oxide mineralization.

INTRODUCTION

The geology of the Grenville Province in southern Labrador encompassed by NTS map area 13D (Figure 1) is known mainly from small-scale reconnaissance mapping completed by the Geological Survey of Canada more than 30 years ago (*cf*. Stevenson, 1969), and from more recent mapping by Thomas *et al*. (1994). As part of a continuing program by the Geological Survey of Newfoundland and Labrador to upgrade the geological database for the Grenville Province in southern Labrador (*see* Figure 3), the southern half of map area NTS 13D was mapped at 1:100 000 in the 2001 field season. Map sheets D/1, D/2, D/7 and D/8 are referred to as the Natashquan River map area (*see* Figure 4); map sheets D/3, D/4, D/5 and D/6 are referred to as the Senécal Lake map area (*see* Figure 5). Mapping was carried out by helicopter landings on isolated outcrops, and was based from a field camp located 6 km east of the town of Churchill Falls. Mapping in 2001 was a continuation of 1:100 000-scale mapping in map area NTS 13D/NE by James and Nadeau (2001c, d), and in NTS 13C/SW by James and Nadeau (2001b, d). A preliminary description and interpretation of the geochemistry of intrusive units in the western Mealy Mountains and Mecatina terranes (*see*

[1] Earth Sciences Sector, Geological Survey of Canada, GSC-Québec

[2] Mines Branch, Newfoundland Department of Mines and Energy

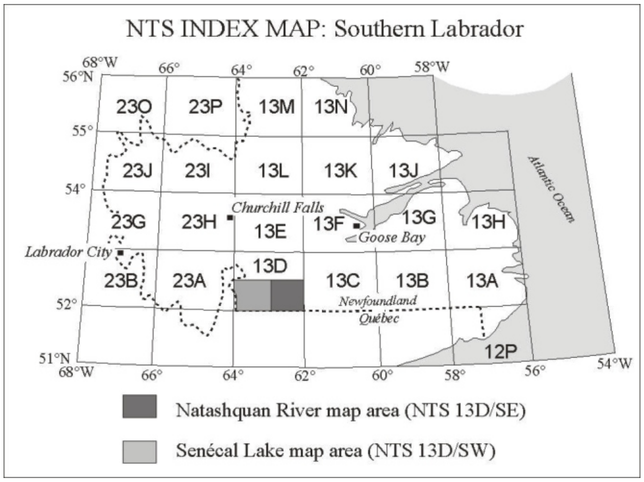

Figure 1. *NTS index map of southern Labrador showing location of the Natashquan River and Senécal Lake map areas.*

Figure 2) is given in Nadeau and James (2001; and *this volume*).

Bedrock in the study areas is variably exposed. In the Natashquan River map area (*see* Figure 4), plutons of late- to post-Grenvillian granite, monzonite and syenite locally form prominent hills and are well exposed. In the Senécal Lake map area (*see* Figure 5), granulite-facies metasedimentary gneiss in the northwest, and gabbro in the central part of the area, are similarly relatively well exposed. However, in most other parts of the Senécal Lake and Natashquan River map areas, rocks are very poorly exposed; these areas are covered by extensive areas of bog, dense forest, or thick accumulations of Quaternary deposits. Abundant drumlinoid ridges that trend from 120° to 130°, in both map areas, suggest the most recent Quaternary ice-flow direction was from the northwest.

Definitive contact relations between geological units were not observed. To some extent, the locations of contacts and faults shown on the generalized geological maps (*see* Figures 4 and 5) were interpreted using regional magnetic anomaly data (*see* Figures 6 and 7) and aerial photographs.

REGIONAL GEOLOGY

The Natashquan River and Senécal Lake map areas cover part of the Interior Magmatic Belt of the northeastern Grenville Province (*see* Gower *et al.*, 1991), and include rocks inferred to belong to the Mealy Mountains and Mecatina terranes (Figure 2). These terranes are Grenvillian (*ca.* 1000 Ma) tectonic divisions, although they consist primarily of late Paleoproterozoic and early Mesoproterozoic crust, respectively; the nature of the boundary between the two terranes is uncertain (*see below*).

The Mealy Mountains terrane (MMT; Gower and Owen, 1984) comprises variably metamorphosed and deformed, late Paleoproterozoic, Labradorian plutons of the Mealy Mountains intrusive suite (MMIS) (*see* Emslie, 1976; Emslie and Hunt, 1990; Krogh *et al.*, 1996), minor occurrences of Paleoproterozoic pre-Labradorian crust, and Pinwarian (1510 to 1450 Ma) intrusions (Gower, 1996). The MMIS includes an older group of anorthositic, gabbroic and local leucotroctolitic rocks, and a younger group of pyroxene-bearing monzonite and quartz monzonite intrusions. Emplacement ages for units of MMIS monzodiorite orthogneiss, porphyritic quartz monzodiorite and pyroxene-bearing monzonite, determined by U–Pb geochronology of zircon and occurring in the Kenamu River map area (Figure 3), are 1659 ± 5 Ma, 1650 ± 1 Ma, and 1643 ± 2 Ma, respectively (James *et al.*, 2000). In addition, pyroxene monzonite and pyroxene granite, inferred to be from the younger group of MMIS rocks and occurring in the northeastern part of the MMIS, have emplacement ages of 1646 ± 2 Ma and 1635 +22/–8 Ma (Emslie and Hunt, 1990), respectively. Emplacement ages of MMIS rocks overlap with tectonothermal and magmatic events of the Labradorian Orogeny, which affected northeastern Laurentia in the interval between 1720 Ma and 1600 Ma (*see* Gower, 1996).

Rocks in the western MMT are variably foliated and locally gneissic; in general, they have northeast- to east–northeast-striking planar fabrics that are inferred to be late to middle Labradorian (ca. 1650 to 1600 Ma; James and Nadeau, 2000). However, the local occurrence of deformed, Pinwarian age (ca. 1514 Ma) granite in the Kenamu River map area (James *et al.*, 2000) demonstrates the western MMT has also been affected by Pinwarian and/or Grenvillian deformation.

The Mecatina terrane (MET) consists of units of deformed granite, monzonite, gabbro, and anorthosite that are provisionally correlated with the Petit Mecatina anorthosite–monzonite–charnockite–granite (AMCG) suite. Foliated quartz monzonite and K-feldspar porphyritic granite, occurring in the MET, Fourmont Lake map area (Figure 3), and inferred to be part of the Petit Mecatina suite, have emplacement ages of 1500 ± 4 Ma and 1493 ± 3 Ma, respectively, determined by U–Pb geochronology of zircon (James *et al.*, 2001). A minor part of the terrane consists of granitoid orthogneiss, and upper amphibolite-facies supracrustal rocks, including quartzite, pelitic gneiss, and amphibolite. The supracrustal rocks are intruded by Petit Mecatina AMCG suite rocks, and on this basis are constrained to have pre-1500 Ma depositional ages. The supracrustal rocks are tentatively correlated with the Wakeham Supergroup,

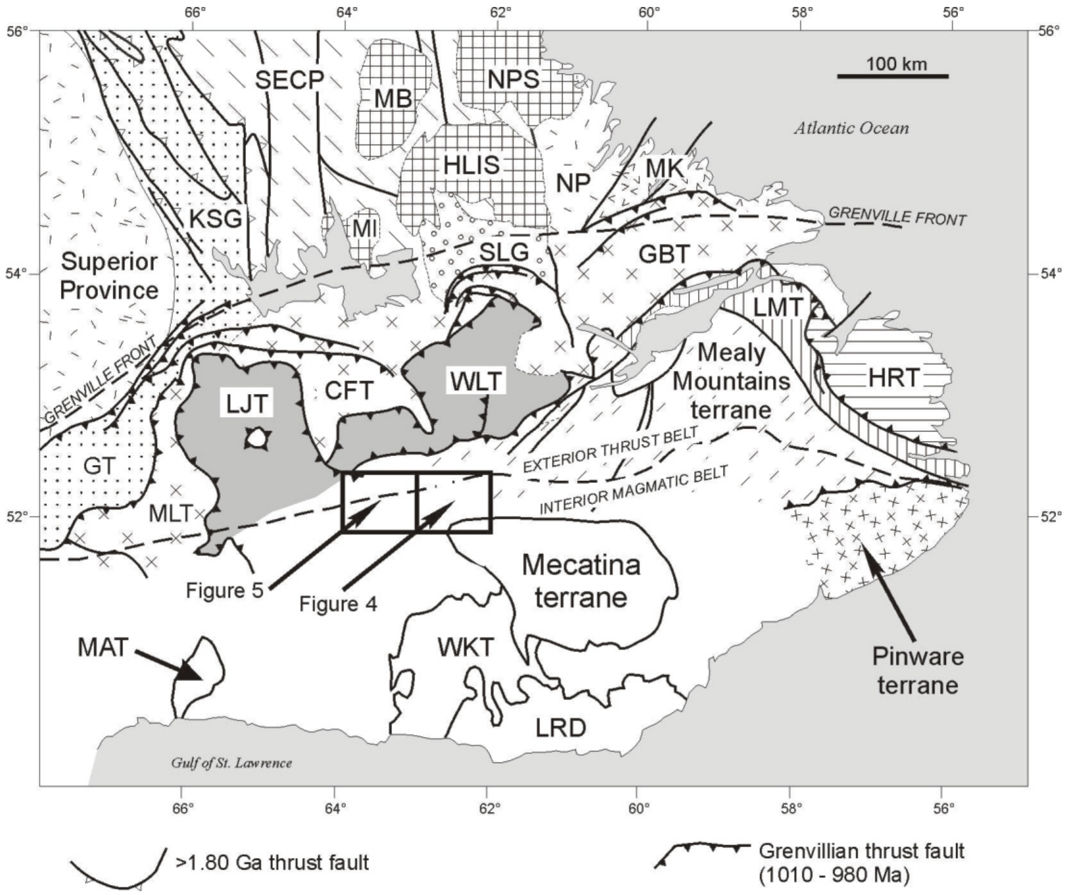

Figure 2. *Tectonic and major lithotectonic units of southern Labrador showing location of the study areas. Grenville Province: HRT - Hawke River terrane, LMT - Lake Melville terrane, GBT - Groswater Bay terrane, WLT - Wilson Lake terrane, CFT - Churchill Falls terrane, LJT - Lac Joseph terrane, MLT - Molson Lake terrane, GT - Gagnon terrane, MAT - Matamec terrane, WKT - Wakeham terrane, LRD - La Romaine domain. Archean divisions: Superior Province, NP - Nain Province (Hopedale Block). Archean and Paleoproterozoic divisions: MK - Makkovik Province, SECP - Southeastern Churchill Province (core zone), KSG - Kaniapiskau Supergroup (2.25 to 1.86 Ga). Mesoproterozoic units: NPS - Nain Plutonic Suite, HLIS - Harp Lake intrusive suite, MB - Mistastin batholith, MI - Michikamau Intrusion, SLG - Seal Lake Group.*

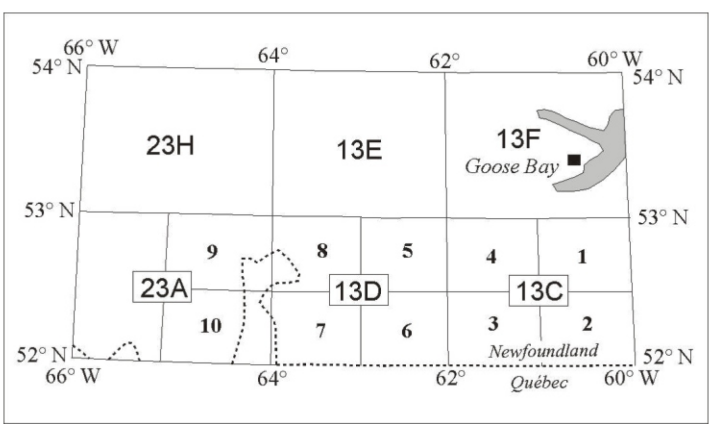

Figure 3. *Reference index map for NTS map areas 13C, 13D, and part of 23A. 1 - Kenamu River map area (James, 1999). 2 - Fourmont Lake map area (James and Nadeau, 2001a). 3 - Lac Arvert map area (James and Nadeau, 2001b). 4 - Minipi River map area (Wardle* et al.*, 2000). 5 - Little Mecatina River map area (James and Nadeau, 2001c). 6 - Natashquan River map area (*this study*). 7 - Senécal Lake map area (*this study*). 8 - Lac Ghyvelde - Lac Long map area (Thomas* et al.*, 1994). 9 - Atikonak Lake map area (Nunn, 1990). 10 - Atikonak River Massif - north part (Nunn* et al.*, 1986a).*

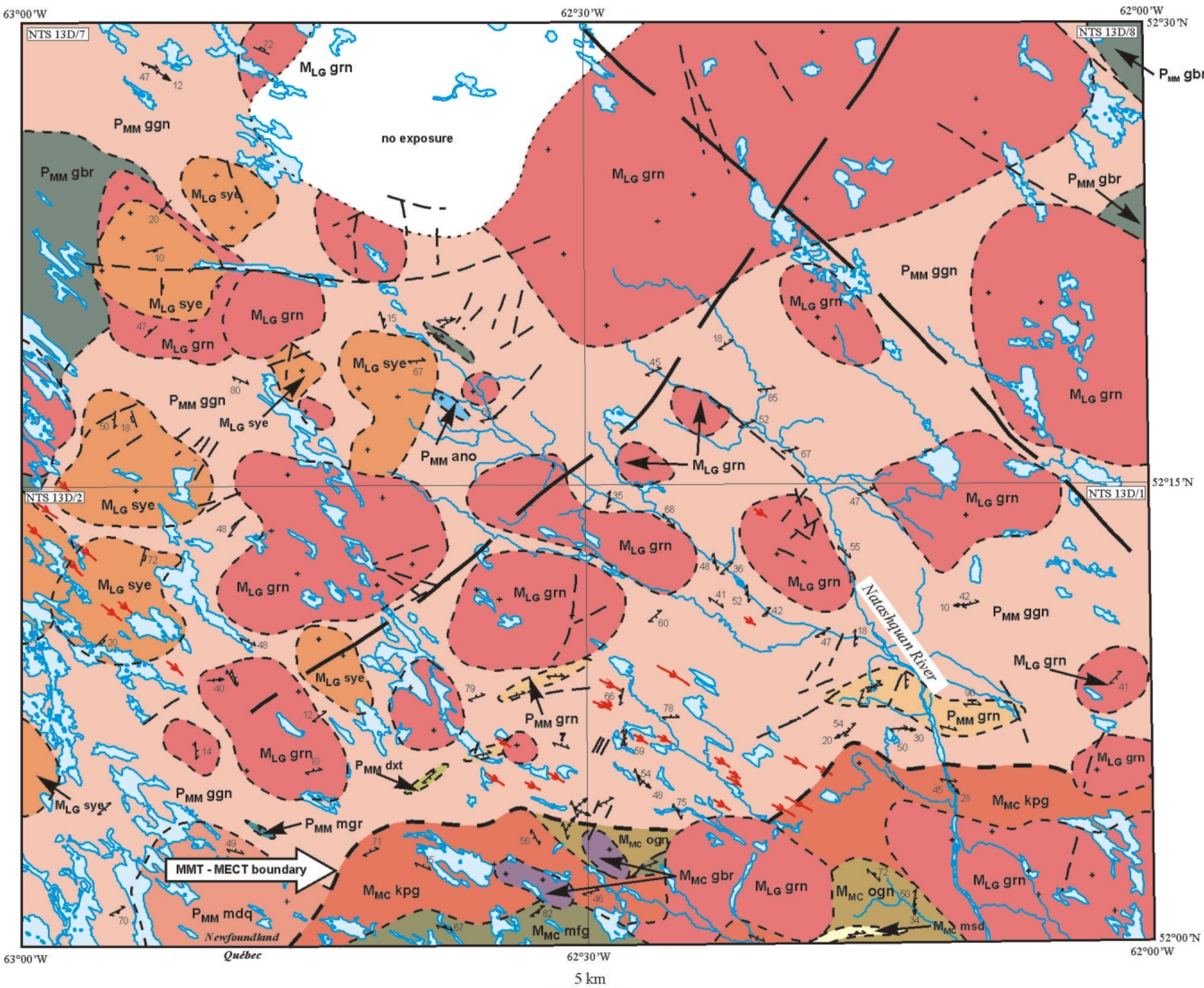

Figure 4. *General geology of the Natashquan River map area (NTS 13D/SE). The boundary between the Mealy Mountains (MMT) and Mecatina (MET) terranes is very provisional and is put on the map mainly to highlight areas of late Paleoproterozoic and early Mesoproterozoic rocks. The tectonic significance of this boundary is uncertain.*

which forms a major component of the Wakeham terrane (Figure 2).

Titanite growth in the 1493 Ma MET porphyritic granite discussed above, has been determined by U–Pb techniques to be at 1043 ± 6 Ma (James *et al.*, 2001), providing evidence that the terrane has been overprinted by Grenvillian metamorphism. However, it is possible that some rocks in the terrane have also been overprinted by Pinwarian (ca. 1510 to 1450 Ma) or older tectonothermal events. Rocks in the MET have a variably developed, mainly west- to west–northwest-striking foliation that is interpreted to be a Grenvillian fabric.

The location and nature of the boundary between the MMT and the MET is uncertain. In the Fourmont Lake map area (James and Nadeau, 2000, 2001a), local occurrences of mylonitic rocks having an undetermined kinematic history suggest the boundary is a south-dipping high-strain zone. However, in the Natashquan River map area (Figure 4) the area inferred to contain the terrane boundary is very poorly exposed and reliable field data for its demarcation are lacking.

The western MMT and the southern Lac Joseph terrane (Figure 2) are intruded by a suite of plutons consisting of troctolite, norite, anorthosite, monzonite, quartz syenite and granite that belong to the late Mesoproterozoic Atikonak River massif (Nunn *et al.*, 1986a, b, c; Nunn, 1990). The rocks have been variably overprinted by Grenvillian deformation and metamorphism. Emplacement ages of a rapakivi granite and pyroxene-bearing quartz monzonite from the

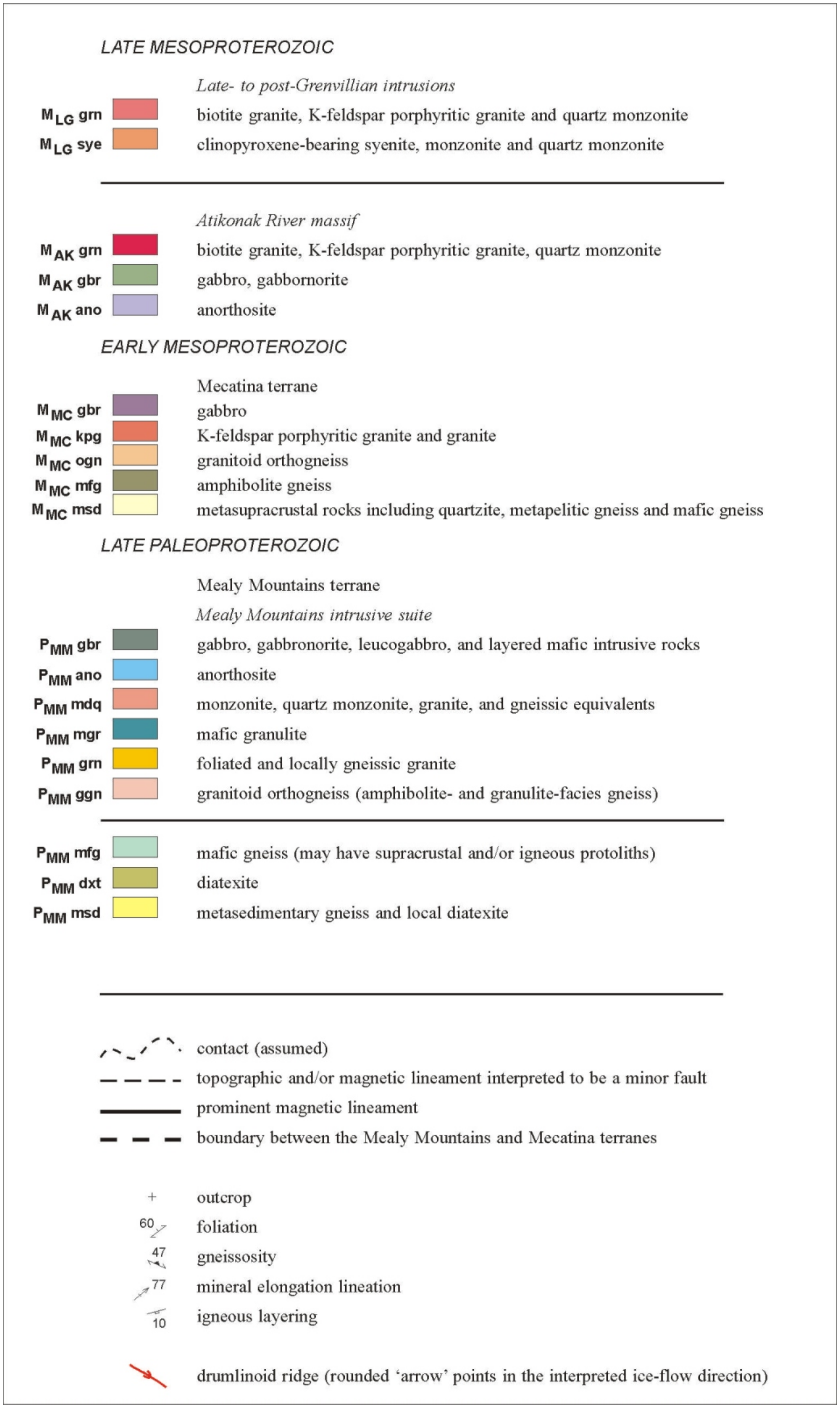

Figure 4. Legend.

massif have been determined by U–Pb geochronology of zircon to be 1133 +10/–5 Ma and 1123 ± 4 Ma, respectively (Emslie and Hunt, 1990). The Atikonak massif represents the northeastern extension of the Lac Fournier massif of Sharma and Franconi (1975), and is part of a larger suite of late Mesoproterozoic AMCG intrusions extending south from the Senécal Lake map area to the Gulf of St. Lawrence.

The MMT and the MET are intruded by plutons of unmetamorphosed, massive to weakly foliated and recrystallized clinopyroxene-bearing syenite, monzonite, and biotite granite. The field relationships demonstrate these plutons slightly overlap and postdate, temporally, the late stages of Grenvillian orogenesis. A clinopyroxene-bearing syenite, which intrudes MMT rocks in the Little Mecatina River map area, has an emplacement age of 982 ± 2 Ma (James *et al.*, *this volume*). A biotite granite, also occurring in the western MMT, is determined to have an emplacement age of 964 ± 3 Ma based on U–Pb techniques on zircon (James *et al.*, 2001). The age of the granite is consistent with 966 to 956 Ma ages for widespread granitoid plutons in the Pinware terrane and, locally, in the southeastern MMT (*see* discussions in Gower, 1996; Gower *et al.*, 2001).

DESCRIPTION OF ROCK UNITS

LATE PALEOPROTEROZOIC UNITS

Mealy Mountains Terrane (MMT)

Metasedimentary gneiss (P_{MM} msd), diatexite (P_{MM} dxt), and mafic gneiss (P_{MM} mfg)

The MMT, in the northwestern part of the Senécal Lake map area (Figure 5), includes high-grade metasedimentary gneiss, related diatexite, and mafic gneiss, possibly derived from a supracrustal protolith. Granulite-facies metasedimentary gneiss (P_{MM} msd) is the dominant unit. Outcrops consist of variable amounts of black-, brown- to rusty-weathering paleosome and white-weathering granitoid leucosome. The paleosome contains biotite, garnet, and local sillimanite (Plate 1). Orthopyroxene, in sillimanite-absent rocks, and cordierite occur locally. In some outcrops having abundant garnet, gneissosity is defined by garnetite layers up to 10 cm thick. Garnet is also locally abundant in the leucocratic neosome. Sedimentary bedding is not preserved, although highly dismembered relicts of presumed iron formation, consisting of high percentages of garnet, magnetite and minor pyrite, and < 20-cm-thick, dismembered layers of quartzite occur locally.

Outcrops of diatexite consisting of >90 percent leucosome, and containing biotite and garnet, occur locally within the metasedimentary gneiss unit (P_{MM} msd) in the northwestern part of the Senécal Lake map area. The spatial relationship between the diatexite and the metasedimentary gneiss, and local gradational contacts between the two indicate the diatexite is derived from near complete anatexis of the metasedimentary gneiss. In addition, an outcrop of pink-weathering diatexite containing abundant sillimanite, K-feldspar, and lacking metasedimentary paleosome, occurs in the southeastern part of the Natashquan River map area (NTS 13D/2; Figure 4). The abundance of sillimanite suggests an aluminous sedimentary protolith.

Metasedimentary gneiss in the northwestern part of the Senécal Lake map area is locally interlayered with black-weathering mafic gneiss (P_{MM} mfg) consisting of variable proportions of pyroxene, amphibole, garnet, plagioclase and biotite. Rocks are layered or massive. The field association with the metasedimentary gneiss may suggest the mafic gneiss has a supracrustal protolith, although it is also possible that the gneiss may represent metamorphosed gabbro.

The protolith ages of the metasedimentary gneiss and the mafic gneiss are unknown, although inferred contact relationships suggest they represent the oldest units in the western MMT. High-grade metamorphism, diatexite formation and the main deformation in the P_{MM} msd, P_{MM} dxt, and P_{MM} mfg units are assumed to be Labradorian.

Orthogneiss (P_{MM} ggn) and deformed granitoid rocks (P_{MM} grn, P_{MM} mdq)

In the Natashquan River and Senécal Lake map areas, the MMT is dominated by a heterogeneous unit of granitoid orthogneiss (P_{MM} ggn) derived from several different protoliths, and possibly including rocks having igneous emplacement ages that are pre-Labradorian (>1720 Ma) and Labradorian (*see discussion below*). Orthogneisses having Labradorian-age protoliths may represent deformed, gneissic equivalents of MMIS rocks.

The most common rock type in the P_{MM} ggn unit is an upper amphibolite-facies, pink- to grey-weathering granite to granodiorite orthogneiss containing biotite and local hornblende (Plate 2). Grey- and black-weathering orthogneiss derived from mafic diorite and tonalite form minor parts of the P_{MM} ggn unit. Orthopyroxene-bearing rocks have not been identified in the field, although local occurrences of rocks having a distinctive

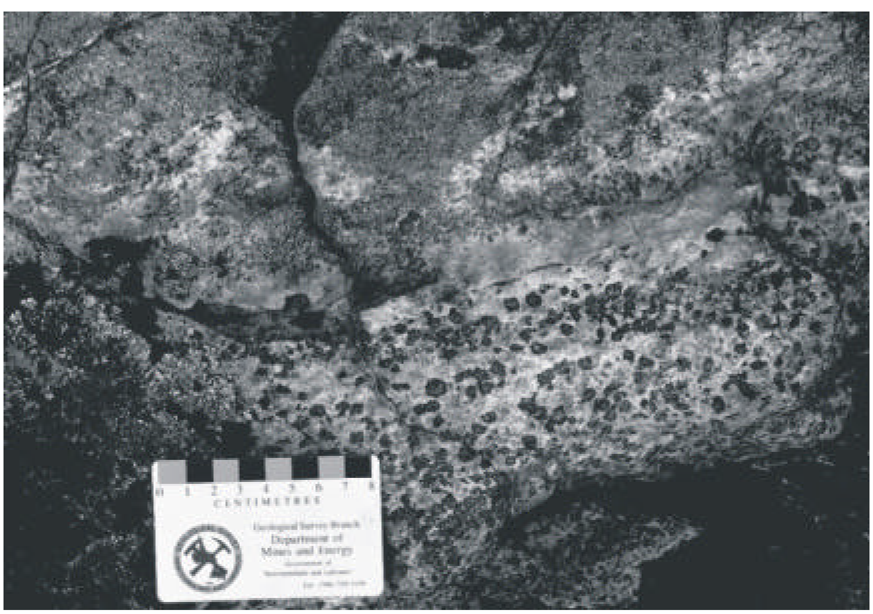

Plate 1. *Granulite-facies metasedimentary (migmatite) gneiss (P_{MM} msd) containing the assemblage garnet + sillimanite + K-feldspar + biotite. The age of granulite-facies metamorphism is interpreted to be late to middle Labradorian (ca. 1650 to 1600 Ma), although it has not been dated. (Photograph DJ-01-1170)*

Plate 2. *Typical field aspects of grey-weathering, amphibolite-facies granodiorite orthogneiss (P_{MM} ggn), Natashquan River map area. (Photograph DJ-01-1076)*

Plate 3. *Metamorphosed and weakly gneissic granite (P_{MM} ggn) containing elongate amphibolite fragments, which may represent disrupted, metamorphosed mafic dykes. (Photograph DJ-01-1078).*

maple-sugar-bronze or olive-green colour suggest the unit includes granulite-facies rocks. Gneissosity is variably developed and defined by differing percentages of mafic minerals. Locally, rocks are migmatitic. Deformed xenoliths of metamorphosed mafic rocks derived from diorite and gabbro occur locally. Some outcrops contain elongate fragments of metamorphosed mafic rocks that may represent the dismembered relicts of mafic dykes (Plate 3). Aplitic granite dykes, which are discordant to gneissosity in the host orthogneiss but are themselves variably foliated, are widespread in the unit.

A granodiorite orthogneiss occurring in the Little Mecatina River map area (Figure 3), and correlated with P_{MM} ggn rocks in the Natashquan River and Senécal Lake map areas, has an igneous emplacement age of 1653 ± 5 Ma based on U–Pb dating of zircon (James *et al.*, *this volume*). In addition, U–Pb dating of a monzodiorite orthogneiss within the Kenamu River map area (Figure 3) that is similar to P_{MM} ggn orthogneiss, indicates an igneous emplacement age of 1659 ± 5 Ma (James *et al.*, 2000). Unit P_{MM} ggn rocks in the Natashquan River and Senécal Lake map areas also may have ca. 1660 to 1650 Ma (middle Labradorian) emplacement ages, although the possibility of pre-Labradorian components in the P_{MM} ggn unit cannot be eliminated. The age of upper amphibolite- to granulite-facies metamorphism of P_{MM} ggn rocks is undetermined but tentatively assigned as late to middle Labradorian (1650 to 1600 Ma). A recrystallized and weakly foliated granitic aplite dyke, which is discordant to gneissosity in host P_{MM} ggn rocks in the Little Mecatina River map area, has an emplacement age of 995 ± 2 Ma (James *et al.*, *this volume*), constraining the age of the gneissosity to be older than 995 Ma. The weak foliation of the dyke indicates the rocks have been slightly overprinted by late-Grenvillian deformation.

Foliated biotite granite (Unit P_{MM} grn), monzonite, quartz monzonite and minor granite (Unit P_{MM} mdq) are minor components of the MMT in the Natashquan River map area. The P_{MM} grn granite is pink-weathering, fine to medium grained, recrystallized, and contains minor biotite. Rocks are foliated but only locally gneissic. The P_{MM} mdq rocks are mainly clinopyroxene-bearing, and also contain hornblende and biotite. Unit P_{MM} mdq rocks have similar textures and structures as P_{MM} grn granite. Units P_{MM} grn and P_{MM} mdq rocks are undated but assumed to be Labradorian and form components of the MMIS. This interpretation is based on correlation with similar clinopyroxene-bearing monzonitic and

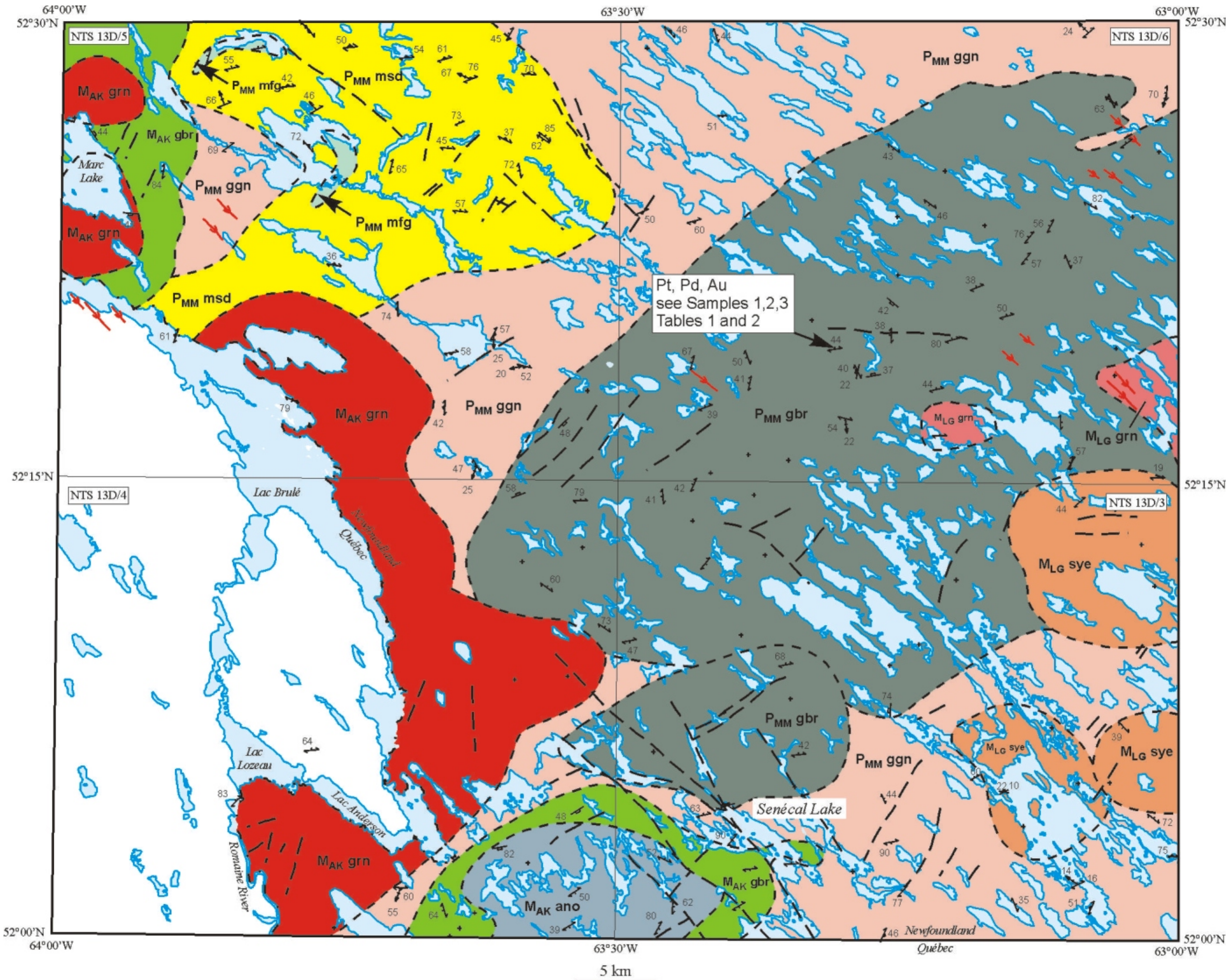

Figure 5. *General geology of the Senécal Lake map area (NTS 13D/SW).*

granitic rocks occurring in areas to the east (*see* James and Lawlor, 1999). Based on similarity of rock types, gneissic equivalents of P_{MM} grn and P_{MM} mdq rocks may form parts of the P_{MM} ggn orthogneiss unit.

Gabbro–gabbronorite (P_{MM} gbr), mafic granulite (P_{MM} mgr), and anorthosite (P_{MM} ano)

Variably metamorphosed and deformed intrusive rocks including gabbronorite, gabbro, leucogabbro, minor ultramafic rocks (P_{MM} gbr), and minor anorthosite (P_{MM} ano) form part of the MMT in the Natashquan River and Senécal Lake map areas. These units are interpreted to be Labradorian and are correlated with the MMIS on the basis of rock types.

The P_{MM} gbr unit is heterogeneous in composition and texture. The heterogeneity occurs at the map scale; in general, outcrops have a consistent composition and texture. Some components are pervasively recrystallized, foliated and do not have igneous mineral textures, whereas other components consist of fresh, and undeformed rocks. Some of the fresh rocks have igneous layering or lamination (Plate 4). Gabbro and gabbronorite are the most common rock types. Biotite-bearing gabbro is common in the central part of the Senécal Lake map area, and is very similar to the widespread biotite gabbro that occurs in the Lac Arvert map area (James and Nadeau, 2001b). Leucogabbro and leucogabbronorite are less common. Ultramafic rocks make up a very minor part of the unit, and occur as components in outcrops dominated by gabbro or gabbronorite. A single occurrence of granulite-facies mafic gneiss (P_{MM} mgr), possibly derived from gabbro or gabbronorite, occurs in the southern part of the Natashquan River map area (Figure 4) and may be a highly metamorphosed equivalent of P_{MM} gbr rocks.

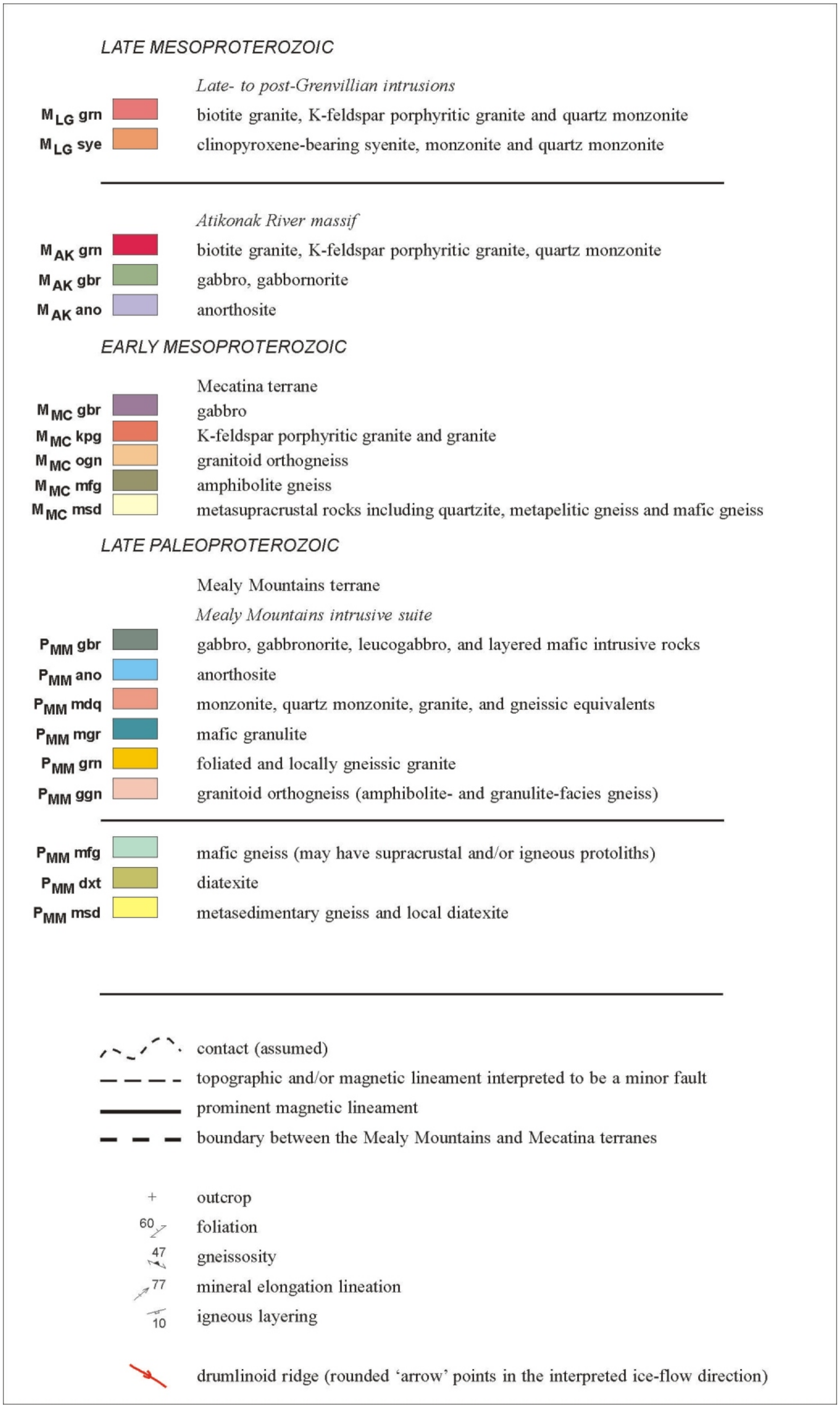

Figure 5. Legend.

In the Natashquan River map area, the MMT includes a single occurrence of metamorphosed anorthosite (P_{MM} ano). The anorthosite underlies a prominent, 1-km-long, northwest-trending ridge in the southeast part of map area NTS 13D/7 (Figure 4). The anorthosite is a white- to grey-weathering, massive, medium-grained, recrystallized, biotite-bearing rock containing relicts of coarse-grained, grey- to blue-weathering plagioclase. Anortho-site is not common in the western MMT, as compared to the northeastern MMT, with the exception of the elongate, 25 by 8 km Tornado anorthosite in the Little Mecatina River map area (James and Nadeau, 2001c).

EARLY MESOPROTEROZOIC UNITS

Mecatina Terrane (MET)

Metasedimentary gneiss (M_{MC} msd)

In the Natashquan River map area, the MET includes a minor amount of upper amphibolite-facies metasedimentary gneiss defined as Unit M_{MC} msd. Outcrops include biotite+ garnet+sillimanite pelitic migmatite, and 1- to 2-m-thick layers of quartzite (Plate 5). Locally, the pelitic migmatite is rusty-weathering, and rocks contain several percent pyrite. Unit M_{MC} msd rocks are correlated with minor occurrences of quartzite and pelitic migmatite in the MET in the Lac Arvert (James and Nadeau, 2001b) and Four-

Plate 4. *Recrystallized, layered gabbronorite (P_{MM} gbr) of the MMIS that forms part of a composite, 25-m-thick outcrop consisting of layered gabbronorite and ultramafic rocks (not pictured), Senécal Lake map area. (Photograph DJ-01-1116)*

Plate 5. *Upper amphibolite-facies pelitic gneiss and quartzite (M_{MC} msd), Natashquan River map area. The age of metamorphism is assumed to be Grenvillian (ca. 1050 to 1000 Ma), but is undetermined. (Photograph DJ-00-9147)*

mont Lake (James and Nadeau, 2001a) map areas. In the Fourmont Lake map area, granitic rocks, which intrude the metasedimentary rocks, constrain the depositional age of the sedimentary protoliths to be older than 1500 Ma. Unit M_{MC} msd rocks are tentatively correlated with quartzite and pelitic gneiss of the >1500 Ma Wakeham Supergroup.

Amphibolite (M_{MC} mfg)

The MET includes several occurrences of amphibolite (M_{MC} mfg). The rocks are medium grained, containing hornblende, plagioclase, and minor biotite. Gneissosity is well developed locally, and consists of layers up to 20 cm thick defined by varying percentages of mafic minerals. Rocks contain variable amounts of white-weathering leucosome forming layers and pods consisting of coarse-grained plagioclase and quartz (Plate 6). Some outcrops are dominated by the leucosome component. The amphibolite could be derived from supracrustal or intrusive rocks; its age is undetermined.

K-feldspar porphyritic granite (M_{MC} kpg) and granitoid orthogneiss (M_{MC} ogn)

The MET in the Natashquan River map area (Figure 1) is dominated by a unit of K-feldspar porphyritic granite (Unit M_{MC} kpg). The unit consists of grey-, white- to light pink-weathering granite containing biotite and minor hornblende. Rocks are variably foliated, recrystallized, and medium to coarse grained having a relict K-feldspar porphyritic texture (Plate 7). Locally, the rocks are extensively recrystallized, strongly foliated and have an augen structure. Elongate inclusions of grey-weathering diorite, which are aligned parallel to the foliation in the host granite, make up less than 5 percent of the unit. On the basis of composition and texture, the M_{MC} kpg granite is correlated with K-feldspar porphyritic granite occurring in the Fourmont Lake map area, which has an emplacement age of 1493 ± 3 Ma, determined by U–Pb geochronology of zircon (James *et al.*, 2001). The sample from the Fourmont Lake area also contains titanite that formed at ca. 1043 Ma, demonstrating the MET has been overprinted by Grenvillian metamorphism, and suggesting the fabric in metamorphosed MET rocks is also Grenvillian.

The M_{MC} ogn unit consists of light pink-, white-, or grey-weathering granitoid orthogneiss. Typically, the rocks are variably layered, have a gneissosity defined by differing

Plate 6. *Typical field aspects of migmatitic amphibolite gneiss (M_{MC} mfg) of uncertain protolith, Natashquan River map area. (Photograph DJ-01-1019)*

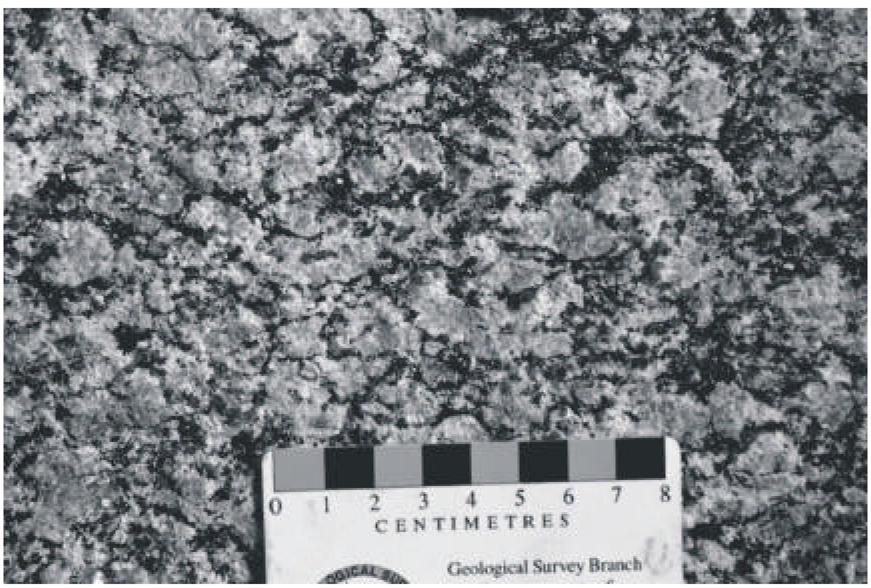

Plate 7. *Recrystallized and foliated, K-feldspar porphyritic granite (M_{MC} kpg). This granite, which makes up a significant part of the northern Mecatina terrane, is interpreted to have an early Mesoproterozoic emplacement age based on correlation with similar, ca. 1493 Ma granite occurring in the Fourmont Lake map area. (Photograph DJ-01-1009)*

percentages of mafic minerals, are locally migmatitic, and contain biotite and hornblende. These gneisses are derived from granite, granodiorite, and quartz monzonite protoliths. Locally, the M_{MC} ogn unit also includes augenitic rocks that may be a gneissic version of the porphyritic granite unit (M_{MC} kpg). Outcrops commonly contain deformed granitic veins and granitic pegmatite.

Igneous emplacement ages of the protoliths of the M_{MC} ogn unit are undetermined. The age of upper amphibolite-facies metamorphism, which produced the gneissosity in these rocks, is also undetermined but tacitly assumed to be Grenvillian on the basis of the U–Pb titanite data discussed above.

There are no definitive textural or compositional features that distinguish M_{MC} ogn and P_{MM} ggn orthogneisses. By definition, M_{MC}ogn and P_{MM} ggn orthogneisses occur in the MET and MMT, respectively. Unit P_{MM} ggn rocks are interpreted to have been metamorphosed to upper amphibolite- to granulite-facies in the Labradorian, whereas metamorphism of M_{MC}ogn orthogneisses is interpreted to be Grenvillian in age. Geochronological studies of M_{MC}ogn and P_{MM}ggn orthogneiss units are necessary to establish ages of igneous emplacement and metamorphism.

Gabbro (M_{MC} gbr)

In the Natashquan River map area, the MET includes two small bodies of gabbro and gabbronorite (M_{MC}gbr). The unit consists of two texturally different rock types. The first type is a black-weathering, medium- to coarse-grained, massive, fresh gabbro. The second type is a massive, medium- to coarse-grained gabbro to gabbronorite, possibly containing minor olivine, and having a pyroxene-porphyritic texture defined by coarser grained pyroxenes and finer grained plagioclase. The pyroxene-porphyritic texture gives the rocks a prominent "spotted" appearance.

Age of M_{MC} gbr gabbro is undetermined but assumed to be early Mesoproterozoic. Similar gabbro occurs in the MET in the Fourmont Lake map area (James and Nadeau, 2001a).

LATE MESOPROTEROZOIC UNITS

Atikonak River Massif

Anorthosite (M_{AK} ano)

Anorthosite, designated as Unit M_{AK} ano, and belonging to the late Mesoproterozoic Atikonak River massif (Nunn *et al.*, 1986a, b, c; Nunn, 1990), occurs in the southern part of the Senécal Lake map area (Figure 5). Rocks are medium to very coarse grained, variably recrystallized and foliated. Fresh to weakly recrystallized and non-foliated rocks are grey-weathering, and consist of coarse- to very coarse-grained, equant to locally elongate plagioclase grains. Recrystallized and foliated anorthosite consists of alternating grey-weathering lenses of weakly recrystallized, coarse-grained plagioclase (some grains are >20 cm long) and white-weathering lenses of extensively recrystallized, fine-grained plagioclase (Plate 8). Igneous pyroxene in the recrystallized rocks is mainly converted to amphibole and minor biotite. Relict igneous layering, defined by differing percentages of mafic minerals, is locally present. Some outcrops contain <10-cm-thick layers of magnetite and possible ilmenite.

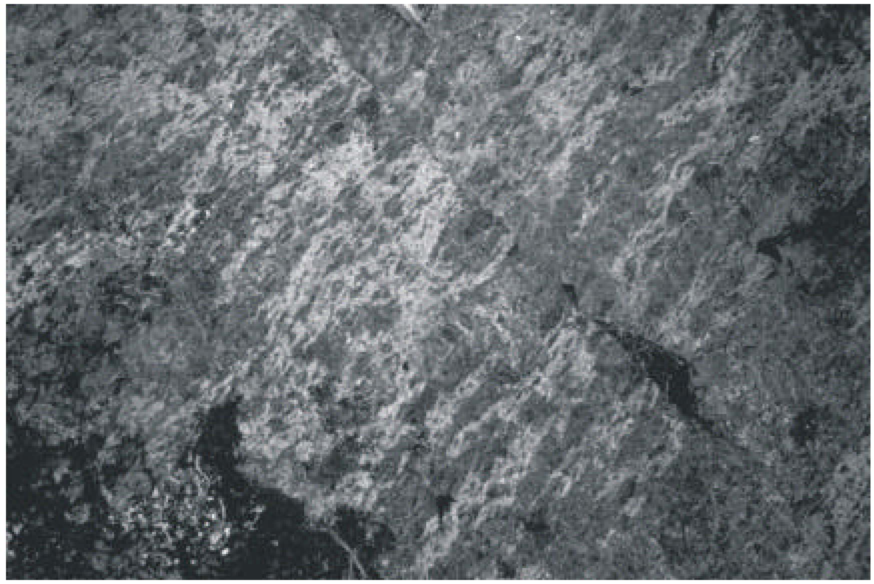

Plate 8. *Foliated anorthosite (M_{AK} ano) of the late Mesoproterozoic Atikonak River massif, Senécal Lake map area. Anorthosite consists of alternating grey-weathering lenses of weakly recrystallized, coarse-grained plagioclase, and white-weathering lenses of extensively recrystallized, fine-grained plagioclase. (Photograph DJ-01-1148)*

Foliation in the M_{AK} ano unit appears to wrap around the margins of the anorthosite body. The minor number of structural observations notwithstanding, the foliation pattern may indicate that the fabric and recrystallization are related to emplacement of the anorthosite and are not Grenvillian tectonic fabrics.

Gabbro and gabbronorite (M_{AK} gbr)

Gabbro and gabbronorite, Unit M_{AK} gbr, interpreted to belong to the Atikonak River massif, underlies part of the northwest and southern margins of the Senécal Lake map area (Figure 5). Rocks are black- or black and white-weathering, mainly medium grained and fresh to weakly recrystallized. In some outcrops, plagioclase has a distinctive pink colour on fresh surfaces. Rocks consist of variable amounts of pyroxene and plagioclase; recrystallized rocks contain minor hornblende and biotite. The unit includes minor undeformed aplitic granitic dykes.

Outcrops are mainly non-layered, although well-preserved layering occurs in M_{AK} gbr gabbro on the east shore of Marc Lake (UTM coordinates 433726 E, 5809778 N). Layers, up to 20 cm thick, are defined by differing volumes of mafic minerals or thin oxide layers (Plate 9). These layered rocks are locally gossanous and contain <15 percent fine-grained, disseminated pyrite.

Granite and quartz monzonite (M_{AK} grn)

In the Senécal Lake map area (Figure 5), the Atikonak River massif includes massive to weakly foliated, biotite granite, K-feldspar porphyritic granite, monzogranite and local quartz monzonite that are collectively designated as Unit M_{AK} grn. The unit consists of light pink-weathering, medium- to mainly coarse-grained rocks within which K-feldspar porphyritic textures are common, and rocks locally have a weak igneous lamination defined by alignment of the phenocrysts. The K-feldspar porphyritic monzogranite is the most abundant rock type. All rocks contain minor amounts of biotite, accessory sphene and magnetite. Minor granitic pegmatite and aplite dykes occur throughout this unit.

Late- to Post-Grenvillian Intrusions

Clinopyroxene-bearing syenite (M_{LG} sye) and granite (M_{LG} grn)

The Natashquan River and Senécal Lake map areas contain plutons of clinopyroxene-bearing syenite and biotite granite, defined as Units M_{LG} sye and M_{LG} grn, respectively.

In general, and especially in the western part of the Natashquan River map area, both units underlie prominent, rounded hills that rise up to 200 m above the surrounding peneplain. In some cases, plutons are associated with a pronounced magnetic anomaly. Outcrops of both units are commonly marked by conspicuous horizontal jointing.

The clinopyroxene-bearing M_{LG} sye plutons consist of medium pink-weathering syenite to monzonite (Plate 10). Rocks are mainly coarse grained, massive, and have fresh, igneous textures, although weakly recrystallized rocks, and rocks having a weak foliation occur locally. In some rocks, the foliation may be a relict igneous lamination defined by coarse-grained feldspar. Rocks contain up to 10 percent, medium-grained clinopyroxene, which is variably replaced by hornblende and minor biotite. Nepheline is suspected to occur in several outcrops. Magnetite is a ubiquitous accessory mineral.

On the basis of similarity of rock types and inferred contact relationships, M_{LG} sye plutons are correlated with clinopyroxene-bearing syenite and monzonite bodies in the Lac Arvert (James and Nadeau, 2001b) and Fourmont Lake (James and Nadeau, 2001a) map areas. The age of emplacement of a clinopyroxene-bearing syenite from the Lac Arvert map area, based on U–Pb dating of zircon, is estimated to be 982 ± 2 Ma (James *et al.*, *this volume*). The fact that M_{LG} sye rocks are mainly unrecrystallized and are lacking in tectonic fabrics suggest that emplacement of M_{LG} sye plutons largely postdates the last period of significant Grenvillian deformation and metamorphism in the region.

Plate 9. *Weakly recrystallized, layered gabbro (M_{AK} gbr) at Marc Lake, NTS area 13D/5, correlated with the late Mesoproterozoic Atikonak River massif. The gabbro at this outcrop is locally gossanous and contains several percent disseminated sulphides. (Photograph DJ-01-1172; see Table 2)*

Plate 10. *Coarse-grained, clinopyroxene-bearing syenite (M_{LG} sye), Natashquan River map area. (Photograph DJ-01-1063)*

Unit M_{LG} grn includes K-feldspar porphyritic granite as well as non-porphyritic granite, quartz monzonite, and minor monzonite. Rocks are mainly medium- to light pink-weathering, have fresh textures, and are undeformed. In general, outcrops have consistent composition and texture, although minor granitic aplite dykes occur locally. Unit M_{LG} grn rocks are correlated on the basis of similarity of rock types and inferred contact relationships with biotite granite occurring in the Lac Arvert (James and Nadeau, 2001b) and Fourmont Lake (James and Nadeau, 2001a) map areas. In the Fourmont Lake map area, one biotite-granite pluton has an emplacement age of 964 ± 3 Ma, determined by U–Pb geochronology of zircon (James *et al.*, 2001).

STRUCTURE AND METAMORPHISM

MEALY MOUNTAINS TERRANE (MMT)

Foliation and gneissosity in P_{MM} msd metasedimentary gneiss, P_{MM} ggn orthogneiss, and rocks of the MMIS are varied in attitude, although generally, planar fabrics are west–southwest-striking and dip moderately to the north–northwest. These fabrics, and the metamorphic minerals that define them, are assumed to be Labradorian but geochronological studies are required to test this assumption.

The metasedimentary gneiss, orthogneiss, and MMIS rocks indicate that upper amphibolite- to granulite-facies Labradorian metamorphism was reached. The metasedimentary rocks are migmatitic and contain biotite + sillimanite + garnet + K-feldspar. Orthopyroxene occurs in sillimanite-absent rocks. The MMIS gabbro and gabbronorite (P_{MM} gbr) are variably recrystallized and metamorphosed. Some P_{MM} gbr rocks have granoblastic textures and contain clinopyroxene and orthopyroxene, whereas other P_{MM} gbr rocks have been mainly converted to amphibolite.

The distribution of granulite- and upper amphibolite-facies rocks in the M_{MT} appears to be patchy at the map scale. The upper amphibolite-facies areas may represent areas of either late-Labradorian retrogression, or Grenvillian retrogression of Labradorian granulite-facies rocks. The degree of Grenvillian overprinting on the M_{MT} remains to be established.

MECATINA TERRANE (MET)

In the Mecatina terrane, metasedimentary gneiss (M_{MC} msd), mafic gneiss (M_{MC} mfg), granitic orthogneiss (M_{MC} ogn), and early Mesoproterozoic, Pinwarian, granitic rocks (M_{MC} kpg) are metamorphosed to upper amphibolite-facies. The metasedimentary rocks contain biotite + garnet + sillimanite and a granitic neosome. Foliation, defined by the metamorphic minerals and recrystallized mineral aggregates, and gneissosity in MET rocks are varied from mainly southwest- to south–southeast-striking. The age of metamorphism and attendant deformation in these rocks is interpreted to be Grenvillian, based on U–Pb data from a deformed M_{MC} kpg granite occurring in the Fourmont Lake area, which demonstrated new titanite growth at ca. 1043 Ma (James *et al.*, 2001).

Boundary between the MMT and the MET

In the Natashquan River map area, the boundary between the MMT and the MET is not exposed. The location and nature of the boundary are uncertain, and in Figure 4 it is provisionally placed mainly along the northern contact of the M_{MC} kpg porphyritic granite unit. To the east, in the Fourmont Lake map area, the boundary is assumed to be a Grenvillian tectonic feature based on two outcrops of mylonitic rocks occurring along the interpreted boundary. The mylonitic rocks, which have an undetermined kinematic history, suggest the boundary, at least in this area, is a south-dipping structure (*see* James and Nadeau, 2000, 2001a).

LATE- TO POST-GRENVILLIAN STRUCTURES

Late- to post-Grenvillian intrusions of syenite, monzonite and granite consist mainly of unrecrystallized and undeformed rocks. However, some rocks have a local, weak foliation defined by biotite. The interpretation of the foliation is equivocal. In some cases the foliation is defined by biotite and alignment of K-feldspar grains suggesting the planar fabric may be a relict igneous feature. In other cases, however, the biotite fabric may be a tectonic feature. A tectonic foliation in these rocks would indicate that local deformation outlasted ca. 1050 to 1000 Ma Grenvillian metamorphism.

The Natashquan River and Senécal Lake map areas also include a number of northwest-, northeast-, and east-striking topographic and magnetic lineaments interpreted to be minor faults (Figures 4 to 7). The lineaments transect units of the Atikonak River massif and the late- to post-Grenvillian intrusions, indicating these assumed faults are post-Grenvillian structures.

EXPLORATION POTENTIAL

Late Paleoproterozoic, MMIS gabbro, gabbronorite and minor ultramafic rocks of the P_{MM} gbr unit have exploration potential for PGE and Ni–Cu–Co sulphide mineralization. Gossanous rocks and sulphide occurrences are rare in the P_{MM} gbr unit, although trace amounts of disseminated pyrite occur locally.

One outcrop of gossanous P_{MM} gbr ultramafic rocks occurs in NTS 13D/6, at UTM 478945 E, 5796801 N (Grid Zone 20, NAD 1927 projection; Figures 5 and 8), and is at the southeast end of a <100-m-diameter pond (James and Nadeau, 2001e). The outcrop is <15 m in diameter and consists of orange brown- and black-weathering, medium-grained ultramafic and mafic intrusive rocks. The rocks are mainly massive and locally layered, although layering is disrupted. Massive, ultramafic parts of the outcrop contain <1-m-long fragments of layered mafic rocks. On the southwestern face of this outcrop, rocks are locally gossanous and deeply weathered. Disseminated sulphide mineralization occurs along a poorly defined layer in 30 by 30 cm pods.

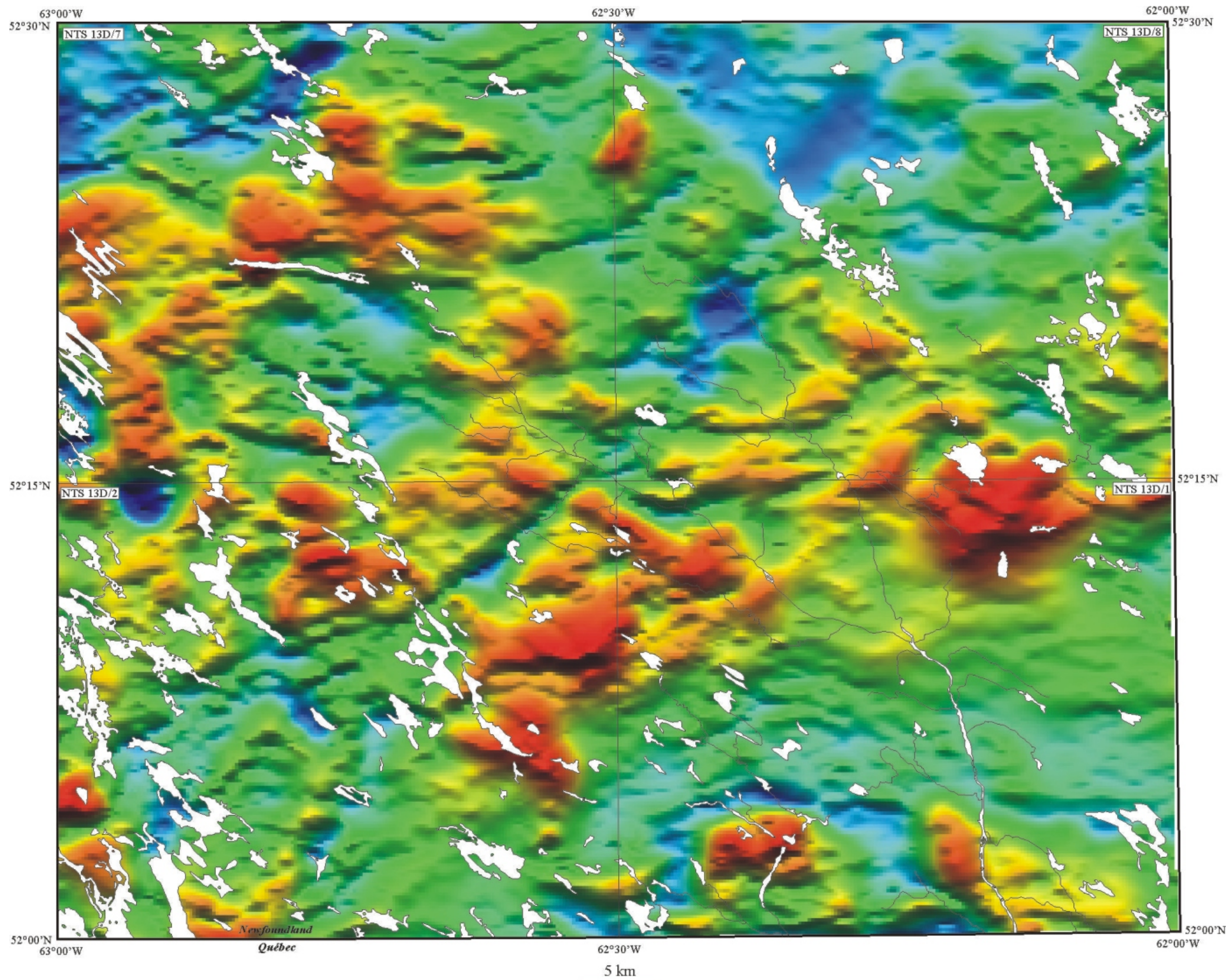

Figure 6. *Shaded-relief magnetic anomaly map of the Natashquan River map area (NTS 13D/SE). False illumination: azimuth - 315°, inclination - 45°. Red end of the spectrum - magnetic highs; blue end of the spectrum - magnetic lows. (Map prepared courtesy of G. Kilfoil, Geochemistry, Geophysics and Terrain Sciences Section, Geological Survey of Newfoundland and Labrador).*

Three gossanous samples from this layer (Samples 1, 2, and 3) contain anomalous concentrations of platinum, palladium, and gold (Table 1). The samples were analysed by Actlabs in Ancaster Ontario, using its 1C-Exploration method (a 30-gram fire assay with ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry) measurement). Sample 3 yielded the best results, having 1.38 g/t combined platinum, palladium and gold. The rocks also contain anomalous Cr, Cu and Ni (Table 2).

Late Mesoproterozoic mafic rocks belonging to the Atikonak River massif may also have some exploration potential for Ni-sulphide and PGE mineralization. One outcrop of layered M_{AK} gbr gabbro at Marc Lake, in NTS 13D/5, UTM coordinates 433726 E, 5809778 N, contains several percent disseminated pyrite but only minor amounts of Ni, Cu and Co (Samples 4 and 5, Table 2). In addition, anorthosite (M_{AK} ano) of the Atikonak River massif has some potential for Ti-oxide mineralization. The QIT Fer et Titane Inc. Ti-oxide deposits, in late Mesoproterozoic anorthosite, near Harve-St.-Pierre, Québec, provide a local example of economic Ti-oxide mineralization in Grenville Province anorthosite (Perreault and Jacob, 1999).

ACKNOWLEDGMENTS

Our sincere thanks to Sharon Parsons for her interest in our project and excellent assistance in the field. The efforts

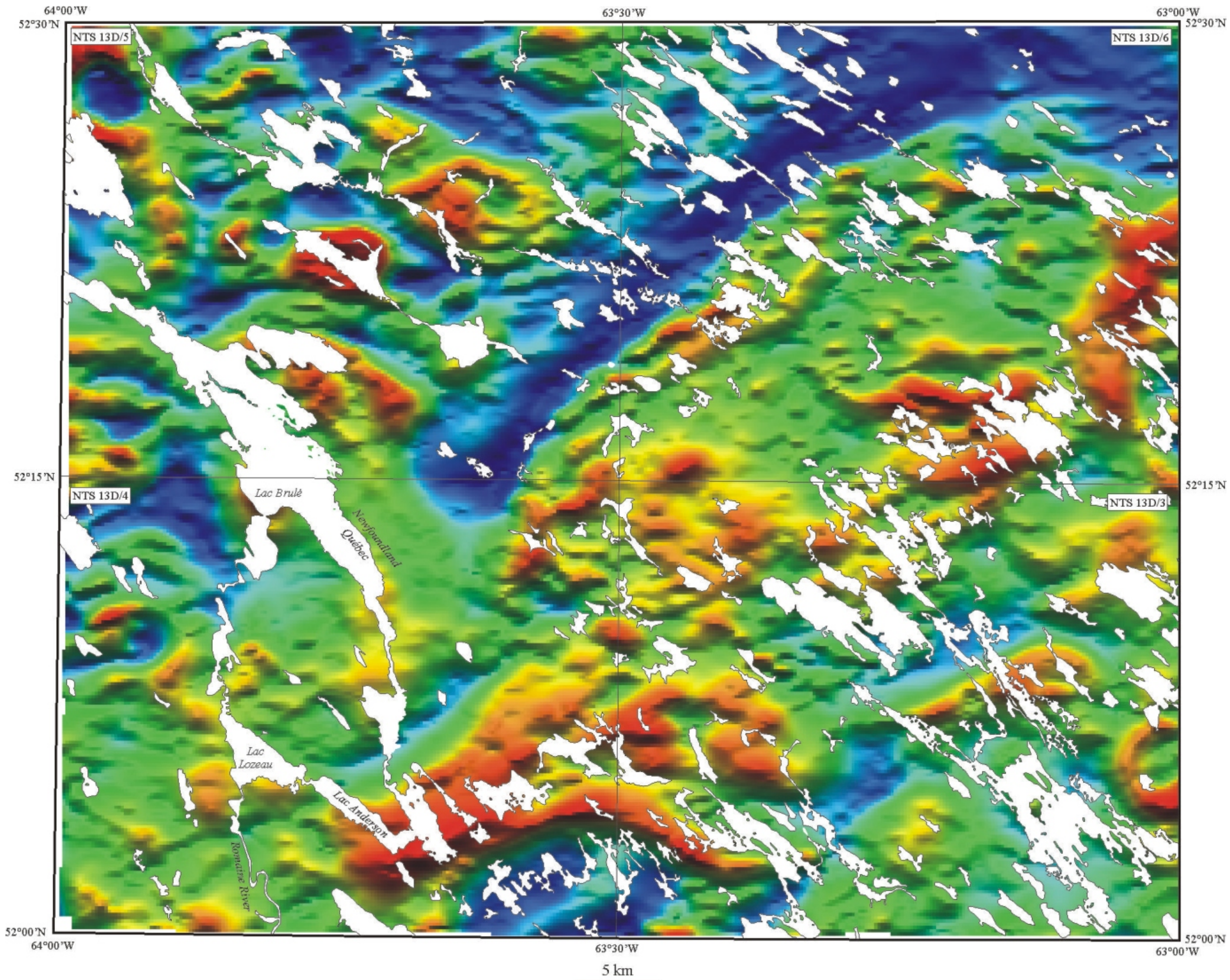

Figure 7. *Shaded-relief magnetic anomaly map of the Senécal Lake map area (NTS 13D/SW). False illumination: azimuth - 315°, inclination - 45°. Red end of the spectrum - magnetic highs; blue end of the spectrum - magnetic lows. (Map prepared courtesy of G. Kilfoil, Geochemistry, Geophysics and Terrain Sciences Section, Geological Survey of Newfoundland and Labrador).*

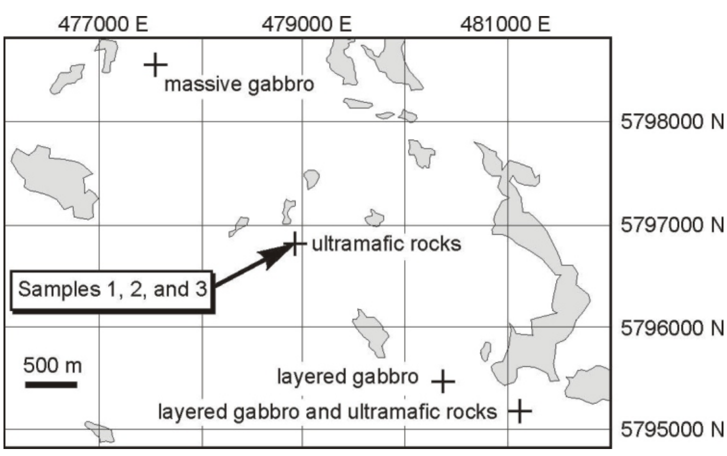

Figure 8. *Detailed location map and UTM grid for part of map area NTS 13D/6. Map shows collection location for Samples 1, 2, and 3. The '+' signs indicate locations of outcrops mapped in 2001. Lakes and ponds are marked by the grey fill pattern.*

Table 1. PGE results for Samples 1, 2 and 3 Also shown are analytical results and compositions for two standards, WMG-1 and FA-10R. The samples were analysed by Actlabs using its 1C-Exploration method - a 30-gram fire assay with ICP-OES measurement. Detection limits are 5 ppb, 4ppb and 2 ppb for platinum, palladium and gold, respectively

Sample Number	Au ppb	Pt ppb	Pd ppb	Field Number	UTM E	UTM N	Grid Zone
Sample 1	136	168	622	NK-01-3043A	478945	5796801	20
Sample 2	63	87	272	NK-01-3043C	478945	5796801	20
Sample 3	254	191	934	NK-01-3043D	478945	5796801	20
Results for Standard WMG-1	93	732	381				
Composition of WMG-1	110	731	382				
Results for Standard FA-10R	465	466	475				
Accepted values for Standard FA-10R	450-500	450-500	450-500				

Table 2. Cr, Ni, Cu and Co results for selected samples. Analyses made by ICP-MS methods at the Geochemical Laboratory, Geological Survey of Newfoundland and Labrador, St. John's

Sample Number	Cr ppm	Ni ppm	Cu ppm	Co ppm	Field Number	UTM E	UTM N	Grid Zone
Sample 1	1209	539	2124	111	NK-01-3043A	478945	5796801	20
Sample 2	1144	434	914	113	NK-01-3043C	478945	5796801	20
Sample 3	1283	268	3077	66	NK-01-3043D	478945	5796801	20
Sample 4	13	21	196	126	DJ-01-1172B	433726	5809778	20
Sample 5	2	9	0	9	DJ-01-1172C	433726	5809778	20

of John Danby, expert pilot and bon vivant, greatly aided in the completion of our field work. The field season was a logistical success thanks to the efforts of Wayne Tuttle, based in the Geological Survey office in Otter Creek, Labrador. Our thanks to George Wheeler, Greg Baikie, and all our friends in Churchill Falls for their kind hospitality and good humour. Steve Colman-Sadd and Otto Van Breemen made visits to the field area. Bruce Ryan is thanked for his thorough review of a preliminary version of this report.

REFERENCES

Emslie, R.F.
1976: Mealy Mountains complex, Grenville Province, southern Labrador. *In* Report of Activities, Part A. Geological Survey of Canada, Paper 76-1A, pages 165-170.

Emslie, R.F. and Hunt, P.A.
1990: Ages and petrogenetic significance of igneous-charnockite suites associated with massif anorthosites, Grenville Province. Journal of Geology, Volume 98, pages 213-231.

Gower, C.F.
1996: The evolution of the Grenville Province in eastern Labrador. *In* Precambrian Crustal Evolution in the North Atlantic Region. *Edited by* T.S. Brewer. Geological Society Special Publication No. 112, pages 197-218.

Gower, C.F. and Owen, V.
1984: Pre-Grenvillian and Grenvillian lithotectonic regions in eastern Labrador - correlations with the Sveconorwegian Orogenic Belt in Sweden. Canadian Journal of Earth Sciences, Volume 21, pages 678-693.

Gower, C.F., Heaman, L.M., Loveridge, W.D., Schärer, U. and Tucker, R.D.
1991: Grenvillian granitoid plutonism in the eastern Grenville Province, Canada. Precambrian Research, Volume 51, pages 315-336.

Gower, C.F., Perreault, S., Heaman, L.M. and Knight, I.
2001: The Grenville Province in southeastern-most Labrador and adjacent Québec. Geological Association of Canada - Mineralogical Association of Canada Joint Annual Meeting, St. John's, Newfoundland, Pre-conference field excursion guide A7.

James, D.T.
1999: Geology of the Kenamu River area (NTS 13C/NE), Grenville Province, southern Labrador. Geological Survey of Newfoundland and Labrador, Depart-

ment of Mines and Energy, Open File 013C/0040, 1:100 000-scale map with descriptive notes.

James, D.T. and Lawlor, B.
1999: Geology of the Grenville Province, Kenamu River area (NTS 13C/NE), southern Labrador: Preliminary observations of Labradorian and Pre-Labradorian(?) intrusions. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 99-1, pages 59-70.

James D.T. and Nadeau L.
2000: Geology of the Minipi Lake area (NTS 13C/South): New data from the southern Mealy Mountains terrane, Grenville Province, Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 2000-1, pages 179-196.

2001a: Geology of the Fourmont Lake area (NTS 13C/SE), Grenville Province, southern Labrador. Geological Survey of Newfoundland and Labrador, Department of Mines and Energy, Map 01-19, Open File 013C/0043, 1:100 000-scale map with descriptive notes.

2001b: Geology of the Lac Arvert area (NTS 13C/SW), Grenville Province, southern Labrador. Geological Survey of Newfoundland and Labrador, Department of Mines and Energy, Map 01-20, Open File 013C/0044, 1:100 000-scale map with descriptive notes.

2001c: Geology of the Little Mecatina River area (NTS 13D/NE), Grenville Province, southern Labrador. Geological Survey of Newfoundland and Labrador, Department of Mines and Energy, Map 01-18, Open File 013D/0029, 1:100 000-scale map with descriptive notes.

2001d: Geology of the Little Mecatina River (NTS 13D/NE) and Lac Arvert (NTS 13C/SW) areas, Grenville Province, southern Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 01-1, pages 55-73.

2001e: Preliminary analyses for selected rock samples collected during the 2001 field season, Grenville Province, Southern Labrador. Newfoundland Department of Mines and Energy, Geological Survey, Open File 013D/06/0030.

James D.T., Kamo, S. and Krogh, T.
2000: Preliminary U–Pb geochronological data from the Mealy Mountains terrane, Grenville Province, southern Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 2000-1, pages 169-178.

James D.T., Kamo, S. Krogh T. and Nadeau L.
2001: Preliminary U–Pb geochronological data from Mesoproterozoic rocks, Grenville Province, southern Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 01-1, pages 45-53.

This volume: Preliminary report on U–Pb ages for intrusive rocks from the western Mealy Mountains and Wilson Lake terranes, Grenville Province, southern Labrador.

Krogh, T.E., Gower, C.F. and Wardle, R.J.
1996: Pre-Labradorian crust and later Labradorian, Pinwarian and Grenvillian metamorphism in the Mealy Mountains terrane, Grenville Province, eastern Labrador. *In* Proterozoic Evolution in the North Atlantic Realm. *Compiled by* C.F. Gower. COPENA-ECSOOT-IBTA conference, Goose Bay, Labrador, Program and Abstracts, pages 106-107.

Nadeau, L. and James, D.T.
2001: Preliminary note on the lithogeochemistry and petrogenesis of intrusive rock suites from the Minipi Lake region (NTS map area 13C/south), Grenville Province, Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey, Report 01-1, pages 75-87.

This volume: Preliminary note on the lithogeochemistry and petrogenesis of intrusive rock suites from the Lac Brûlé region (NTS map area 13/D) Grenville Province, Labrador.

Nunn, G.A.G.
1990: Geology of the Atikonak Lake map area, 23A/NE. Map 87-09. Scale: 1:100 000. Newfoundland Department of Mines and Energy, Geological Survey Branch.

Nunn, G.A.G., Emslie, R.F., Lefebvre, C.E., Noel, N. and Wells, S.
1986a: The Atikonak River massif and surrounding area, western Labrador and Québec. *In* Current Research. Newfoundland Department of Mines and Energy, Report 86-1, pages 125-145.

Nunn, G.A.G., Emslie, R.F., Lefebvre, C.E., Noel, N. and Wells, S.
1986b: Geology of the Atikonak River Massif - north

part (23A/SE), southwestern Labrador and Quebec. Map 86-67. Scale: 1:100 000. Newfoundland Department of Mines and Energy, Mineral Development Division.

Nunn, G.A.G., Noel, N. and Wells, S.
1986c: Geology of the Atikonak River Massif - south part (22P/NE), southwestern Labrador and Quebec. Map 86-68. Scale: 1:100 000. Newfoundland Department of Mines and Energy, Mineral Development Division.

Perreault, S. and Jacob, H-L.
1999: Les minéraux industriels en Minganie: une ressources exploitée depuis 75 ans. Explorer au Québec: Le défi de la connaissance. Programme et résumes, 1999, page 62.

Sharma, K.N.M. and Franconi, A.
1975: Magpie, Saint Jean, Romaine Rivers area. Québec Ministère des Richesses Naturelles, Geological Report 163, 73 pages.

Stevenson, I.M.
1969: Lac Brule and Winokapau Lake map-areas, Newfoundland and Quebec (NTS 13D, 13E). Geological Survey of Canada, Paper 67-69, 15 pages (includes Geological Survey of Canada Map 26-1967 (Lac Brule), scale: 1:253 440).

Thomas, A., Culshaw, N.G. and, Currie, K.L.
1994: Geology of the Lac Ghyvelde - Lac Long area, Labrador and Quebec. Geological Survey of Canada, Bulletin 448, 37 pages.

Wardle, R.J., Crisby-Whittle, L.V.J. and Blomberg, P.
2000: Bedrock geology map of the Minipi River area (13C/NW), Labrador. Newfoundland and Labrador Department of Mines and Energy, Geological Survey, Open File 013C/0042. Map 2000-13, Scale: 1:100 000.