GEOLOGICAL MAPPING IN THE WABUSH LAKE AREA, SOUTHWESTERN LABRADOR

by

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INTRODUCTION

Mapping was carried out during the summer on parts of N.T.S. areas 23B/10, 23B/14, 23B/15, 23G/2 and 23G/3, and the area between Wabush Lake and the Quebec border is now covered. The work involved completion of two map areas (23B/15 and 23G/2) and checking the detailed maps of Iron Ore Company of Canada and Newfoundland and Labrador Corporation in the remaining parts of the area. The detailed mapping was found to be generally good, and few changes were made in the designation of units. The interpretation, however, is substantially different in places.

General Geology

The area spans two tectonic provinces, the Superior Province and the Grenville Province. The border between the two, known as the Grenville Front, is marked by a series of thrust faults in the Wabush area (see also Rivers & Massey, 1979), and also by cataclastic fabrics imposed on the older rocks immediately northwest of the thrust faults. The Grenville Front, therefore, marks the northerly limit of deformation imposed during the Grenvillian Orogeny, and is unrelated to the age, structural state or metamorphic grade of the rocks included within the Grenville Province to the south.

North of the Grenville Front, gneisses and igneous rocks of the Ashuanipi Complex form a basement upon which the metasedimentary Gagnon Group of Aphebian age was deposited. Rocks of the Gagnon Group outcrop extensively south of the Grenville Front and comprise a distinctive succession of schist, marble, quartzite, iron formation and schist respectively in decreasing age. The two schist units are frequently difficult to distinguish on the basis of lithology, but the succession marble-quartzite-iron formation permits a younging direction to be established in certain areas.

Evidence of three distinct phases of deformation can be found in rocks of the Gagnon Group, all of which were probably part of the Grenvillian Orogeny which took place about 1,000 Ma ago. Metamorphic grade during the Grenvillian Orogeny varied from greenschist grade near the Grenville Front to amphibolite grade in the southeastern part of the area.

Previous Work

1 inch to 1/2 mile mapping by Iron Ore Company of Canada (Neale, 1951) and by Newfoundland and Labrador Corporation (Boyko, 1953) outlined the general geology of most of the area. Subsequently, during the 1950's geologists of Iron Ore Company and Labrador Mining and Exploration Company carried out 1 inch to 1,000 foot scale mapping in areas of iron formation outcrop. Ph.D. theses by Jackson (1962) and Knowles (1967) include part of the area, and the whole area is covered by the Geological Survey of Canada maps of Stevenson (1964) and Jackson (1976). Much detailed geological information is available around the open pit iron ore mines operated by Iron Ore Company and Wabush Mines, and a third mining operation at Mount Wright in Quebec is located a few kilometres southwest of the mapped area. That part of the area adjacent to Wabush Lake was mapped at the beginning of the project during 1977 (Rivers, 1978 a, b), and part of the

northeastern corner of the map area was completed during 1978 (Rivers and Massey, 1979).

Objectives

The objectives of the mapping project were to:

(a) evaluate the existing map coverage of the area and determine if it could be used as a basis for compilation;

(b) investigate the structural geometry of the Gagnon Group;

(c) investigate the nature of the Grenville Front;

(d) assess the economic potential of the area;

(e) to collect samples for $^{40}Ar/^{39}Ar$ radiometric dating in the region of the Grenville Front in order to investigate the nature of that important, but poorly understood, boundary. This project was started in 1978 (see Rivers and Massey, 1979), and the intention this year was to fill in gaps in the 1978 sample distribution.

DESCRIPTION OF UNITS

Ashuanipi Complex - Unit 1

Two distinctive lithologies comprise the Ashuanipi Complex in the map area. In the northwestern part of the area, the unit is composed of a banded migmatitic gneiss of granodioritic to dioritic composition, similar to that mapped during 1978 (Rivers & Massey, 1979). Bands, lenses and boudins of foliated dioritic gneiss are typically surrounded by granodioritic to granitic rocks with igneous textures. Pyroxenes are present in both phases of the migmatite.

Provisionally included in the Ashuanipi Complex, although younger than the Archean gneisses described above, is a massive, coarse grained, white alaskitic granite. Relationships between the gneisses and the granite are not seen, but the granite presumably intrudes the gneisses and is post-Kenoran in age. Both the granite and the gneisses are cut by a coarse cataclastic fabric of Grenvillian age in the Grenville Front region, which provides an upper limit on the age of intrusion of the granite.

Unit 2 - Katsao Formation

The lowest unit of the Aphebian Gagnon Group, the Katsao Formation is composed of a massive to banded biotite bearing quartzofeldspathic schist ± hornblende, garnet, muscovite, kyanite and K-feldsar. It is typically a medium to coarse grained rock with a well developed foliation defined by biotite. Concordant migmatitic veining occurs locally, and near the thrust faults in the Grenville Front region, feldspar augen are common and the rock is a porphyroclastic augen schist.

Unit 3 - Duley Formation

Buff to black weathering marble with quartz veins constitutes the Duley Formation, which conformably overlies the Katsao Formation in part of the area. It is present as an extensive unit in the central part of the area, but apparently wedges out laterally to the east and west over a distance of 5-10 km. Dolomite typically predominates over calcite; tremolite and diopside are common, and quartz may compose over 75% of the rock in some places.

Unit 4 - Wapussakatoo Formation

Coarse grained massive quartzite and subordinate quartz-muscovite schist compose this unit, which outcrops on many of the high hills west and southwest of Wabush lake. The Wapussakatoo Formation locally overlies the Duley Formation, but west of the outcrop of the latter unit, it lies directly on the Katsao Formation, possibly unconformably as is seen in the Labrador Trough to the north, *e.g.* Wardle and Doherty, 1978.

LEGEND

HELIKIAN

8 Shabogamo gabbro: Metagabbro and amphibolite

APHEBIAN

7 Amphibolite: Metatuffs (?)

GAGNON GROUP

6 Nault Formation: Quartzofeldspathic schists and gneisses

5 Wabush Formation: Iron Formation

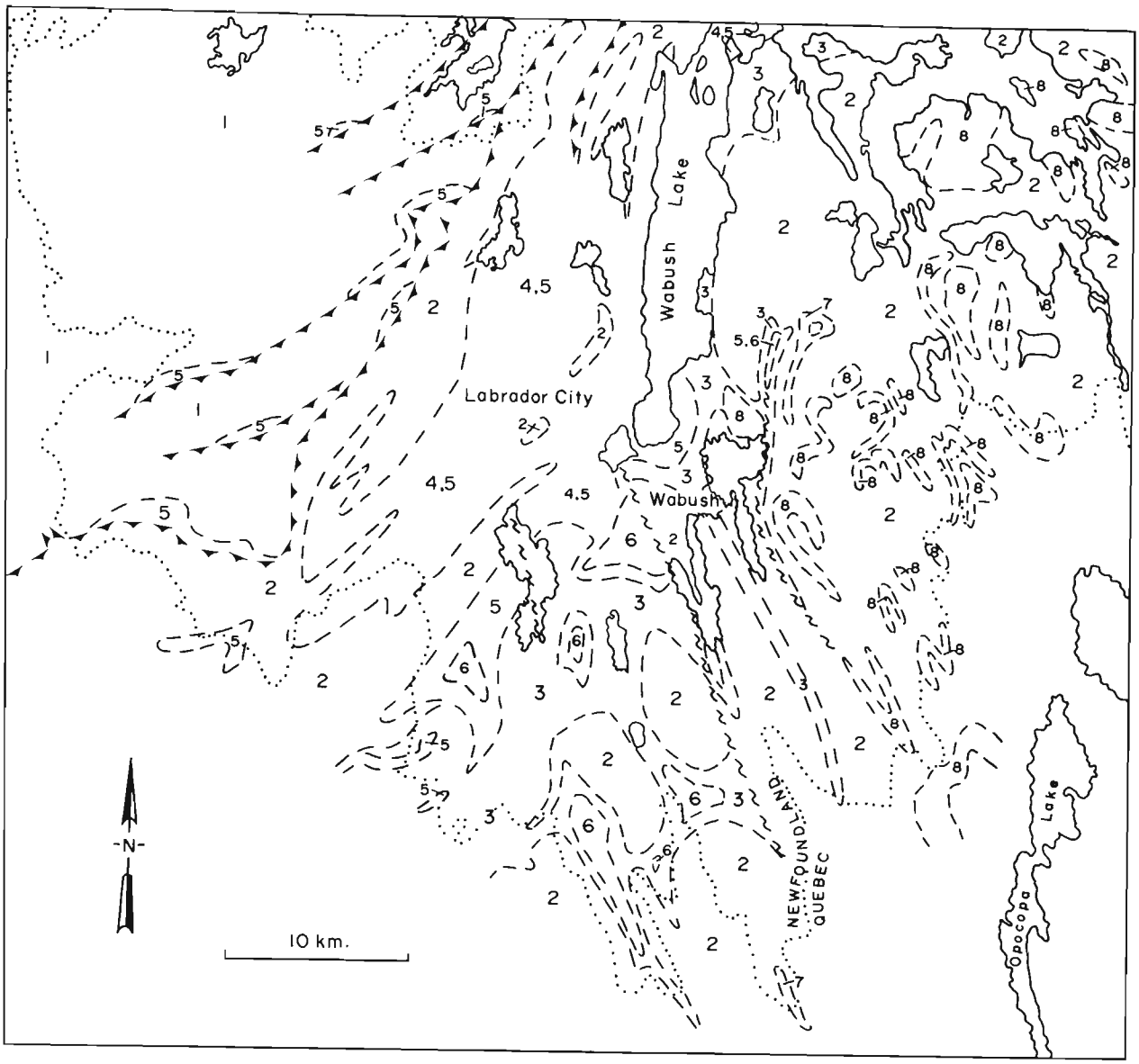
4 Wapussakatoo Formation: Quartzite

3 Duley Formation: Marble

2 Katsao Formation: Quartzofeldspathic schists and gneisses

ARCHEAN

1 Ashuanipi Complex: Banded migmatitic gneiss and intrusive granitoid rocks.


Wabush Lake
Labrador City
Wabush
NEWFOUNDLAND
QUEBEC
Pocopa Lake
-N-
10 km.

On the accompanying sketch map, the Wapussakatoo Formation has been included with the overlying Wabush Formation to simplify the map pattern.

Unit 5 - Wabush Formation

Iron formation and associated rocks constitute the Wabush Formation. The following lithologies compose most of this unit: - (a) silicate-carbonate iron formation, consisting of quartz, Fe carbonate (siderite, ankerite or Fe dolomite), grunerite, hedenbergite, magnetite; (b) ferruginous quartzite; (c) tuffaceous iron formation, composed of quartz, Fe carbonate, grunerite, hornblende/actinolite and garnet; (d) oxide iron formation composed of hematite, quartz and magnetite. Oxide iron formation is the lithology upon which the mining industry is based, and it occurs in large deposits in the belt west and southwest of Wabush Lake.

Unit 6 - Nault Formation

The Nault Formation conformably overlies the Wabush Formation. In the north of the area, small outcrops of this unit (not on map) are composed of a distinctive black graphitic schist. However, further south, where the metamorphic grade is higher, graphite is not present, or is present only as grain coatings, and the unit is a quartz-feldspar-biotite schist, very similar in appearance to the Katsao Formation.

Unit 7 - Amphibolite

Coarse grained, massive, highly garnetiferous amphibolite occurs in several locations within the Katsao Formation. It appears to be a distinct lithology unrelated to the Shabogamo Gabbro (see below) which typically has considerably more plagioclase feldspar. The origin of the unit is speculative, but it may be a metavolcanic rock of some sort, possibly a metatuff.

Unit 8 - Shabogamo Gabbro

The Shabogamo Gabbro is predominantly composed of leucogabbro and its metamorphosed equivalents, coronitic metagabbro, amphibolite and mafic biotite schist. This unit outcrops extensively within the Katsao Formation in the east of the map area, mostly in the form of sills concordant with the foliation in the schist. West of Wabush Lake, sills of gabbro intrude a variety of units, but they are too small to appear on the accompanying sketch map. Throughout the area there is considerable textural variation within the gabbro, with medium and coarse grained phases occurring in the same intrusion, and very coarse grained pegmatitic phases being encountered in several locations.

STRUCTURAL GEOLOGY

In the migmatitic gneisses of the Ashuanipi Complex there is evidence of two periods of deformation of presumed Kenoran age (about 2,600 Ma ago).

Rocks of the Gagnon Group have been affected by three distinct episodes of deformation of Grenvillian age (about 1,000 Ma ago). During the first of these, they were thrust up against the Ashuanipi Complex, and deformed into tight, recumbent, intrafolial folds, generally of small amplitude. A penetrative axial planar foliation was developed in most lithologies, and a coarse cataclastic fabric was developed in the adjacent portions of the Ashuanipi Complex in the Grenville Front region.

Folds of the second generation are northeast trending, gently plunging structures, overturned towards the northwest (*i.e.* the basement). The latest phase of folds to develop were northwest trending features, formed at high angles to the preceeding structures. D1 and D2 structures

dominate the map pattern near the Grenville Front and D3 trends are predominant in the interior Grenville Province in the southeast part of the map area. South of Wabush Lake, interference of D2 and D3 structures has given rise to a dome and basin interference pattern.

METAMORPHISM

The quartzofeldspathic gneisses of the Ashuanipi Complex contain pyroxenes, indicating that metamorphism during the Kenoran Orogeny attained upper amphibolite or granulite facies.

Metamorphism of rocks of the Gagnon Group took place during the Grenvillian Orogeny. Near the thrust faults, metamorphic grade is in upper greenschist facies, and it rises to upper amphibolite facies towards the southeast. Kyanite is locally common in schists of the Katsao and Nault Formations throughout much of the area; tremolite and diopside occur in the Duley Formation, and minerals such as grunerite-cummingtonite, hedenbergite and eulite-orthoferrosilite occur in silicate carbonate iron formation. Composite metamorphic coronas around primary olivine, pyroxene and opaques are common in the Shabogamo Gabbro, and typically consist of actinolite $\pm$ garnet $\pm$ biotite. In gabbro samples with little igneous texture remaining, hornblende is the dominant mafic mineral.

ECONOMIC GEOLOGY

Vast deposits of oxide iron formation occur west and south of Wabush Lake, and these provide the basis for three mining operations in the region. Several more deposits of suitable tonnage and grade exist for possible future developments.

There are few other mineral showings of interest. Disseminated magnetite in gabbros and sulphides in marble are unlikely to be economic.

Possible materials for industrial use include the quartzite of the Wapussakatoo Formation, which assays over 99.5% SiO_2 in analysed samples. Kyanite in the Katsao and Nault Formations, however, is probably too disseminated to be of commercial value.

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