GEOLOGY OF THE DOUBLE MER - LAKE MELVILLE AREA, LABRADOR

by

D.G. Bailey

INTRODUCTION

The area described in this report is located about 100 km northeast of Goose Bay, Labrador, and is part of an isthmus separating Double Mer from Lake Melville. The nearest community is Rigolet, about 50 km to the east-northeast of the area mapped. The area is accessible from Goose Bay by float plane and boat.

The region was first mapped by Stevenson (1970) and Eade (1962) as part of the Geological Survey of Canada regional mapping programs. In 1977 the area was included in a regional geochemical lake sediment sampling program and some lake sediment samples were found to be anomalously high in uranium. Follow-up work by the Mineral Development Division (McConnell, 1979) determined the presence of uranium mineralization at three localities. Because the area contains the only significant uranium showings discovered to date in the eastern Grenville Province of Labrador, it was decided to map the area immediately.

Regional Geology

The Double Mer - Lake Melville area is underlain by rocks of the Grenville Province, a region of the Canadian Shield defined by 1,000 Ma K/Ar dates and easterly structural trends. The northern part of the Grenville Province of eastern Labrador is marked by east-west shear zones (Stevenson, 1970; Bailey *et al.*, 1979) which parallel a large granitic batholith comprising the Benedict Mountains. South of the Benedict Mountains, Stevenson (1970) has mapped a zone of paragneiss, although there is some suggestion that this zone may consist mainly of highly deformed granite (Bailey *et al.*, 1979; Gower, personal communication, 1979). Metamorphic grade is generally middle to upper amphibolite facies (Bourne, 1978) but just to the north of Double Mer, granulite facies rocks occur (Stevenson, 1970).

Stevenson (1970) has mapped granitic gneiss of possible Helikian age south of Double Mer and in the area described in this report. A large anorthosite massif, described by Emslie (1976), and undefined gneisses and highly deformed granitic rocks occur south of Lake Melville.

Sandstones and shales of the Double Mer Formation are preserved in down-faulted blocks on the north and south sides of Double Mer, and south of Lake Melville in the vicinity of Goose Bay. The age of the formation is not known, although it is younger than the Grenville Orogeny. Stevenson (1970) considered that these rocks may be of Cambrian age since they are similar to Cambrian strata in the southeastern part of Labrador. On the other hand, they may also be of similar age to the Siamarnekh sandstones of possible Hadrynian age in northern Labrador and Quebec.

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The map area is underlain by gneisses, migmatites and granitic rocks which, for the most part, are strongly deformed. Gneisses are subdivided on the accompanying map on the basis of composition as seen on outcrop scale. Since no petrography has yet been carried out on these rocks, complete metamorphic mineral assemblages have not been determined.

Unit 1

This unit consists of well banded gneiss in which the leucosome is dominant over the melanosome. The leucosome comprises white and gray bands of granitic composition, up to one metre wide; the dark bands are of amphibolitic composition. The unit is subdivided on the basis of the composition of melanosome bands. Unit 1A has amphibolite containing dark red porphyroblasts of garnet, in some places reaching a size of about 10 cm diameter. Unit 1B is apparently devoid of garnets, at least on the hand specimen scale.

Unit 1A is in gradational contact with Unit 2. Contacts of Unit 1B with other units were not seen, but since adjacent rocks are considered to be younger, a fault contact is postulated between Unit 1B and Unit 8.

Unit 2

This unit is composed of dominantly amphibolitic material towards its upper contact, although its lower part is similar in composition to Unit 1. It is well banded with individual bands ranging from a 10 cm to several metres in width. The leucosome is of granitic composition. The contact of Unit 2 with Unit 3 varies from sharp to gradational over several metres.

Unit 3

Unit 3 is a highly distinctive rock, comprising a very well foliated and somewhat banded prophyroblastic gneiss. Individual porphyroblasts range up to several centimetres in diameter and generally consist of white potassium feldspar. The matrix of the porphyroblastic gneiss is granitic, although in places there is an abundance of dark minerals. Banded parts of the unit consist of porphyroblastic gneiss and amphibolite.

Unit 4

Unit 4 is generally similar to Units 2 and 6A. It has an intermediate to mafic composition, with a granitic leucosome. Generally the granitic part of the gneiss is the older; the more mafic part consists of amphibolite which probably represents mafic dikes intruded into a dominantly granitic terrain. The unit is in sharp contact with Unit 3 but in gradational contact with the structurally overlying gneiss (Unit 5).

Unit 5

This unit is a transitional lithology between Unit 4 and Unit 6. It is dintinguished from adjacent units by a greater amount of granitic material, and also has concordant bands of well foliated leucogranite.

Unit 6

In places this unit is very complex and is difficult to characterize. It is subdivided into two distinct rock types; 6A, which consists of well banded amphibolitic gneiss; and 6B, which is a poorly banded to nonbanded migmatite of dominantly granitic composition in which dark green and gray mafic bands and lenses are common. The subunits are sufficiently distinctive to be separated, but because 6A and 6B appear to occupy the same structural level, they are grouped into the same unit.

Unit 7

This unit is strongly deformed and comprises several rock types. The dominant lithology is fine grained pink to gray granite and granodiorite. In some outcrops the granite is leucocratic; in other outcrops there is an abundance of hornblende. Bright pink foliated granite is also common in addition to the pink granodiorite.

LEGEND

HADRYNIAN (?)

11 DOUBLE MER FORMATION: Red and brown arkosic sandstone and shale.

HELIKIAN (?)

10 White, gray, locally pink, coarse grained leucogranite. Occurs as irregular bodies and dikes.

APHEBIAN-HELIKIAN (?)

9 Medium to fine grained amphibolite.

8 A. Medium grained, pink equigranular hornblende granite and granodiorite, strongly foliated.

B. Coarse grained, strongly foliated and augened hornblende-biotite granite and granodiorite, minor biotite-hornblende granodiorite.

C. Medium to coarse grained strongly foliated biotite granite with abundant mafic bands and lenses.

7 Gray to pink, fine to medium grained, well foliated hornblende granite and leucogranite; contains large amount of mafic and intermediate material as bands and lenses; migmatitic and schlieric in places.

ARCHEAN-APHEBIAN (?)

6 A. Well-banded amphibolite gneiss; melanosome greater than leucosome.
B. Granite gneiss and migmatite; leucosome greater than melanosome.

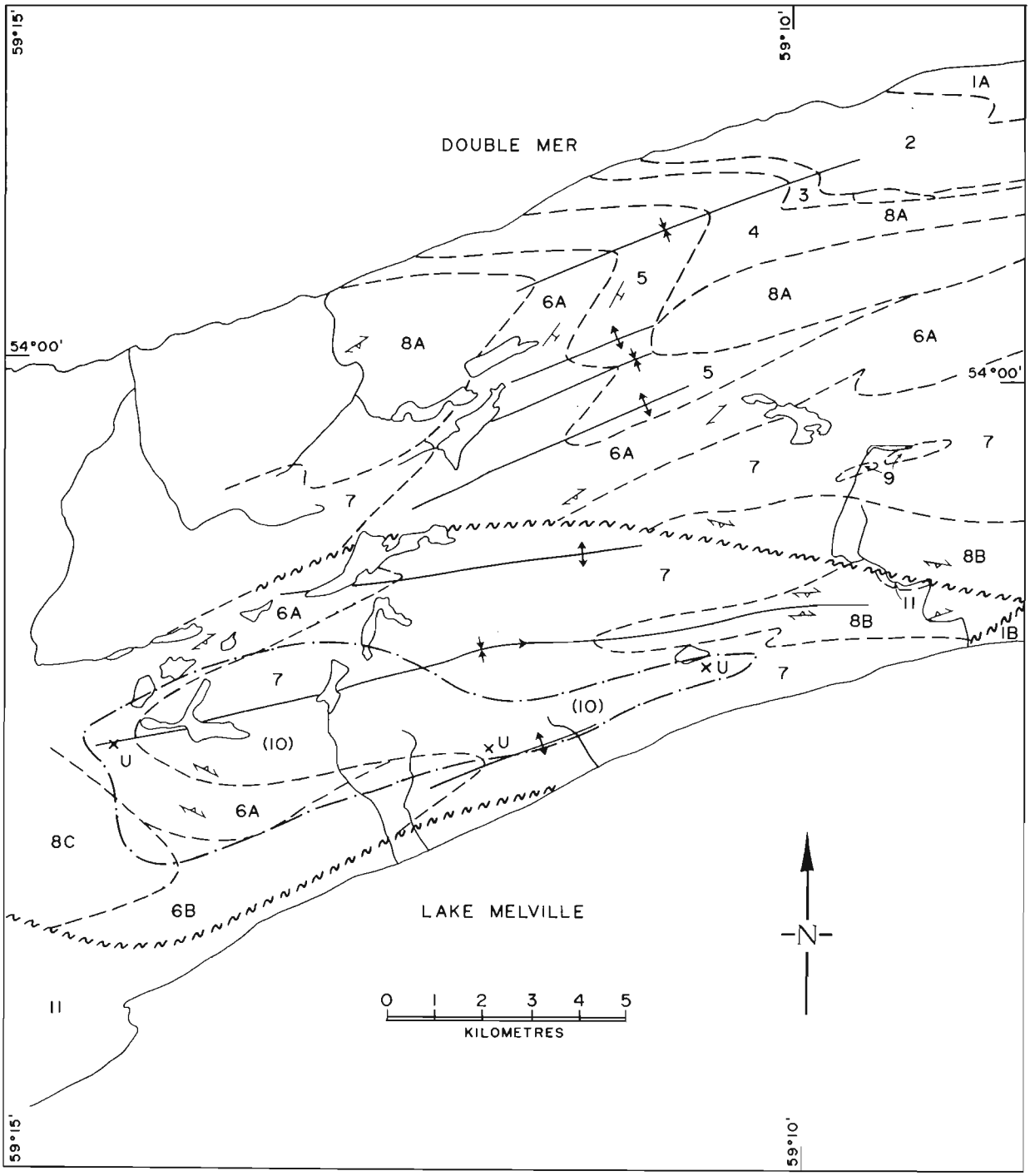
5 Well-banded gray granitic gneiss and leucogranite.

4 Well-banded intermediate to mafic gneiss; granitic leucosome.

3 Gray, porphyroblastic granitic gneiss.

2 Dark gray and green banded amphibolite gneiss.

1 A. Gray to buff granitic gneiss; garnetiferous amphibolitic paleosome.
B. Gray to buff granitic gneiss; non-garnetiferous paleosome.



Geological Map of Double Mer — Lake Melville Area (13G/14, 13J/3), Labrador.

These pink rocks are generally of coarser grain size than the pink and gray fine grained granite.

A variety of rock types which are mainly of mafic composition and contain abundant hornblende and biotite occur within the granites. They may have been part of an older igneous terrain into which the granitic rocks were intruded.

Unit 8

Unit 8, which is subdivided on the basis of texture and composition, is generally strongly foliated and of granitic to granodioritic composition. Unit 8A comprises a pink well foliated biotite and hornblende granodiorite with minor pink granitic phases. These rocks are generally medium to fine grained. Mafic bands and xenoliths, now transposed into the plane of foliation are common throughout the unit.

Unit 8B is a very distinctive, augened, coarse grained granodiorite with large megacrysts of potassium feldspar. These megacrysts are now ovoid and may be porphyroblastic in origin. Numerous amphibolite dikes, deformed and transposed into the foliation, occur throughout the unit. Some minor amounts of more granitic, less foliated rocks occur within the augen granodiorite.

Unit 8C comprises a coarse grained, gray, biotite-rich granite to granodiorite. Mafic nebulitic bands and streaks within the granite may be partially assimilated mafic rock into which the granite was intruded.

Unit 9

Numerous mafic dikes and lenses occur throughout the area and are clearly pretectonic. They are generally diabasic although the original diabasic texture has been destroyed by deformation in most cases. The dikes occur parallel to the regional foliation direction, and, in areas of poor exposure, are difficult to dintinguish from the older mafic bands within granitic rocks.

Unit 10

Numerous dikes, veins and irregular masses of generally coarse grained leucogranite intrude all other rock types with the exception of the Double Mer Formation. The area containing the greatest concentration of this rock type is represented on the accompanying map by a dashed and dotted line although it is impossible to map out individual bodies at the scale of mapping. In places this leucogranite has intruded concordantly along the banding and foliation of the older rocks, giving the appearance of a migmatite. The unit is important as it is associated with uranium mineralization in the area.

Unit 11

Sandstones and shales of the Double Mer Formation (Kindle, 1924) are preserved in the eastern part of the map area within a half graben produced by downfaulting. Near the fault contact, the sandstones are coarse grained and exhibit good crossbedding, but they pass upwards into more shaly members containing intercalated sandstone beds. Although not seen in the map area, conglomeratic beds occur towards the base of the formation north of Double Mer.

The writer considers that these sediments once covered the whole of the map area but have subsequently been removed by erosion. On the north side of the area, sandstone is preserved as infillings in cracks in the basement rocks.

STRUCTURE

The rocks throughout the map area, with the exception of Units 10 and 11, are generally strongly deformed with easterly and northeasterly trending foliation and gneissosity. Both gneissosity and foliatin are folded into

antiforms and synforms indicating at least two periods of deformation in the area. Foliation in many places is warped into a strain-slip or crenulation fabric at roughly 30° to the main fabric direction, *i.e.* in a northeasterly direction.

The gneisses which are structurally lower in the sequence have been affected by multiple deformation, in contrast with the single fabric development seen throughout most of the structurally higher rocks. This would suggest the presence of a break between the two groups (*i.e.* units 1 to 6 and units 7 to 9) which has probably been obliterated by structural reworking.

On the map scale two major folds occur in the area. A large east-plunging synform occurs south of the east-west fault which runs through the middle of the map area; an antiform occurs north of the fault and plunges to the west. This pattern would indicate that scissor - type movement has occurred on the fault, but in general with the northern block upthrown with respect to the southern block.

On the northern coast of the area, abundant shearing is present with individual shears striking at about 080°. Along shear zones, biotite has retrogressed to chlorite and secondary hematite and epidote have developed. Shears generally dip to the south, although northerly dips have been recorded.

METAMORPHISM

The grade of metamorphism is probably of the middle amphibolite facies. Typical metamorphic assemblages consist of biotite-hornblende plagioclase-garnet. In zones of retrogression the chlorite-epidote-hematite assemblage has developed from biotite and hornblende. In some rocks it seems that biotite has developed from the break down of hornblende.

Metamorphic minerals considered to be diagnostic of sedimentary protoliths have not been recognized in the region. However, since no thin sections have been studied, this cannot be verified; some older rocks in Unit 7 have compositions which may be similar to that of graywacke.

AGE OF THE ROCK UNITS

In the absence of any units of known age, attempts to place the rock units into a Precambrian stratigraphic framework are tenuous. Relative ages of rocks can be assessed by the number of deformational events to which they have been subjected, but whether these events occurred during the same orogeny or during different orogenies is not known.

The rock units have been grouped according to the number and intensities of deformation. The youngest granitoid rock (Unit 10) has undergone almost no deformation, an intermediate group of granitic rocks has only one dominant fabric, and the oldest group has undergone several deformations. In addition, the oldest group has rocks in which a strong gneissosity has developed, whereas younger rocks, although having a well developed foliation, have no compositional banding attributable to metamorphism.

On that basis, deformation of Units 1 to 6 is considered to have occurred during an earlier orogeny than the deformation of Units 7 to 9. The time of deformation, however, is not known and can only be inferred. If Unit 10 was intruded during the Helikian era, it can be concluded that effects of Grenvillian deformation in the map area are minimal. If this is the case, then the Grenvillian Orogeny is manifested in the area only by a metamorphic retrogression. However, shearing along the northern side of the map area may be Grenville in age as it is clearly later than deformational fabrics of the gneisses.

If the granite of Unit 10 is post-Grenville in age, *i.e.* Hadrynian, then it is possible that rocks of Units 1 to 6 are of Aphebian or Archean age and rocks of Units 7 to 9 are of Helikian age, and were deformed during the Grenville Orogeny. Definition of the ages of the various rock types must await radiometric dating.

URANIUM MINERALIZATION

Uranium occurs in three known showings within the zone in which there is a dominance of Unit 10 granite. Rocks in this area have zones of above normal background radioactivity (up to 500 cps compared to about 150-200 cps outside the area, measured as total counts on a G1S-4 spectrometer).

The primary uranium mineral has not been identified, but showings typically have yellow uranophane (?) coatings on exposed surfaces. Uranium occurs both as patches within the leucogranite of Unit 10 and at the contacts of the granite with older, more mafic rock. In the latter case, uranium mineralization is commonly concentrated in chloritic partings parallel to the foliation of the older rocks.

Minor molybdenite is associated with uranium in a radioactive boulder found in the westernmost showing; minor fluorite has also been recognized. At the central showing large black cyrstals of tourmaline are also present. Magnetite appears to occur in high concentrations with some mineralization while hematite is also associated with the uranium.

The high U/Th ratios of the uranium showings suggest that mineralization was concentrated by hydrothermal solutions, but extensive zones of hydrothermal alteration do not seem to have developed.

Because of the rather large extent of Unit 10 there may be considerable potential for the discovery of further areas of uranium mineralization, although detailed prospecting will be required in areas of poor outcrop.

REFERENCES

Bailey, D.G., Flanagan, M.J. and Lalonde, A.
1979: Geology of eastern Central Mineral Belt (13J/10-15, 130/2-3), Labrador. *In* Report of Activities for 1978. *Edited by* R.V. Gibbons. Mineral Development Division, Newfoundland Department of Mines and Energy, Report 79-1, pages 103-108.

Bourne, J.M.
1978: Metamorphism in the eastern and southwestern portions of the Grenville Province. *In* Metamorphism in the Canadian Shield. *Edited by* J.A. Fraser and W.W. Heywood. Geological Survey of Canada, Paper 78-10, pages 315-328.

Eade, K.E.
1962: Geology, Battle Harbour - Cartwright. Geological Survey of Canada, Map 22-1962.

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.

Kindle, E.M.
1924: Geography and geology of Lake Melville district, Labrador Peninsula. Geological Survey of Canada, Memoir 141.

McConnell, J.W.
1979: Geochemical follow-up studies in Labrador. *In* Report of Activities for 1978. *Edited by* R.V. Gibbons. Mineral Development Division, Newfoundland Department of Mines and Energy, Report 79-1, pages 159-162.

Stevenson, I.M.
1970: Rigolet and Groswater Bay map area, Newfoundland (Labrador). Geological Survey of Canada, Paper 69-48.