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GEOLOGY OF THE KENEMICH RIVER MAP AREA (NTS 13G/SW), LABRADOR

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ABSTRACT

Most of the map area is underlain by the Mealy Mountains Intrusive Suite, a bimodal spatial association of anorthositic and younger pyroxene-bearing monzonitic and granitic rocks, which have yielded dates of ca. 1650 – 1630 Ma in adjacent areas to the east and northeast. The anorthositic rocks consist of leucotroctolite, leuconorite and anorthosite. Monzonite and quartz monzonite constitute most of the younger group of rocks.

The suite contains outcrop- to map-scale granulite-facies inclusions of paragneiss, basic pyroxene granulite and granite, which are of assumed Labradorian metamorphic age (1665 ± 10 Ma). The anorthositic rocks are mostly undeformed whereas the monzonitic rocks contain widespread recrystallization, which is commonly associated with a weakly to moderately developed foliation. The recrystallized rocks and adjacent pristine monzonite are all anhydrous pyroxene-bearing rocks.

In the northwest of the map area, a fault scarp separates the Mealy Mountains Intrusive Suite from the inferred presence of late Neoproterozoic terrestrial red beds of the Double Mer Formation, which are also inferred to underlie a half-graben in the western part of the map area. The Double Mer Formation is blanketed by recent marine-terrace deposits in the northwest and by drift in the west and is not exposed in the map area.

INTRODUCTION

The map quadrant 13G/SW (NTS map areas 13G/3, 4, 5 and 6) forms the western half of a two-part 1:100 000-scale mapping project by the Newfoundland Department of Natural Resources, which investigated the Mealy Mountains Intrusive Suite (MMIS) and its country rocks. This quadrant is centred 60 km east of Goose Bay, Labrador (Figure 1). The eastern part of the project (quadrant 13G/SE; NTS map areas 13G/1, 2, 7 and 8) is described by Gower and van Nostrand (*this volume*). These areas were previously covered by the 1:250 000-scale mapping of Eade (1962) and Emslie (1976, and unpublished data).

The eastern portion of the 13G/SW quadrant was mapped from a joint base camp established on Muskrat Lake near the boundary between the two project quadrants; the western part was mapped out of Goose Bay. In the northeastern part of the area, the work was augmented by R.F. Emslie of the Geological Survey of Canada. Mapping consisted of a combination of ground and helicopter traversing. Only a reconnaissance-style coverage was attained over most of the area and several small areas were not visited.

The Mealy Mountains Intrusive Suite (Gower and van Nostrand, *this volume*) underlies an upland massif consisting of a moderately dissected peneplain of 550 to 600 m elevation that rises gently in the northeast corner of the map area and contains scattered residual peaks of 750 to 800 m. In the north, the valleys are narrow and in the south they become increasingly broad and small areas of swampy ground are more common. The peneplain is bounded on its northwestern side by a fault scarp 400 to 500 m in height, which crosses NTS map area 13G/5 diagonally from northeast to southwest. Northwest of the scarp, a low-lying plain, comprising several marine-terrace levels, borders the tidal waters of Lake Melville (Plate 1).

Where the drainage flows northward over the scarp, the rivers are deeply incised and gorges of 200 to 400 m deep are common. The largest of these, the Kenamu River, dissects the westernmost part of the plateau. Rapid headward erosion by these rivers and their major tributaries has resulted in river capture of many of the headwater streams of the formerly southeastward-directed regional drainage pattern in the northwest half of the map area.

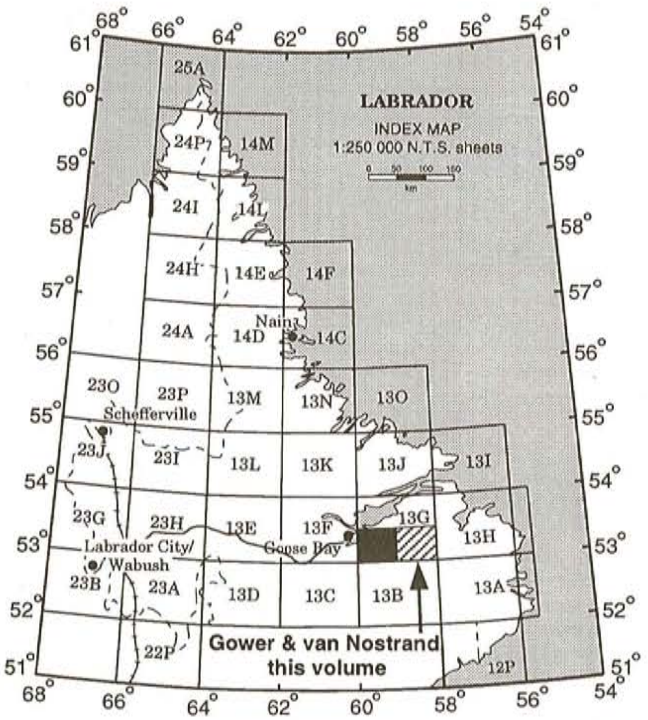

Figure 1. *Location of the Kenemich River map area (NTS 13G/SW), Labrador.*

Plate 1. *Lake Melville and the adjacent plain, which is capped by marine terrace deposits in the Lake Melville Graben. Looking northwest from near the top of the fault scarp, forming the southern margin of the graben.*

Close to the scarp, the underlying rock types are well exposed and there are large barren areas. Southward, the tree cover gradually increases through scattered scrub to thick woodland containing numerous small outcrops.

REGIONAL SETTING

The study area lies within the Grenville Province of southeastern Labrador (Figure 2). Most of this area is in the Mealy Mountains terrane (MMT), one of several thrust-stacked terranes situated in an 80- to 150-km-wide zone south of the Grenville Front (Gower *et al.*, 1980), termed the Exterior Thrust Belt (Gower *et al.*, 1994). Within the Exterior Thrust Belt, the MMT oversteps the Lake Melville terrane onto the Groswater Bay terrane, the lowest terrane in the thrust stack.

All three terranes are composed mostly of rocks belonging to the Labrador Orogen, an orogenic cycle consisting mainly of pre-orogenic sedimentation (ca. 1750 to 1680 Ma), mostly high-grade deformation and metamorphism (ca. 1670 to 1620 Ma), and syn-, late and posttectonic plutonism (ca. 1660 to 1610 Ma), as outlined by Schärer *et al.* (1986), Schärer and Gower (1988), Gower (1990), Wardle *et al.* (1990), Gower *et al.* (1992), and Bussy *et al.* (1995).

South of the study area, the ground is unmapped at 1:100 000 scale and is covered only by the smaller scale mapping of Eade (1962). The MMT is possibly in contact with the Pinware terrane, a younger cycle of metasedimentary and metaplutonic rocks that is intruded by Grenvillian plutons and forms part of the Interior Magmatic Belt of Gower *et al.* (1994). This relationship has been reported from farther east (*ibid.*).

The thrust stacking of the various terranes is Grenvillian (Wardle *et al.*, 1986; Rivers *et al.*, 1989; Bussy *et al.*, 1995); however, Grenvillian thermotectonic effects are largely confined to the terrane boundaries (Schärer and Gower, 1988; Bussy *et al.*, 1995), and deformation and metamorphism within the MMT are thought to be related to the Labrador Orogeny.

In the local area, the toe of the MMT is overprinted by the Lake Melville graben, a late Precambrian structure that probably has dropped Neoproterozoic red beds down into Labradorian rocks (Erdmer, 1984; Gower *et al.*, 1986; Murthy *et al.*, 1992). The presence of the red beds around the southwestern end of Lake Melville is inferred from their occurrence in the graben north of Lake Melville (Gower *et al.*, 1986) and from neptunian dykes in MMIS rocks on the south shore of Lake Melville north-northeast of the map area (Emslie, 1976). The fault scarp that traverses the study area forms the southern margin of the graben.

GENERAL GEOLOGY

Most of the map area is underlain by the MMIS. The suite is bimodal and consists of anorthositic rocks, chiefly leucotroctolite, leuconorite and anorthosite; and monzonitic rocks, chiefly monzonite and quartz monzonite with minor granite.

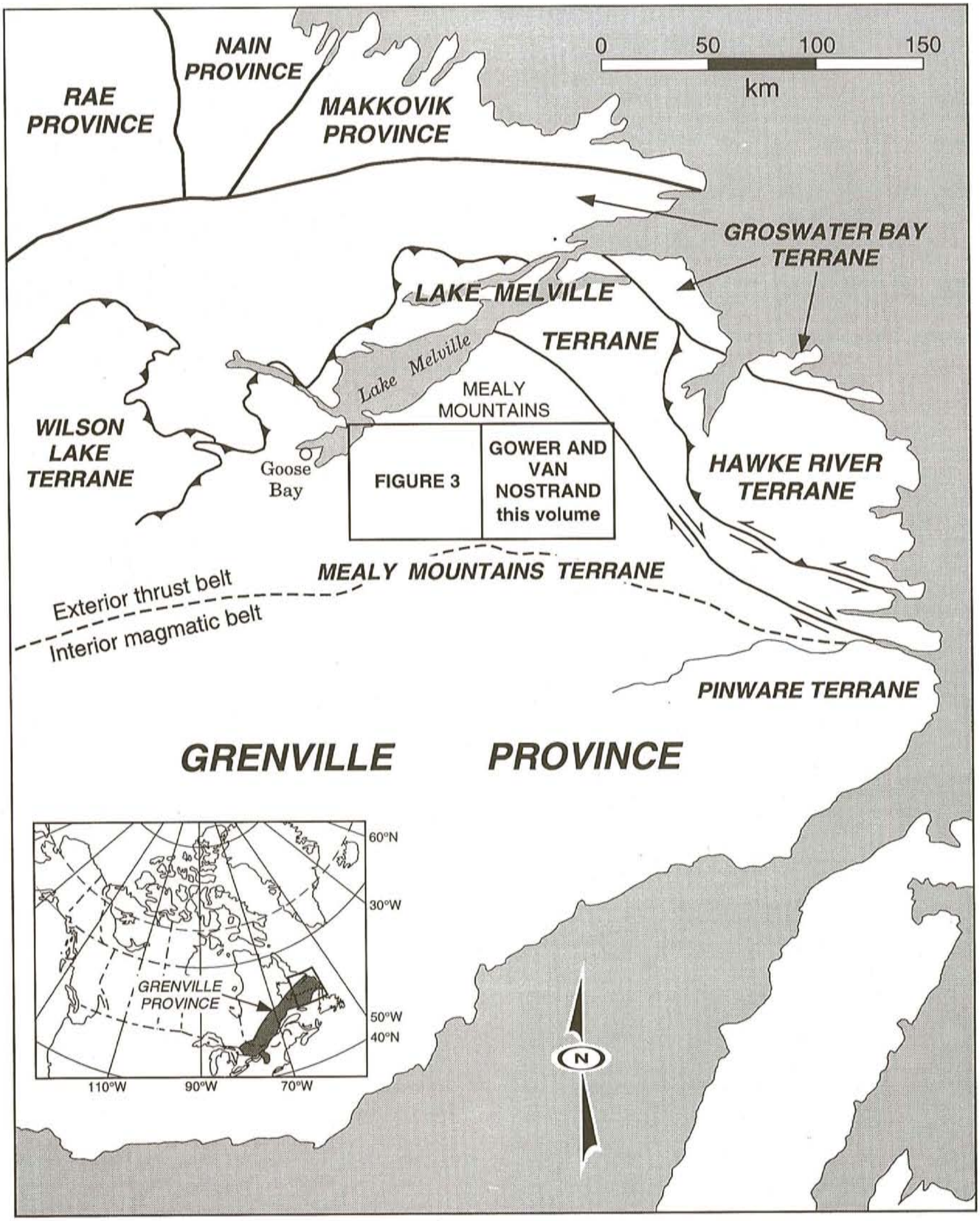

Figure 2. *Structural setting of the map area, Mealy Mountains terrane, eastern Grenville Province, Labrador (modified from Gower and van Nostrand,* this volume*).*

Scattered throughout the MMIS are areas and inclusions of older rocks. Pyroxene granulite, granite, diatexite, glassy and/or feldspathic rocks and basic rocks constitute this varied group. Younger rocks than the MMIS occur in the northwest and west of the map area, in the Lake Melville graben and a related half-graben, respectively, where red beds of the Double Mer Formation are thought to underlie recent marine-terrace deposits and drift.

The distribution of the various rock types is shown in Figure 3. Individual members of a swarm of post-MMIS, pre-graben diabase dykes are too small to be shown on the map.

UNIT DESCRIPTIONS

Inclusions of Older Rocks

Pyroxene granulites are fine-grained, grey, light-grey- to cream-weathering, equigranular feldspathic rocks that have a metamorphic texture. Plagioclase is the dominant mineral; it occurs with clinopyroxene ± orthopyroxene ± biotite and minor opaque oxide and quartz. These minerals define a gabbroic to enderbitic composition. Locally, the presence of K-feldspar indicates a monzodiorite composition. Most mineral species exhibit a weak grain-orientation fabric; the biotite mineral fabric is better developed and, rarely, also forms clots. Rare, fine- to medium-grained, millimetre-scale neosomes are concordant or discordant to the mineral fabric, locally follow shears, are generally isotropic and commonly concentrate quartz, K-feldspar (where present) and porphyroblastic clinopyroxene.

Granite inclusions are fine- to medium-grained, grey to pinkish-brown, equigranular or quartz-porphyritic rocks that are isotropic or foliated.

Very rare, fine-grained, grey, light-weathering, homogeneous, *glassy* inclusions may be metasedimentary hornfels. Their composition is unknown and the glassy appearance could be due to siliceous, feldspathic or cordierite-rich compositions, or to thermal metamorphism.

Variable, mostly medium-grained, grey, inequigranular, isotropic or foliated, massive or layered rocks consisting of feldspar, quartz and pyroxene ± biotite ± cordierite ± garnet constitute most of the *diatexite*. Layers occur at centimetre to decimetre scale and consist of compositional and grain-size variations. Within layers, the refractory-mineral species generally are unevenly distributed among the felsic minerals; differentiation into restite and neosome location fabrics is less common. A polygonal to anhedral granoblastic recrystallization is common and well-developed mineral fabrics are rare. Locally, the diatexite contains a layering of lenses of a finer grained, biotite-bearing felsic rock, which may represent disrupted layers of a more hydrous protolith (Plate 2).

Plate 2. *Garnetiferous diatexite containing a lens of layered, biotite-bearing paragneiss (lower centre of picture).*

Some decimetre-scale, brown-weathering, pyroxene-bearing felsic layers may be recrystallized monzonitic sheets rather than parts of the paragneiss. Fine-grained, black, concordant mafic layers, up to 25 cm wide, could be intercalated supracrustal basic rocks or mafic dykes. Some mafic layers exhibit boudinage.

Pre-foliation, pink granitic dykes are moderately to tightly infolded with the diatexite south of Muskrat Lake.

Fine-grained, grey, buff-weathering, equigranular, centimetre-scale layers of *feldspathic rock* intercalated with diatexite may represent more psammitic layers within the paragneiss sequence.

A large outcrop of fine-grained, dark-grey, equigranular, foliated plagioclase–biotite rock forms a single area of *basic rock* about 8 km south of Muskrat Lake.

Wherever the inclusions of older rocks have been observed in contact with dykes or host rocks of the MMIS, the latter crosscut the layering and postdate the foliation in the inclusions.

Mealy Mountains Intrusive Suite

The geology of the MMIS has been described by Emslie (1976) and its isotopic and mineral-chemistry data have been presented in Emslie (1985) and Emslie and Hunt (1990). The age of granitic and monzonitic members of the suite is approximately 1650 to 1630 Ma (Emslie and Hunt, 1990). In general, there is a good correlation between monzonitic rocks and aeromagnetic highs, and between anorthositic rocks and aeromagnetic lows within the MMIS.

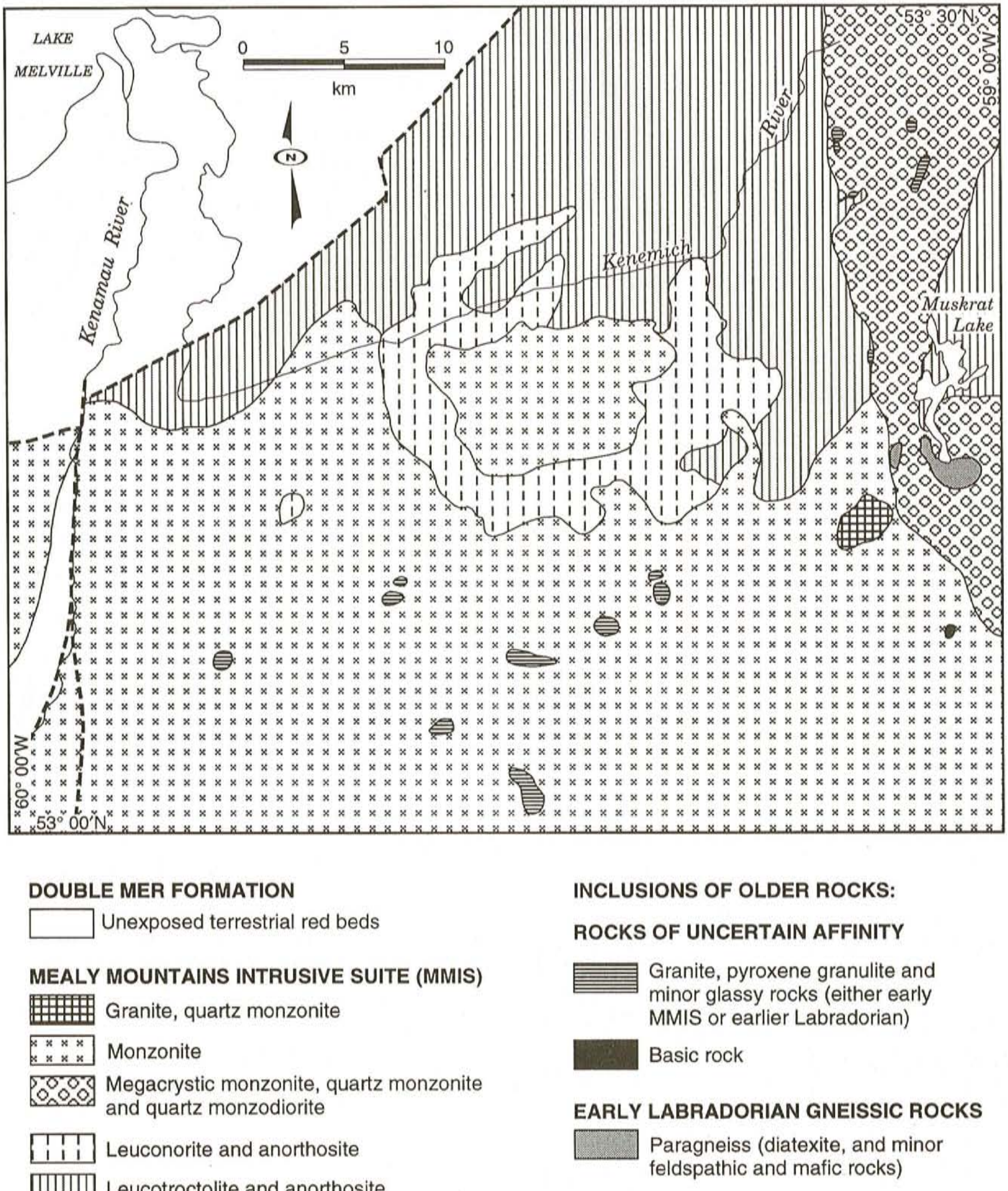

Figure 3. *General geology of the Kenemich River map area.*

Anorthositic Rocks

Leucotroctolite forms the most abundant of the anorthositic rocks. In the western parts of the outcrop area, the leucotroctolite is a coarse- to very coarse-grained rock consisting of equant to tabular, randomly oriented plagioclase laths, commonly 10 cm or more across, and interstitial olivine and minor magnetite and orthopyroxene (Plate 3). Coarse-grained to pegmatitic patches, 1–6 m across and containing plagioclase laths up to 1.3 m in length, are common (Plate 4); these may be relatively olivine, orthopyroxene or oxide rich. The very coarse-grained facies contain rafts of troctolite, leucotroctolite and anorthosite, which commonly are layered and/or laminated and are typical of much of the remaining outcrop areas of the leucotroctolite (see below). The rafts range from several metres to several decametres across.

Plate 3. *Coarse-grained, isotropic leucotroctolite consisting of random, equant to somewhat tabular laths of plagioclase and intergranular olivine and magnetite.*

Plate 4. *Coarse-grained, intergranular-textured patch of magnetite-oxide-rich troctolite.*

The remaining areas of leucotroctolite and anorthosite (Figure 3) contain a wide variety of textural and compositional features. Coarse-grained (1 to 4 cm), equant to tabular, isotropic or laminated, dark-grey cumulus plagioclase, with a medium- to coarse-grained intercumulus component of varying amounts of olivine, plagioclase, magnetite and orthopyroxene, form the most abundant rock types (e.g., Plate 5). The intercumulus olivine commonly is concentrated in irregular, decimetre- to metre-scale ovoid patches of leucotroctolite or troctolite surrounded by an anorthosite or low-colour-index leucotroctolite host. The relatively olivine-rich patches commonly coalesce to enclose patches of anorthosite. In both cases, the resultant bulk composition falls within the leucotroctolite field (colour index 5 to 25). Small variations within these relationships locally define planar boundaries, but most outcrops are homogeneous.

Plate 5. *Typical appearance of laminated hypersthene leucotroctolite. The intercumulus dark minerals in the centre and left of the picture are mostly olivine and minor magnetite; the hypersthene occurs in the less obviously laminated part of the rock below and right of the clinometer.*

Locally, anorthosite forms a significant compositional variant in areas ranging from outcrop size to several kilometres across. The presence of plagioclase megacrysts is the most conspicuous textural variation (Plate 6). Megacrysts usually form 5 to 10 percent of the rock but may constitute as much as 30 percent. Mostly they are 6 to 15 cm across and some have been noted to be around 80 cm. Tabular megacrysts commonly define a lamination.

Layering occurs in many areas and is defined by changes in composition, grain size (Plate 7), texture or combinations of these. The layering is present at scales ranging from a half metre to at least several tens of metres. Some layers contain blocks of other layered facies. Coarse-grained to pegmatitic patches are present in all compositional and textural rock types. The patches are isotropic, 0.3 to 2 m across, and either

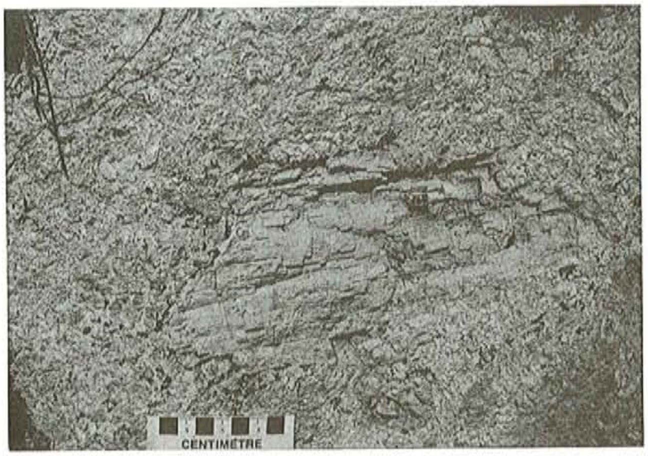

Plate 6. *Plagioclase megacryst, 25 cm long, set in medium- to coarse-grained anorthosite.*

Plate 7. *Layering of coarse-grained (left) and medium- to coarse-grained (right) leucotroctolite.*

contain tabular plagioclase laths, which enclose intersertal areas of olivine and minor magnetite ± orthopyroxene, or contain subequant plagioclase and anhedral grains or aggregates of these same ferromagnesian species (Plate 8).

Plate 8. *Coarse- to very coarse-grained patch of subequant plagioclase laths and anhedral olivine and magnetite (darkest grey) in a medium-grained anorthosite groundmass.*

The area outcropping at the eastern margin of the map area is part of a discrete ovoid body that continues into the adjacent project area (Gower and van Nostrand, *this volume*). The rock is a coarse-grained leucotroctolite that commonly contains 10 to 25 percent of equant to tabular plagioclase megacrysts and coarse concentrations of rusty-weathering olivine. Layering and lamination, particularly of tabular plagioclase megacrysts (Plate 9), are common in this body. Its western edge consists of a disparate collection of medium- to coarse-grained, layered and/or laminated gabbro, gabbronorite, troctolite, leucogabbro and leucotroctolite. This body is approximately outlined by a strong aeromagnetic low.

Plate 9. *Tabular plagioclase megacrysts displaying lamination in a coarse-grained leucotroctolite groundmass; the coin is 2 cm across.*

The leuconorite and anorthosite unit (Figure 3) contains many of the same ranges of composition, texture and structure as occur in the leucotroctolite, except that olivine is not present. In general, isotropic textures (Plate 10) dominate in the leuconorite, and layering is rarely developed.

Plate 10. *Coarse-grained noritic patch in medium-grained leuconorite; both have an isotropic texture.*

Anorthositic rocks are intruded by small monzonitic dykes near the contacts with monzonitic units, and anorthosite also occurs as rare inclusions in monzonite in these areas.

Monzonitic Rocks

The main body of monzonite is medium to coarse grained and consists of 85 to 95 percent of equant feldspar, which forms an hypidiomorphic, interlocking aggregate (Plate 11). In general, there is a continuous grain-size range within a sample (Plate 11); however, locally, 1 to 2 cm grains of feldspar occur as scattered megacrysts in a medium-grained groundmass. Megacrysts form 3 to 10 percent of these rocks. The feldspars are ternary feldspars (R.F. Emslie, personal communication, 1995). Ferromagnesian minerals consist of orthopyroxene, clinopyroxene, minor opaque oxides and rare olivine. Orthopyroxene (± clinopyroxene) dominates in northern areas whereas clinopyroxene alone occurs in the south of the map area.

Weak to moderate foliations are irregularly distributed throughout the monzonite. Locally, they are associated with a compositional layering, which is defined by small variations in colour index, and may be primary. In southern areas, coarse-grained clinopyroxene-bearing segregations are also present (Plate 12).

In the east of the map area, a distinct megacrystic monzonitic body surrounds the ovoid leucotroctolite area (Figure 3). It ranges in composition from monzonite in the north to quartz monzonite and, locally, quartz monzodiorite farther south. The rock is feldspar megacrystic (generally 2 to 3 cm across) and contains a groundmass of two pyroxenes

Plate 11. *Typical monzonite texture consisting of interstitial clinopyroxene and minor magnetite moulded on variably sized equant grains of ternary feldspar.*

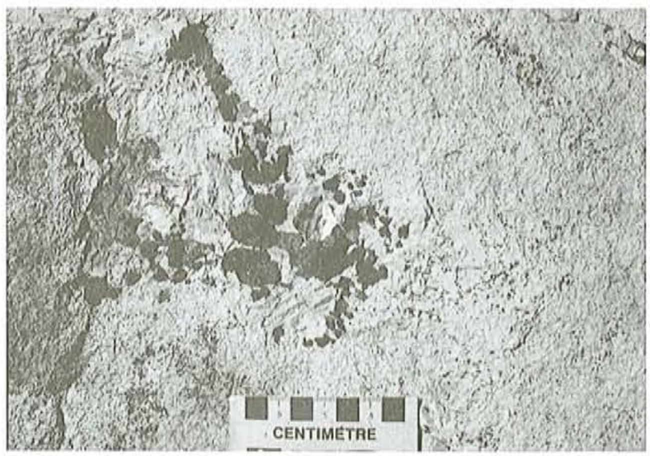

Plate 12. *Coarse-grained feldspar – clinopyroxene segregation in medium-grained, hypidiomorphic-textured monzonite.*

and opaque oxides ± quartz and plagioclase. Commonly the quartz-rich parts of the pluton are weakly to strongly foliated, and in some areas the feldspar has unmixed into plagioclase and K-feldspar during the associated recrystallization. In southern areas of this body, several sets of fine- to medium-grained monzonite and fine- to coarse-grained granite dykes are common.

A small ovoid body of granite to quartz monzonite occurs in the east of the map area. This body consists of a fine- to medium-grained, foliated, pyroxene-bearing rock or a medium- to coarse-grained, weakly foliated, megacrystic rock (Plate 13). Both contain granite and quartz-rich granitoid veins.

A partial to complete recrystallization to a fine-grained granular rock occurs in some areas of the various monzonitic

Plate 13. *Weakly foliated, feldspar-megacrystic pyroxene granite.*

rocks, with or without the development of foliation. Locally, such a rock may have replaced a grain-supported aggregate of centimetre-size feldspars that had small amounts of fine-grained ferromagnesian-bearing groundmass anastomosing around them.

Mealy Dykes

The Mealy Dykes were named, dated at 1380 ± 54 Ma (Rb – Sr errorchron) and described by Emslie *et al.* (1983, 1984).

A swarm of olivine diabase dykes intrude the MMIS (Plate 14). Most are steeply north dipping and strike around 075°. They range in width from centimetres up to tens of metres and appear to decrease in width and frequency southwards (this is also the direction of decreasing exposure).

Double Mer Formation

The Double Mer Formation is inferred to underlie the area northwest of the graben boundary fault (Gower *et al.*, 1986) but is not exposed in the map area. It is a terrestrial red-bed sequence composed mostly of conglomerate and sandstone with minor siltstone and shale (*ibid.*). Similar clastic rocks, assigned to the Double Mer Formation (Gower *et al.*, 1986), occur in the Kenamu River valley southwest of the map area and are, therefore, also inferred to occupy the half-graben in the western part of the map area.

STRUCTURAL AND METAMORPHIC HISTORY

The inclusions of older rocks contain gneissic layering and granite dykes. At the south end of Muskrat Lake, the two have been folded together and the granite dykes have an axial-planar foliation. In the paragneiss, the foliation parallels

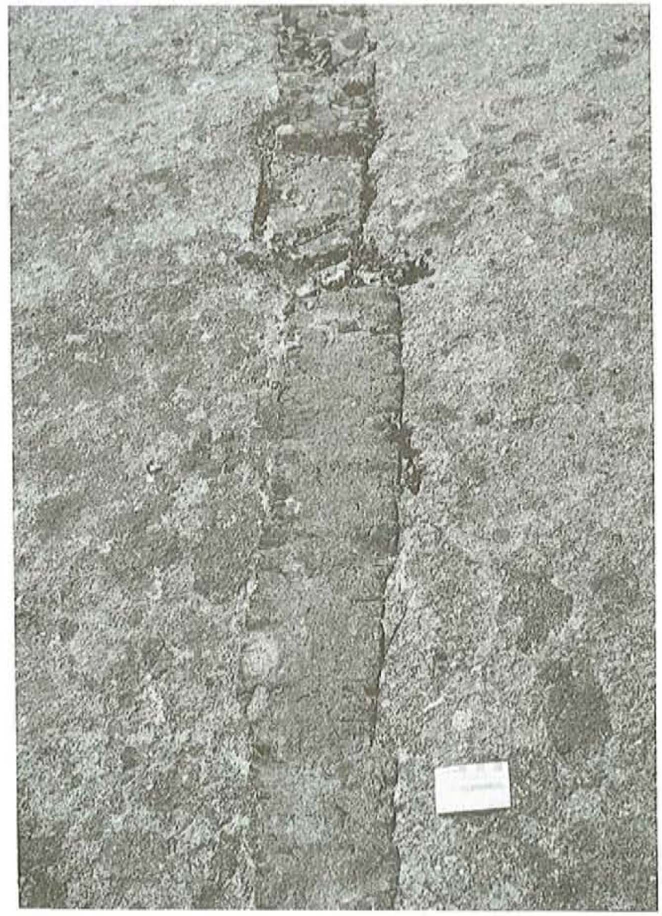

Plate 14. *Typical Mealy dyke exhibiting chilled margins.*

the gneissosity or is overprinted by a more static recrystallization, both of which occurred at granulite grade. By comparison with dated rocks to the east, these features are thought to be Labradorian (Schärer and Gower, 1988).

The emplacement of the MMIS postdates the Labradorian structures, although the static recrystallization may be related to the intrusion of this large body of high-temperature magma. The anorthositic rocks are largely unaffected by younger dynamothermal events. Except for shearing and alteration associated with brittle structures, they contain only rare high-grade ductile shears and minor grain-boundary recrystallization. The monzonitic rocks of the MMIS postdate the anorthositic rocks but are, in part, foliated or recrystallized. Both the primary and the metamorphic mineral species in the monzonitic rocks are pyroxene-bearing granulite-facies assemblages. These features may indicate a relationship between high-grade Labradorian metamorphism and emplacement of the MMIS, and perhaps a synplutonic development for the foliation in the MMIS monzonites and related rocks.

The Mealy Dykes are undeformed and, for the most part, still relatively fresh; they also exhibit chilled margins (Plate 14).

The Lake Melville graben and related faulting is probably latest Neoproterozoic or Cambrian (Gower *et al.*, 1986).

ECONOMIC GEOLOGY

Minor mineralization occurs in the inclusions of older rocks at one locality near the monzonite – leucotroctolite border in the north of the map area. It consists of several pyrite-bearing, conformable gossanous layers of from 5 to 15 cm thick, across a strike width of about 25 m, in a gneissic host.

The MMIS contains oxide concentrations. In the leucotroctolites, they consist of residual patches or pods of Fe (–Ti) oxide (Plate 15), up to a metre across, and, rarely, layered concentrations of similar texture and width. A 40-cm-wide dyke composed almost entirely of olivine and magnetite also occurs. In the monzonite, patches of magnetic oxide, 10 to 30 cm across, possibly in association with a copper mineral, are developed in one area.

Plate 15. *Irregularly shaped pod of oxide (15 by 45 cm) in coarse-grained leucotroctolite. The olivine in the leucotroctolite weathers dark red to brown.*

Although sulphide concentrations were not found, the abundant presence of olivine-bearing anorthositic rocks indicates the potential for deposits of this type (*viz.*, Ni–Cu–Co and PGEs).

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REFERENCES

Bussy, F., Krogh, T.E. and Wardle, R.J.
1995: Late Labradorian metamorphism and anorthosite–granitoid intrusion, Cape Caribou River allochthon, Grenville Province, Labrador: evidence from U–Pb geochronology. Canadian Journal of Earth Sciences, Volume 32, number 9, pages 1411-1425.

Eade, K.E.
1962: Geology, Battle Harbour–Cartwright, Labrador. Geological Survey of Canada, Map 22-1962, 1:250 000 scale.

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.

1985: Proterozoic anorthosite massifs. *In* The Deep Proterozoic Crust in the North Atlantic Provinces. *Edited by* A.C. Tobi and J.L.R. Touret. NATO Advanced Study Institute, Series C, Volume 158, pages 39-60.

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 213-232.

Emslie, R.F., Loveridge, W.D. and Stevens, R.D.
1984: The Mealy dykes, Labrador: petrology, age and tectonic significance. Canadian Journal of Earth Sciences, Volume 21, number 4, pages 437-446.

Emslie, R.F., Loveridge, W.D., Stevens, R.D. and Sullivan, R.W.
1983: Igneous and tectonothermal evolution, Mealy Mountains, Labrador. Geological Association of Canada–Mineralogical Association of Canada–Canadian Geophysical Union, Annual General Meeting, Program with Abstracts, Volume 8, page A20.

Erdmer, P.
1984: Precambrian geology of the Double Mer–Lake Melville region, Labrador. Geological Survey of Canada, Paper 84-18, 37 pages.

Gower, C.F.
1990: Mid-Proterozoic evolution of the eastern Grenville

Province, Canada. Geologiska Föreningens i Stockholm Förhandlingar, Volume 112, pages 127-139.

Gower, C.F., Erdmer, P. And Wardle, R.J.
1986: The Double Mer Formation and the Lake Melville rift system, eastern Labrador. Canadian Journal of Earth Sciences, Volume 23, pages 359-368.

Gower, C.F., Ryan, A.B., Bailey, D.G. and Thomas, A.
1980: The position of the Grenville Front in eastern and central Labrador. Canadian Journal of Earth Sciences, Volume 17, pages 785-788.

Gower, C.F., Schärer, U. and Heaman, L.M.
1992: The Labradorian orogeny in the Grenville Province, eastern Labrador, Canada. Canadian Journal of Earth Sciences, Volume 29, pages 1994-1957.

Gower, C.F. and van Nostrand, T.
This volume: Geology of the southeast Mealy Mountains region, Grenville Province, southeast Labrador.

Gower, C.F., van Nostrand, T. and Evans-Lambswood, D.
1994: Geology of the Pinware River region, southeast Labrador. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 94-1, pages 347-369.

Murthy, G., Gower, C., Tubrett, M. and Pätzold, R.
1992: Paleomagnetism of Eocambrian Long Range dykes and Double Mer Formation from Labrador, Canada. Canadian Journal of Earth Sciences, Volume 29, pages 1224-1234.

Rivers, T., Martignole, J., Gower, C.F. and Davidson, A.
1989: New tectonic divisions of the Grenville Province, southeast Canadian Shield. Tectonics, Volume 8, pages 63-84.

Schärer, U. and Gower, C.F.
1988: Crustal evolution in eastern Labrador: constraints from precise U–Pb ages. Precambrian Research, Volume 38, pages 405-421.

Schärer, U., Krogh, T.E. and Gower, C.F.
1986: Age and evolution of the Grenville Province in eastern Labrador from U–Pb systematics in accessory minerals. Contributions to Mineralogy and Petrology, Volume 94, pages 438-451.

Wardle, R.J., Rivers, T., Gower, C.F., Nunn, G.A.G. and Thomas, A.
1986: The northeastern Grenville Province: new insights. *In* The Grenville Province. *Edited by* J.M. Moore, A. Davidson and A. Baer. Geological Association of Canada, Special Paper 31, pages 31-29.

Wardle, R.J., Ryan, B., Philippe, S. and Schärer, U.
1990: Proterozoic crustal development, Goose Bay region, Grenville Province, Labrador, Canada. *In* Mid-Proterozoic Laurentia–Baltica. *Edited by* C.F. Gower, T. Rivers and A.B. Ryan. Geological Association of Canada, Special Paper 38, pages 197-214.