Current Research (1987) Newfoundland Department of Mines and Energy,
Mineral Development Division, Report 87-1, pages 225-235

GEOLOGY OF THE LAC CAOPACHO–LAC FLEUR-DE-MAY AREA, SOUTHWESTERN LABRADOR

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ABSTRACT

Mapping within the Lac Caopacho–Lac Fleur-de-May area has revealed two structurally and lithologically distinct terranes. The eastern terrane is underlain by a ca. 1650-Ma-old sequence of upper-amphibolite to granulite-grade, pelitic, semipelitic, psammitic and mafic paragneiss, which have been intruded by basic and acid intrusive rocks of post-1650 Ma age. The western terrane is underlain by a metagabbro unit, which is correlated with the 1400-Ma-old Shabogamo Intrusive Suite, and granitoid intrusive rocks. Rocks within the poorly exposed boundary zone between these two terranes are strongly foliated, and are characterized by moderately developed straight magnetic patterns. The gneiss-forming event at ca. 1650 Ma resulted in strong gneissic banding and mineral fabrics within the supracrustal rocks, and a regionally pervasive mineral assemblage of K-feldspar–plagioclase–quartz–sillimanite–biotite–magnetite–garnet within the pelitic paragneiss. Both terranes subsequently experienced a northwest–southeast shortening, which resulted in extensive refolding of the earlier gneiss fabric within the eastern terrane and the development of the first tectonic fabrics within the western terrane. This phase of deformation is thought to have deformed a granitoid body that has yielded a preliminary U–Pb date of ca. 1100 Ma, suggesting a Grenvillian age for the refolding event. Large-scale folds within the western terrane and locally developed small-scale folds in the eastern terrane, which display a common northwest trend, indicate the area was subsequently subjected to a northeast–southwest shortening that is interpreted to have occured continuously with the Grenville-aged refolding event. The eastern gneiss terrane and the western intrusive terrane are thought to correlate with the allochthonous and parautochthonous terranes respectively, as defined by Rivers and Nunn (1985), where the allochthonous terranes have been thrust to the northwest over the telescoped parautochthonous terrane.

INTRODUCTION

Project Description

The 1986 mapping program continued the regional mapping initiated in 1982, and is presently operating under the Canada–Newfoundland Mineral Development Agreement, 1984–1989. The project consists of 1:100,000 scale regional mapping of a 6000-km² map area located about 60 km south-southeast of Wabush along the Quebec–Labrador border (Figure 1). It comprises NTS map areas 23A/3, 4, 5 and 6, and those parts of map areas 23B/1, 23B/8 and 22P/14 within Labrador. Some reconnaissance mapping was carried out within Quebec to assist the interpretation of the geology within Labrador.

Access and Topography

The Q.N.S. & L. Railway line between Sept Iles and Schefferville cuts through the central part of the map area and provided transportation for fuel and equipment. The eastern and western areas are accessible only by float plane or helicopter. An electric powerline transects the eastern region.

The western part of the map area is dominated by poorly drained, string-bog-covered lowland areas that are sparsely exposed. In contrast, the eastern region is dominated by upland areas that have moderate exposure along the tops and sides of hills.

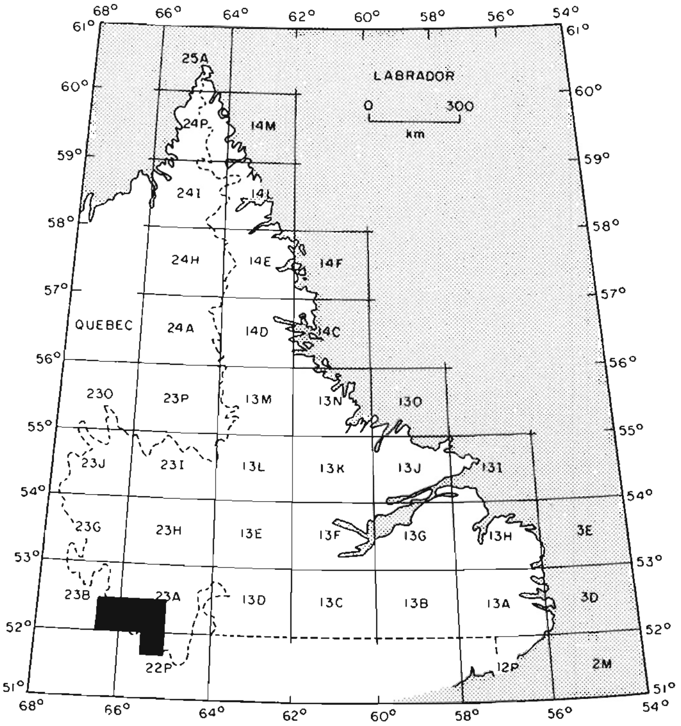

Figure 1: *Location map of the Lac Caopacho–Lac Fleur-de-May map area.*

This project is a contribution to the Canada–Newfoundland Mineral Development Agreement, 1984–1989

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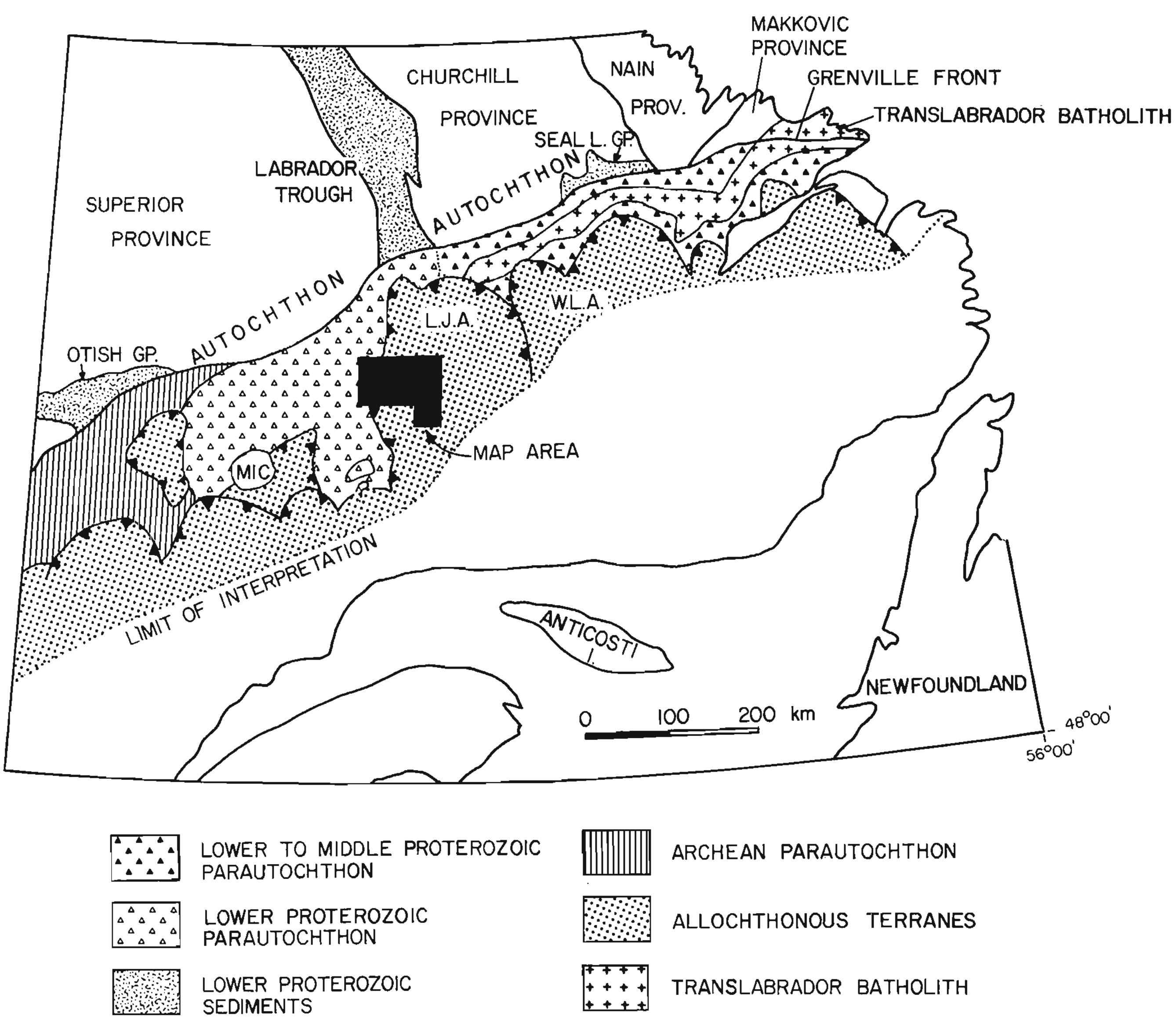

Figure 2: *Tectonic subdivisions of the Grenville Orogen in Labrador and Québec. Lithologic units that can be traced from autochthon to parautochthon are shown. L.J.A.—Lac Joseph Allochthon (from River and Chown, 1986).*

Previous Work

The area covered by NTS map sheet 23A was previously mapped and described by Stevenson (1968) at 1:250,000 scale. The western region (NTS sheets 23B/1 and 8) has been mapped by Jackson (1976) at 1:100,000 scale.

Regional Setting

Recent work in western Labrador (Rivers, 1983; Rivers and Nunn, 1985; Rivers and Chown, 1986; Wardle *et al.*, 1986; and Thomas *et al.*, 1985) has subdivided western Labrador into an autochthon, a parautochthon and a number of allochthons (Figure 2) on the basis of radiometric dating and thermotectonic histories. The autochthon consists of Kenoran and Hudsonian gneisses of the Superior and Churchill provinces respectively, deformed Aphebian sedimentary rocks of the Knob Lake Group, and Helikian cover sequences that were undeformed prior to the Grenvillian Orogeny. The parautochthon in southwestern Labrador comprises Knob Lake Group, which was undeformed prior to the Grenvillian Orogeny, and high-grade gneisses and plutonic rocks that are part of the ca. 1650-Ma Labradorian Orogeny (Nunn *et al.*, 1984; Nunn *et al.*, 1985; and Thomas *et al.*, 1985). The parautochthon underwent metamorphism up to amphibolite facies during the Grenvillian Orogeny (Rivers and Nunn, 1985; Rivers and Chown, 1986). The allochthons comprise Labradorian-aged amphibolite- to granulite-grade paragneisses that are intruded by basic and acid plutonic rocks, and are interpreted to have been emplaced on top of the telescoped parautochthonous terrane (Rivers and Nunn, 1985; Rivers and Chown, 1986). The concordant nature of the U–Pb dates (ca. 1650 Ma) from the allochthonous terranes suggests that they did not undergo extensive thermal reworking during the Grenville Orogeny.

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The objectives of this project, aside from regional mapping, are to confirm the presence of the Lac Joseph Allochthon and adjacent parautochthon in this area, to establish the tectonometamorphic history of these two terranes with special interest in the effects of the Grenville Orogeny on the allochthon, and to investigate the nature of the terrane boundary.

GENERAL GEOLOGY

The map area (Figure 3) may be divided, on the basis of rock types, structure, limited geochronological data, aeromagnetic patterns, and physiography, into two terranes: a western terrane comprising suites of basic and acid plutonic rocks; and an eastern terrane that is underlain by pelitic, semipelitic and basic paragneiss, which is intruded by basic and acid plutonic rocks. The eastern terrane exhibits greater magnetic intensities and variations and shows more clearly defined linear patterns than the western terrane (Geological Survey of Canada, 1977). The boundary zone beween the terranes is dominated by granitoid rocks, which express moderately developed straight magnetic patterns.

Eastern Terrane

The eastern terrane is predominantly underlain by pelitic paragneiss (subunit 1a). Although variable in composition and appearance, it is commonly composed of thin (0.5 to 2 cm), dark-grayish-blue restite seams of sillimanite–biotite–magnetite–garnet interlayered with a pink, medium grained K-feldspar–plagioclase–quartz leucosome that varies in width from 1 to 10 cm (Plate 1). The concordant leucosome and restite layers form a strong gneissic banding, which is locally cross-cut by a late leucosome phase (Plate 2).

Plate 1: *Northeast-trending F_{2e} folds in sillimanite-bearing paragneiss (subunit 1a).*

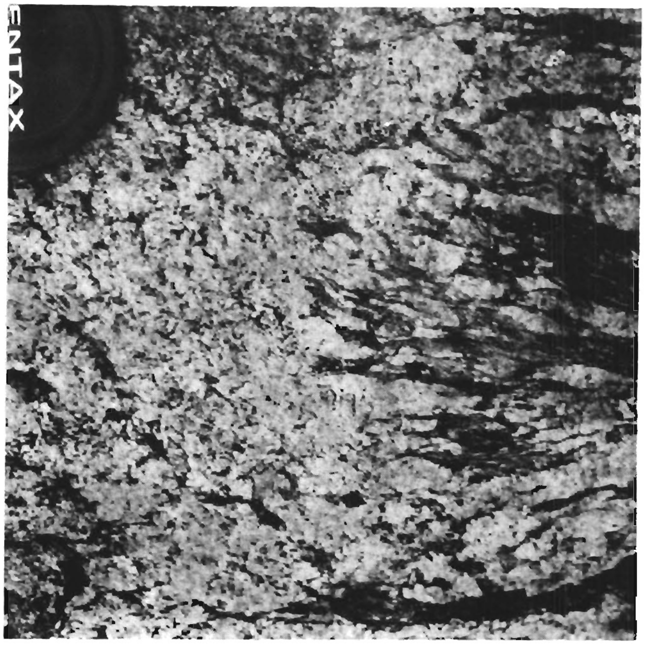

Plate 2: *Late leucosome phase cross-cutting the S_{1e} gneissosity in sillimanite-bearing paragneiss (subunit 1a).*

The sillimanite-bearing paragneiss is interlayered with minor amounts of semipelitic and psammitic gneiss, which lack an aluminosilicate phase and are generally richer in quartz and feldspar. Rocks of psammitic composition tend to be poorly layered, and, perhaps in part due to the limited exposure, cannot be mapped along strike as continous layers. Several outcrops of white, coarse grained marble (subunit 1e) are located in the northeast corner of the map area.

Muscovite-bearing paragneiss (subunit 1b) underlies the eastern part of the map area along the contact of the granitic rocks, and along the western margin of the eastern terrane. This unit is thought to be similar in composition and structure to the sillimanite-bearing paragneiss. It typically comprises narrow restite seams of muscovite–biotite–garnet–magnetite interlayered with wider, light-gray leucosome layers of plagioclase–quartz–K-feldspar to form a strong gneissosity (Plate 3).

Pelitic paragneiss containing both sillimanite and muscovite (subunit 1c) is spatially associated with subunit 1b. Although sillimanite typically occurs within the restite and muscovite generally occurs in the leucosome, both minerals may coexist within the restite. This unit also appears to be similar in structure and composition to the sillimanite-bearing paragneiss.

The mafic gneiss (subunit 1d) is interlayered, on the scale of an outcrop to several outcrops, with the pelitic paragneiss, and varies in appearance from straight, banded gneiss to an agmatitic rock where blocks of paleosome are disrupted by neosome dikes (Plate 4). The paleosome typically comprises plagioclase–clinopyroxene–orthopyroxene–hornblende,

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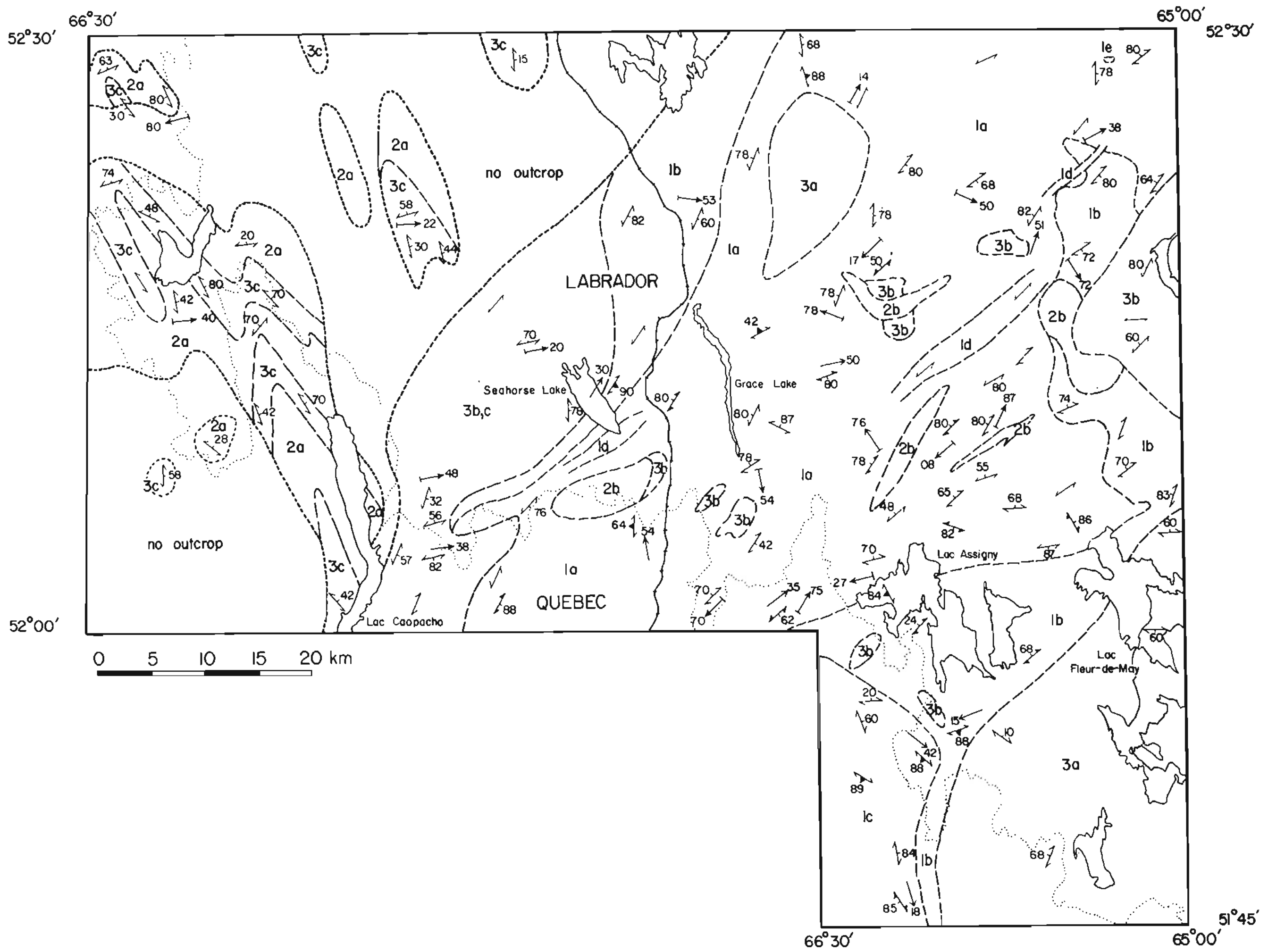


Figure 3: *Geology and structure of the Lac Caopacho–Lac Fleur-de-May area.*

whereas the crosscutting to concordant neosome contains plagioclase and orthopyroxene. The scale of interlayering suggests that subunit 1d probably represents volcanic layers within the pelitic sedimentary rocks, and, perhaps locally, mafic dikes.

The paragneisses of Unit 1 are intruded by basic plutonic rocks (subunit 2b) that range in compostion from norite to gabbro, but are dominated by gabbronorite. These composite plutonic bodies are medium to coarse grained rocks that lack the strong penetrative fabrics present in Unit 1. They commonly exhibit well preserved igneous textures, but primary igneous layering was not observed. The dominant minerals are plagioclase, clinopyroxene and/or orthopyroxene and oxides; olivine locally forms cores to a plagioclase–clinopyroxene corona.

Granitoid rocks within the eastern terrane vary in composition from granite to tonalite, and in texture from equigranular to megacrystic. The most extensive area of granitoid rocks occurs along the eastern margin of this terrane. These rocks are internally homogeneous, typically xenolith free and exhibit abrupt contacts with the country rocks. The batholith in the southeast region (subunit 3a) is a medium grained, K-feldspar-megacrystic, hornblende–biotite granite (Plate 5) that has a localized, weakly developed tectonic fabric. The plutonic body north of Lac Fleur-de-May (subunit 3b) is dominated by weakly to moderately foliated, equigranular, medium grained, hornblende–biotite granite and subordinate amounts of megacrystic granite. A locality within this unit, in the map area east of the study area, has yielded a preliminary U–Pb age of 1100 Ma (R. Emslie, personal communication, 1986). The intrusive body northeast of Grace Lake (subunit 3a) comprises rapakivi-textured megacrystic and equigranular granites (Plates 6 and 7). Field relationships suggest these two phases are coeval. They exhibit weak to moderate foliations and are locally crosscut by late, narrow (1 to 4 cm) shears containing pseudotachylite (Plate 7).

Numerous, small, weakly to moderately foliated granite to tonalite bodies exist within the supracrustal rocks. In several well exposed areas along Grace Lake and the electric powerline, well banded pelitic paragneiss is transitional into areas dominated by granite containing numerous paragneiss xenoliths. It appears that these small, irregularly shaped, weakly deformed granitic intrusions may represent supracrustal-derived partial melts associated with the later

LEGEND

NEOHELIKIAN OR OLDER

Granitoid Rocks

3a *K-feldspar-megacystic granite including lesser amounts of equigranular granite; K-feldspar megacrysts locally exhibit rapakivi texture; commonly massive but locally weakly to moderately foliated*

3b *Equigranular- to seriate-textured granite including minor amounts of megacrystic granite; massive to strongly foliated*

3c *Equigranular granite to granodiorite; medium grained, strongly foliated and/or lineated*

PALEOHELIKIAN

Basic Intrusive Rocks

2a Shabogamo Intrusive Suite: *garnet and clinopyroxene bearing, strongly foliated and/or lineated, and deeply weathered*

2b *Norite, gabbronorite and gabbro; massive to moderately foliated, medium to coarse grained; locally exhibits primary igneous textures*

PALEOHELIKIAN OR OLDER

Supracrustal Rocks

1a *Pelitic to semipelitic paragneiss; typically comprises sillimanite–biotite–garnet–magnetite restite interlayered with K-feldspar–plagioclase–quartz leucosome*

1b *Pelitic to psammitic paragneiss; muscovite–biotite–magnetite–garnet restite interlayered with plagioclase–quartz–K-feldspar leucosome*

1c *Pelitic to semipelitic paragneiss; contains both sillimanite and muscovite*

1d *Mafic paragneiss; commonly interlayered with pelitic paragneiss; clinopyroxene–plagioclase hornblende paleosome commonly cross-cut by plagioclase–orthopyroxene neosome*

1e *Marble; foliated, white, coarse grained*

SYMBOLS

S_1 foliation/gneissosity (inclined, vertical, horizontal)

S_2 foliation (inclined, vertical, horizontal)

F_2 axial plane (inclined, vertical, horizontal)

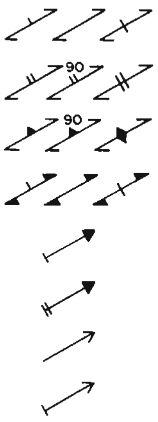
S_1 foliation–F_2 axial plane (inclined, vertical, horizontal)

L_1 lineation (mineral and extension lineations)

L_2 lineation

F_2 minor fold axis

L_1/F_2 minor fold axis



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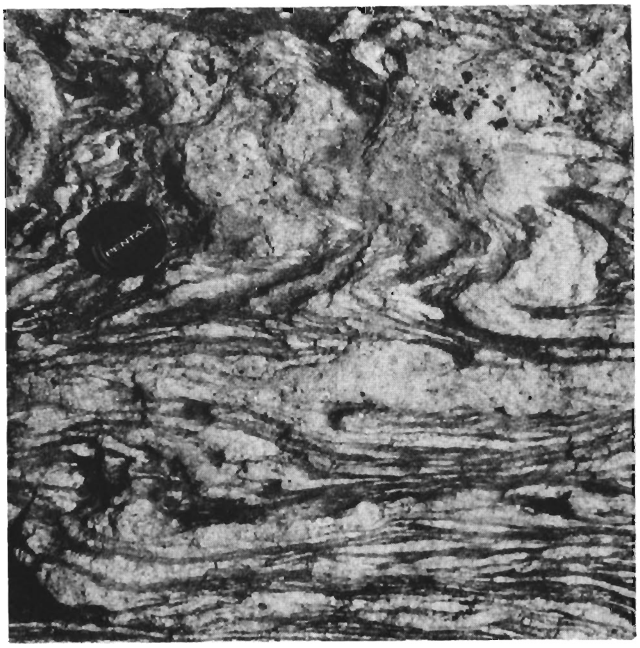

Plate 3. *Northeast-trending F_{2e} folds in muscovite-bearing paragneiss (subunit 1b).*

Plate 4. *Mafic paragneiss (subunit 1d); blocks of paleosome crosscut by plagioclase–orthopyroxene neosome.*

Plate 5. *K-feldspar-megacrystic granite (subunit 3a); alignment of megacrysts is thought to be a primary igneous feature.*

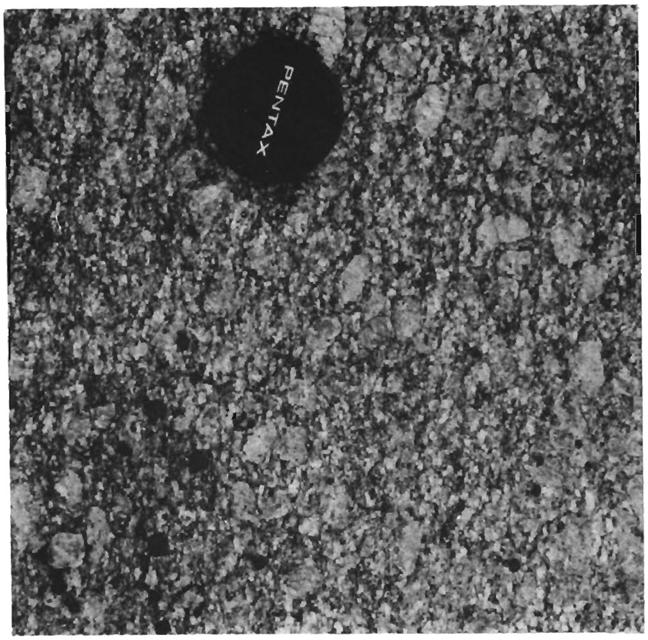

Plate 6. *K-feldspar-megacrystic granite (subunit 3a); exhibits weakly developed rapakivi texture.*

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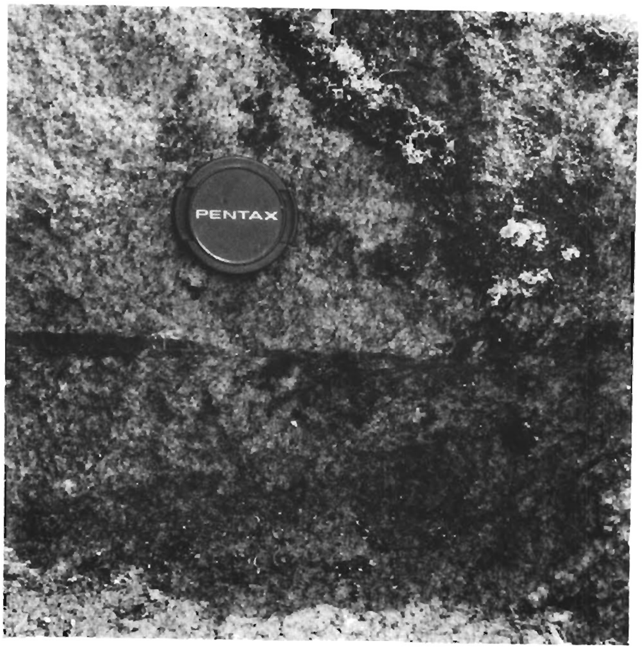

Plate 7. *Equigranular granite associated with the rapakivi-textured granite northeast of Grace Lake; crosscutting late shears contain pseudotachylite.*

Plate 8. *L_{1e} lineations in sillimanite bearing paragneiss (subunit 1a); lineation defined by elongated quartz and plagioclase; pen is parallel to F_{2e} axis.*

stages of the ca. 1650-Ma-deformation event rather than a later separate event.

Western Terrane

The poorly exposed western terrane is dominated by two rock types. Subunit 2a is a deeply oxidized, medium to coarse grained metagabbro, commonly exhibiting a well developed foliation and lineation. Variable metamorphic recrystallization has resulted in a variety of mineral assemblages within this unit. Ubiquitous minerals include plagioclase, garnet, biotite and magnetite, whereas clinopyroxene, orthopyroxene and hornblende are present separately or in combination. Plagioclase is equigranular and commonly granoblastic, rarely containing inclusions of corundum. Garnet may be disseminated or present as rims that are separated from cores of clinopyroxene or hornblende by a zone of plagioclase. Orthopyroxene is recognized in outcrop and thin section, but is commonly partially altered to amphibole. Subunit 2a is correlated with the Shabogamo Intrusive Suite on the basis of 1) mineralogy and texture, and 2) the continuity of this subunit into the area to the north, where it has been described by Rivers (1980). To the north, this unit has been dated at approximately 1400 Ma by Rb–Sr, Sm–Nd and $^{40}Ar/^{39}Ar$ methods (Brooks *et al.*, 1981; Zindler *et al.*, 1981; Dallmeyer, 1982).

Granitoid rocks (subunit 3c) vary in composition from granite to tonalite, but are typically medium grained, equigranular granodiorite containing biotite, muscovite and hornblende as accessory minerals. These rocks are variably foliated and lineated, and do not exhibit gneissic layering. The age of subunit 3c relative to subunit 2b is unknown; however, they exhibit compatible tectonic fabrics indicating that they experienced similar deformation histories.

The large granitoid body west of Seahorse Lake is included here in the western terrane on the basis of texture, composition and fabric orientation. However, linear aeromagnetic patterns expressed by the eastern part of this body are more akin to the eastern terrane.

STRUCTURE AND METAMORPHISM

Eastern Terrane

The dominant structural element in the eastern terrane is a penetrative mineral fabric and gneissosity within subunit 1a (Plate 1), which is attributed to a deformational episode termed D_{1e} (where subscript $_e$ refers to the eastern terrane). The mineral assemblages within this unit indicate that metamorphic conditions reached amphibolite to granulite grade during D_{1e}. The S_{1e} cleavage is defined by aligned biotite and matted sillimanite in the Unit 1 restite, and the L_{1e} lineation by sillimanite alignment in the restite and elongated quartz and plagioclase aggregates within the leucosome (Plate 8). The widespread development of the K-feldspar–plagioclase–quartz–sillimanite–biotite–garnet–magnetite assemblage within Unit 1 suggests that much of the eastern terrane experienced uniform P–T conditions during D_{1e}.

D_{1e} fabrics within the mafic gneiss are defined by aligned pyroxene and/or hornblende, and appear coeval with those in the pelitic paragneiss.

The D_{1e} fabrics were refolded into tight to isoclinal, northeast-trending, upright F_{2e} folds (Plates 1 and 3) that

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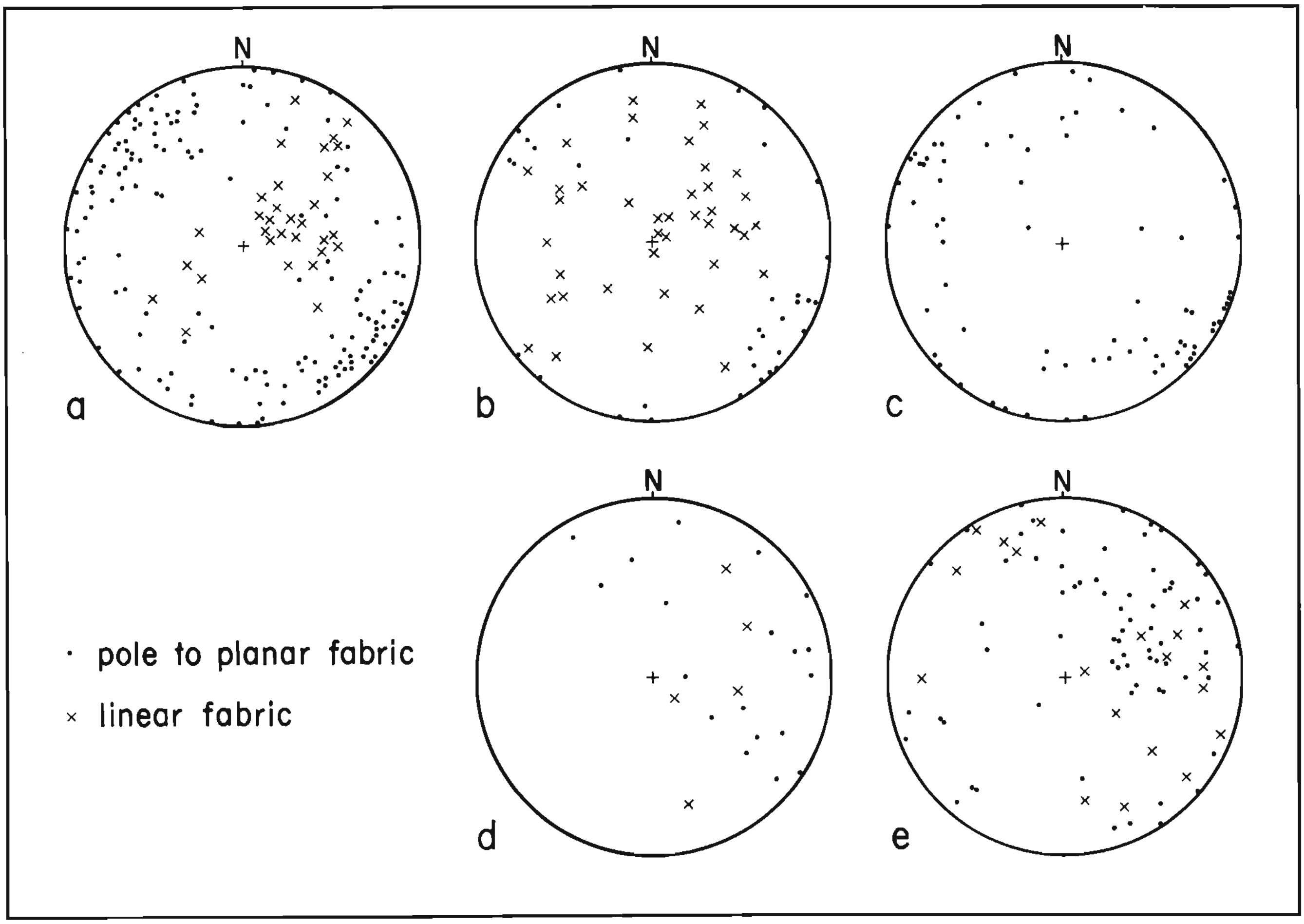

Figure 4. *Stereoplots of fabric elements; southern hemisphere projection: a,* S_1-L_1 *fabrics within the supracrustal rocks of the eastern terrane; b,* F_2 *axial plane and* F_2 *axes in eastern terrane; c, planar fabrics (*S_{2e}*?) in granitoid rocks in eastern terrane; d, planar and linear fabrics in the central granite body; e,* D_{1w} *planar and linear fabrics in the western terrane.*

have variably plunging fold axes, commonly parallel to the L_{1e} lineations (Figure 4a,b). The present orientation of the D_{1e} fabrics therefore yield no information about D_{1e} shortening and extension directions. The presence of weakly developed F_{2e} axial planar fabrics, and the preservation of intricate F_{2e} crenulations of the S_{1e} mineral fabrics (Plate 9) suggest that lower temperatures prevailed during the F_{2e} folding event.

The fabrics within the intrusive rocks of the eastern terrane are typically weak to moderate with a northeast trend similar to the fabric orientation within the supracrustal rocks (Figure 4c). The fabrics are defined by flattened and, less commonly, elongated mineral aggregates. These rocks exhibit a single fabric compatible in orientation with the D_{2e} northwest–southeast-shortening direction.

Locally the S_{1e} fabrics are folded into northwest-trending, tight, upright folds (Figure 4b). Since the relationship between these folds and the northeast-trending F_{2c} folds is never clearly observed, it is not certain that they represent a discrete D_{3e} phase of folding.

Subunit 1b is thought to have experienced the same deformation history as the sillmanite-bearing paragneiss. The muscovite is randomly oriented and cannot be correlated with either deformation event; rather it appears to have been generated by static retrogression of the sillimanite-bearing paragneiss after D_1e by the reaction:

$$\text{sill} + \text{K-feld} + H_2O = \text{musc} + \text{qtz}$$

The lighter color of the leucosome associated with the muscovite-bearing paragneiss may be due to the consumption of K-feldspar by this reaction. The presence of orthopyroxene in the mafic paragneiss layers within the muscovite-bearing paragneiss imply that these regions experienced temperatures high enough to form sillimanite, and, by extension, that the muscovite assemblage is not a lower temperature prograde equivalent of the sillimanite-bearing assemblage. The muscovite-bearing paragneiss appears to be spatially related to large granitic intrusions and, on a smaller scale, to areas containing significant amounts of mafic paragneiss. The plutonic bodies may have provided the heat and/or water necessary to generate the muscovite. In areas where muscovite is not found in association with granitic bodies, the ambient temperatures must have been either too high or too low to form muscovite. The association of subunit 1b with metabasite layers is not understood. No evidence was

Plate 9. *F_{2e} fold in muscovite- and sillimanite-bearing paragneiss showing F_{2e} crenulations.*

found to suggest that a tectonic break occurs at the contact between the muscovite- and sillimanite-bearing paragneiss.

Coexisting sillimanite and muscovite in subunit 1c most likely represent an incomplete retrogresion of sillimanite to muscovite; the sillimanite is usually found lineated within the restite, whereas muscovite is randomly oriented within the leucosome and, less commonly, in the restite. This is compatible with the occurence of subunit 1c southwest of Lac Assigny between subunits 1a and 1b, whereas in other areas these two units are in abrupt contact, without an intervening belt of subunit 1c.

Western Terrane

Both basic and acid intrusive rocks within the western terrane exhibit similar fabric styles and orientations, and are therefore interpreted to have experienced a similar deformation history. Planar and linear fabrics, commonly present with equal intensity, are defined by aligned biotite and flattened and/or elongated mineral aggregates. The correlation of these S_{1w} fabrics (where w refers to the western terrane) and the distribution of outcrops suggest that S_{1w} was folded into a series of northwest-trending, tight folds (F_{2w}) (Figure 3 and Figure 4e). These folds are not visible at outcrop scale and are not associated with any axial planar fabrics. Based solely on field relationships in the western terrane, it is uncertain whether the formation of these fabrics during D_{1w} and the subsequent folding were continuous or episodic events. Given the lack of rock types suitable for estimating metamophic grade, pressure and temperature conditions during deformation in the western terrane are unknown.

Rocks within the boundary zone exhibit fabric orientations and intensities that are similar to the western terrane (Figure 4d). Northeast-trending mylonitic fabrics (without any convincing kinematic indicators) occur locally.

Structural Correlation

Table 1 summarizes and correlates the tectonic evolution of the two terranes. Pelitic paragneiss in central Labrador are constrained in age by U–Pb ages of ca. 1650 Ma from plutonic suites that cut across high-grade penetrative fabrics (Nunn *et al.*, 1985). Paragneiss in the Wilson Lake and Lac Joseph allochthons has yielded U–Pb and Rb–Sr whole-rock and combined isochron ages that cluster between 1666 and 1649 Ma, which Nunn *et al.* (1985) have interpreted to represent a major thermotectonic episode that they termed the Labradorian Orogeny. Unit 1 of the map area is correlated with the aforementioned pelitic paragneiss on the basis of rock-type continuity and its uniform composition and mineralogy. The syn-D_{1e} metamorphic event in the eastern terrane is therefore thought to have culminated during the Labradorian Orogeny or ca. 1650 Ma.

The timing of D_{2e} is not well constrained. The granitoid and basic intrusive rocks do not exhibit D_{1e}-related migmatization or penetrative deformation, yet contain a weak fabric compatible in orientation and perhaps intensity with D_{2e}. This may indicate a significant time lapse between D_{1e} and D_{1e}—at least enough time for the emplacement of these intrusive rocks. More specifically, the preliminary age of 1100 Ma from the post-D_{2e} granite body on the eastern margin of the map area suggests that D_{2e} may be an expression of the Grenville Orogeny.

It is uncertain whether the northwest-trending folds (F_{3e}) formed continuously with D_{2e} or represent a separate deformation episode; the lack of any recognizable, regional, post-Grenville deformation may favour the former interpretation.

Accepting that the metagabbro in the western terrane is a 1400-Ma-old correlative of the Shabogamo gabbro, D_{1w} must have occured after 1400 Ma, which implies that high-grade, Labradorian-age fabrics within the eastern terrane have no equivalents within the western terrane. Although the D_{1w} event is not directly constrained by a more stringent maximum age than 1400 Ma, the compatibility of D_{1w} and D_{2e} fabrics (prior to refolding) suggests that these two events may have been coeval. This would imply that D_{1w} was part of the Grenville Orogeny.

Hornblende $^{40}Ar/^{39}Ar$ dates, ranging between 968 and 905 Ma, from rocks to the northwest of the map area (Dallmeyer and Rivers, 1983) may mark a lower age limit for deformation in the western terrane. This constraint suggests that D_{2w} may have followed D_{1w} as a protracted, continuous event, and may, therefore, correlate with D_{3e}.

Although D_{2e} and D_{1w}, and D_{3e} and D_{2w} may be correlated on the basis of relative timing and fabric orientations, deformation styles vary between terranes. The extensive fabric development during D_{1w} compared to the minor recrystallization that accompanied the D_{2e} refolding event requires higher temperatures to have prevailed in the western terrane. Similarily, the more intense folding during D_{2w}

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Table 1. Summary of deformation events

Age	Eastern Terrane	Western Terrane
pre-1650 Ma	deposition of supracrustal sequence	
1650 Ma	upper-amphibolite to granulite metamorphism (D_{1e})	
1400 Ma		Shabogamo Intrusive Suite (and granitoid rocks?)
1100 Ma (prelim.)	emplacement of K-feldspar-megacrystic granite (subunit 3a)	
post-1100 Ma	refolding of early D_{1e} fabrics (D_{2e})	development of first tectonic fabrics (D_{1w})
post-1100 Ma (pre-968 to 905 Ma?)	local refolding (?) of earlier fabrics into small-scale northwest-trending folds (D_{3e})	refolding of D_{1w} fabrics into northwest-trending large-scale folds (D_{2w})
post-Grenville	intrusion of diabase dikes	

relative to D_{3e} indicates that this temperature difference persisted during the last stages of deformation.

The nature of the boundary zone is presently not understood. The discontinuous nature of rock types and contrasting deformation styles between terranes suggest this zone may be a regionally significant tectonic break. However, apart from the straight magnetic patterns and local occurence of mylonitic fabrics along this zone, there is little direct evidence to substantiate this interpretation.

CONCLUSIONS

Rivers and Chown (1986) and Rivers and Nunn (1985) have suggested that the northwestern part of the parautochthonous terrane has undergone two, continuous, protracted events. They suggest that early thrusting and asymmetrical folding was followed by the development of northeast-trending overturned folds having northwestward vergence. Toward the southeast, this second phase of folding is transitionally replaced by northwest-trending, large-wavelength folds. They suggest the allochthons have been subjected to at least one high-grade deformation event at ca. 1650 Ma, and that the effect of the Grenville Orogeny is not yet well understood.

The information collected by this study suggests that the eastern and western terranes exhibit similar structural styles, rock types and metamorphic grade as the regionally identified allochthonous and parautochthonous terranes respectively, as described by Rivers and Nunn (1985) and Rivers and Chown (1986). At this early stage of investigation, it is suggested that the eastern terrane is part of the Lac Joseph Allochthon, and it has clearly undergone an early, high-grade metamorphic event that has no correlative in the western terrane; the western terrane appears to be a correlative of the parautochthonous terrane. Correlation between the terranes of subsequent deformation episodes is, as yet, poorly constrained. Further dating of appropriate mineral phases, detailed petrofabric analysis and P–T evolution curves will be required to substantiate the proposed correlations.

ACKNOWLEDGEMENTS

We would like to thank Kathy Manser, Leonard Tee and Duanne Cole for their conscientious, multitalented assistance in the field. Visits in the field by R. Wardle, T. Rivers and G. Nunn were invaluable. Al Peche and Jeff Serpell of Viking Helicopters provided first-rate helicopter service and a keen eye for outcrop; Gordon Alexander Murray's skillful helicopter maintenance and general inventiveness made life much easier. The constant efforts of Wayne Tuttle, Wayne Ryder and Ken O'Quinn in the realm of logistical arrangements were most valuable. This paper benefited greatly from critical reviews by R. Wardle, G. Nunn and A. Kerr. Finally, the management and staff of the Newfoundland Hotel are acknowledged for their hawk-eyed curatorship of several selected rock specimens.

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