# GEOLOGICAL MAPPING IN THE MCKAY RIVER - GABBRO LAKE AREA, WESTERN LABRADOR

by

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## INTRODUCTION

The McKay River area (N.T.S. 23H/12) and the western half of the Gabbro Lake area (N.T.S. 23H/11) were mapped during the summer, thus completing coverage of iron formation and associated lithologies of the Gagnon Group in the Grenville Front region. Ground traversing was mainly restricted to the central part of the McKay River area, where outcrop is abundant. Most of the peripheral areas were mapped by helicopter and there is only a sparse outcrop distribution upon which to base interpretation.

### General Geology

The map area is located at the southeastern end of the Labrador Trough near the boundary with the Grenville Province, and the whole area lies in the Grenville Front Tectonic Zone. Most of the lithologies of the Gagnon Group* are present in the area (with the exception of quartzite), and the stratigraphy also includes basic to intermediate volcanic rocks and volcanogenic sediments possibly equivalent to the Nimish Subgroup (Evans, 1978). Felsic volcanic rocks and associated volcanogenic sediments, considered to be a separate group (Blueberry Lake group) from the basic volcanics (Wardle, 1979a, b), occur in the eastern part of the map area.

In the northern third of the area, structural trends are northwest and reflect the Hudsonian Orogen; in the southern part of the area most structures strike approximately east-west and are of Grenvillian age. In the McKay River area, as elsewhere along its length (Rivers and Massey, 1979; Rivers, this volume), the Grenville Front is interpreted to be a region of thrust faulting in which rocks of the Grenville Province were overthrust onto rocks of the adjacent, older tectonic province to the north.

### Previous Work

The first maps of the area were produced by Iron Ore Company of Canda (Baird, 1950) and Labrador Mining and Exploration Company (Beland, 1950) at 1 inch to 1/2 mile scale, and these were followed by the more detailed work of Tiphane (1951), Jackson (1952), Frazer (1952), Peach (1952) and Slipp (1952). Later regional mapping by the Geological Survey of Canada covered the whole map area (Wynne-Edwards, 1961). Various aspects of the geology have been considered in some detail in the theses of Goodwin (1951), Badhroom (1961), Giovanella (1961) and Henderson (1965).

Mapping of the Sims Formation was carried out by the Newfoundland Department of Mines and Energy (Ware, 1979; Ware and Wardle, 1979) and has been compiled directly in this project. The Blueberry Lake group in the Gabbro Lake area was the object of some detailed mapping by the Newfoundland Department of Mines and Energy (Wardle, 1979a, b), and this too has been compiled in the present project.

*Previous Workers (*e.g.* geologists of Iron Ore Company of Canada, Wynne-Edwards, 1961; Wardle, 1979) assigned the Aphebian rocks in the area to the Knob Lake Group. Gagnon Group is the name given to the metamorphosed equivalents of the Knob Lake Group within the Grenville Province.

## Objectives

It was hoped that the mapping would shed some light on the following problems:

(a) the nature and affinity of the basic to intermediate volcanic rocks, and in particular their relationship, if any, with the Wabush Formation;

(b) the nature of the Grenville Front;

(c) the relationship between the newly defined Blueberry Lake group (Wardle, 1979a, b), and the Gagnon Group;

(d) the structural configuration at the southeast end of the Labrador Trough, where Hudsonian and Grenvillian trends intersect; and

(e) to assess the mineral potential of the area.

## DESCRIPTION OF UNITS

### Unit 1 - Archean - granodiorite to tonalite gneiss

Although this unit outcrops extensively to the north where it is known as the Eastern Basement Complex (Wardle, 1979b), there are only a few outcrops in the map area. It is a white to gray orthogneiss consisting predominantly of quartz + plagioclase + biotite ± hornblende and K-feldspar, quite distinct from the banded gneisses of the Ashuanipi Complex described by Rivers and Massey (1979) and Rivers (this volume). Wardle (1979b) reports that some outcrops of this unit are situated within bodies of Shabogamo Gabbro and have the form of large rafts or inclusions.

### Unit 2 - Katsao Formation

The oldest unit of the Gagnon Group, the Katsao Formation, outcrops both north and south of the thrust faults in the area. North of the thrust faults it is a banded graywacke/shale sequence with sedimentary structures such as crossbedding, vague graded bedding and load structures locally visible. A single tectonic fabric (slaty cleavage) is present.

In the southern part of the map area, the Katsao Formation appears as a quartz-feldspar-biotite schist ± hornblende, garnet, K-feldspar and muscovite. Textures vary from schistose to massive, with some examples displaying strongly developed cataclastic fabrics (augen schists and mylonites). In contrast to the Katsao Formation north of the thrust fault zone, these rocks have evidently undergone polyphase deformation.

### Unit 3 - Duley Formation

This unit is typically composed of dolomitic marble as elsewhere in the Gagnon Group; locally calcite predominates over dolomite though, and layers and boudins of dolomitic marble occur in gray-black calcitic marble with minor graphite. Minor conglomeratic units are seen, in one place containing clasts of granite gneiss, similar to the Archean Ashuanipi Complex in the west (Rivers and Massey, 1979).

A significant difference between the Duley Formation in the McKay River - Gabbro Lake area and elsewhere in the Gagnon Group is the intimate associaton with chlorite schist (unit 4). A complete gradation between marble with minor chlorite schist fragments to chlorite schist with disseminated carbonate exists, and the units have been arbitrarily subdivided on the basis of the predominant lithology in any given outcrop.

### Unit 4 - Chlorite schist and conglomerate - Nimish Subgroup?

Rocks of this unit are in close spatial association with the Duley Formation (see above) and the Wabush Formation (unit 6). Chlorite schists are typically medium grained rocks, dark green in colour and possessing disseminated carbonate in many outcrops. They may represent tuffs or reworked tuffaceous sediments.

LEGEND

HELIKIAN

10 Shabogamo Gabbro

9 Sims Formation: Orthoquartzite

APHEBIAN

8 Blueberry Lake group: Polymictic conglomerate, tuffaceous sandstone, slate.

Gagnon Group

7 Nault Formation: Gray phyllite

6 Wabush Formation: Silicate-carbonate iron formation, magnetite graywacke, tuffaceous magnetite iron formation.

Nimish Subgroup (?)

5 Basic volcanic rocks, including pillow lava.

4 Chlorite schist (metatuff) and chloritic conglomerate.

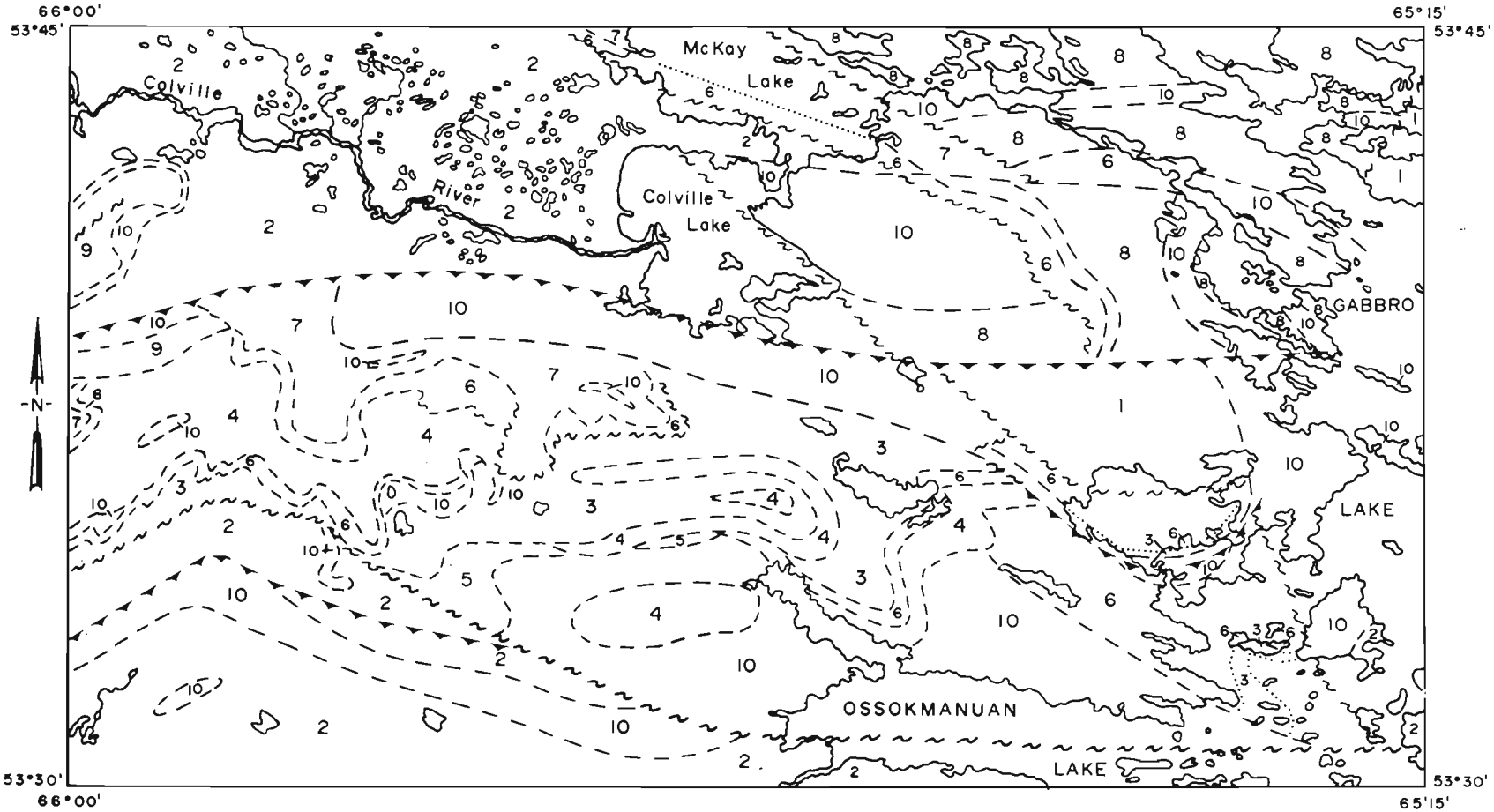
3 Duley Formation: Dolomitic marble

2 Katsao Formation: Graywacke/slate sequence (in north of map); quartzofeldspathic schist (in south of map)

ARCHEAN

1 Granodiorite to tonalite gneiss.

Note: (1) Much of the Blueberry Lake group compiled from Wardle (1978).
(2) Sims Formation compiled from Ware (1978)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Chloritic conglomerates are intimately associated with the chlorite schists and the matrix of the conglomerate is composed of chlorite schist identical to that described above. Clasts in the conglomerate are composed principally of volcanic rocks (see unit 5), with minor amounts of fine grained sediment (slate) also being present in some outcrops. Disseminated pyrite mineralizaton is common throughout this unit and disseminated magnetite is restricted to the chlorite schists.

Unit 5 - Volcanic rocks - Nimish Subgroup?

Volcanic rocks, locally porphyritic, amygdaloidal and vesicular, and including pillow lavas, compose unit 5. These rocks vary from massive to schistose and contain chlorite and actinolite as the dominant mineralogy. In the pillow lavas, the interpillow area is commonly filled with calcite which may be primary, possibly indicating extrusion into the carbonate environments which existed during deposition of the Duley or Wabush Formations. Furthermore, the volcanic rocks appear to be the lateral equivalents of the iron formation in the southern part of the area, suggesting that they may represent a volcanic pile which locally replaced iron formation in the stratigraphy. Two outcrops of a crowded feldspar porphyry occur in association with iron formation in the eastern part of the map area; these may represent crystal-lithic tuffs or highly porphyritic lavas.

It is difficult to assess the chemical composition of these retrogressed rocks in the field, but it is likely that they lie in the basalt-andesite field.

On the basis of stratigraphic position, the volcanic and volcanogenic rocks of units 4 and 5 are tentatively assigned to the Nimish Subgroup (Evans, 1978) of the Labrador Trough. Chemical analyses, including rare earths, are currently being performed by one of the authors (Noel) in order to define more fully the affinities of the suite.

Unit 6 - Wabush Formation

Iron formation and associated lithologies compose the Wabush Formation. The predominant lithology is carbonate and cherty carbonate iron formation, which is locally grunnite bearing and may contain magnetite. Cherty iron formation with tuffaceous fragments occurs locally, and this too is magnetite bearing. Cherty magnetite graywacke and magnetite-bearing siltstone, lithotypes not previously encountered, occur in the northeastern corner of the map area.

Unit 7 - Nault Formation

A fine grained black schist/slate, which outcrops north of the iron formation in the Colville Lake area, is believed to be part of the Nault Formation. It is locally graphite bearing, but is otherwise a rather featureless rock devoid of sedimentary structures.

Unit 8 - Blueberry Lake group

Rocks assigned to this unit were mostly mapped by Wardle (1979a, b) and only the westerly extensions of the unit in the McKay River area were examined by the authors. There, polymictic conglomerate forms the preponderant lithology, with subordinate light green sandstone and siltstone. Clasts in the conglomerate include porphyritic plutonic rocks, quartz, orthoquartzite, slate and felsic tuff fragments. East of McKay Lake, metasandstone and siltstone identical to those included in the Blueberry Lake group contain significant magnetite, suggesting that they may be associated with the iron formation. In the south of the area (not on map) a small body of a porphyritic intrusive rock with rounded inclusions of biotite schist, occurs within the Shabogamo

Gabbro, It appears similar to the andesite porphyry of the Blueberry Lake group described by Wardle (1979b) from the Gabbro Lake area and may be related to the group.

The age of the Blueberry Lake group is presently in doubt (Wardle, 1979b). In the McKay River area, dikes of Shabogamo Gabbro cut metasediments of the group in one locality, and elsewhere inclusions of sandstone considered part of the Blueberry Lake group occur in Shabogamo Gabbro: thus, if the association of these sediments with the Blueberry Lake group is correct, the group may be Aphebian in age, and possibly related to the volcanic rocks of the Nimish Subgroup. If the sediments are not part of the Blueberry Lake group however, as seems possible, then the group may be considerably smaller than indicated on the accompanying sketch map.

### Unit 9 - Sims Formation

Orthoquartzite, with minor granule conglomerate, of the Sims Formation, forms two hillcappings in the west of the area. These rocks, which lie unconformably on the Gagnon Group, were mapped by the Newfoundland Department of Mines and Energy in 1978 and are more fully described by Ware (1979) and Ware and Wardle (1979).

### Unit 10 - Shabogamo Gabbro

Coarse to fine grained, melanocratic to mesocratic metagabbro and associated chlorite-actinolite-albite schist occurs throughout the map area, in some places as large bodies which effectively blot out the stratigraphy of the Gagnon Group. Relict igneous textures are commonly present, with the mafic minerals largely replaced by actinolite and chlorite. Mylonitic fabrics in metagabbro are seen in several localities throughout the map area, and these may be associated with faults. Disseminated sulphides are found in both metagabbro with relict igneous texture and in the associated chlorite-albite-actinolite schist.

## STRUCTURAL GEOLOGY

In the central part of the map area, where exposure is good, the structural geology has been worked out in some detail; elsewhere many of the contacts are poorly defined and the structure is largely interpretative. In the northeast corner of the area, structural trends are northwest and the deformation occurred during the Hudsonian Orogeny. The rocks in this region are gently dipping and appear only slightly deformed. The Grenville Front crosses the upper half of the map area, although its exact location is unknown. South of the Front, evidence for three phases of deformation of Grenvillian age can be found. Well developed tectonic fabrics ($S_1$) defined by micas and other minerals and possibly associated with major thrust faults are folded into east-west trending folds ($F_2$), and subsequently into northwest trending folds ($F_3$) giving rise to the complex map pattern. Examination of the map pattern shows that during the formation of $F_2$ and $F_3$ folds, disharmonic folding was common and faulting accompanied fold formation in several localitites. This was probably largely due to the juxtaposition of large bodies of rock of very different ductilities, such as marble/chlorite schist against gabbro and massive lavas. Interpretation in the eastern part, in particular, is tentative and may be revised shortly.

## METAMORPHISM

In the north of the map area, metamorphic grade is in the sub-greenschist facies, there has been little recrystallization, and primary structures are visible in many rocks. In the central part of the area the prevailing grade of metamorphism is in the greenschist facies, with chlorite-albite-actinolite assemblages being common in metavolcanic, volcanogenic and metaplutonic rocks. In the extreme south of the area, the

metamorphic grade may rise to amphibolite facies. Localized hornfelsing and contact metamorphism of schists occurs around some of the larger gabbro intrusions.

## ECONOMIC GEOLOGY

Oxide iron formation is a subordinate lithology of the Wabush Formation in this map area and is unlikely to be of commercial interest for iron ore. Disseminated magnetite occurs in iron formation, chlorite schist and gabbro, but is probably too dispersed to warrant further investigation. Pyrite, pyrrhotite and minor chalcopyrite occur in chlorite schist, conglomerate, gabbro and derived chlorite-actinolite-albite schists. It is probably of primary origin in most rocks but may have been remobilized and locally concentrated in zones of low stress (*e.g.* shear zones) during metamorphism. Some electromagnetic anomalies drilled by Labrador Mining and Exploration Company (Breau, 1957) located minor amounts of massive sulphide mineralization in some holes.

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