GEOLOGICAL MAPPING IN THE CENTRAL LABRADOR TROUGH

by R.A. Doherty

INTRODUCTION

This report summarizes field mapping during the 1978 season in the northernmost section of the Labrador Trough in western Labrador. The area mapped included all or parts of map areas 23O/1, 23O/2, 23O/7, 23J/15, and 23J/16 (N.T.S. 1:50,000).

Detailed mapping (1 inch = 1000 feet) programs were initiated by the Iron Ore Company of Canada and Labrador Mining and Exploration Company in the 1950's (Hurd, 1950; Burgess, 1951; Hagen, 1952 and Bloomer, 1954, 1955) and later by the Geological Survey of Canada (Frarey, 1967). Geological mapping by these workers was incorporated into regional 1 inch = 4 miles maps produced by the Geological Survey of Canada (Frarey, 1960; Barager, 1967).

The most recent work in the area, undertaken by Labrador Mining and Exploration Company, involved sulfide showings in the Martin Lake area (Hoag, 1971), and investigation of geochemical and airborne E.M. anomalies on the east side of Attikamagen Lake (Grant, 1977a, 1977b).

The southern section of the accompanying map is based on field work carried out during the latter part of August 1977.

REGIONAL GEOLOGY

The area is underlain by Aphebian sedimentary and volcanic rocks of the Kaniapiskau Supergroup, which has been subdivided into a miogeosynclinal sequence of sediments and pillow lavas, termed the Knob Lake Group, to the west, and a eugeosynclinal sequence of basic volcanics and pyroclastics, termed the Doublet Group, to the east (Frarey and Duffell, 1964). These rocks were subsequently intruded by a thick series of gabbroic sills referred to as the Montagnais group.

The sediments and sills were deformed during the Hudsonian Orogeny (circa 1735 Ma), which produced tight asymmetric northwesterly trending folds, westerly directed high angle thrust faults and subgreenschist facies metamorphism.

Knob Lake Group (Units 1-7)

Seward Formation (Unit 1)

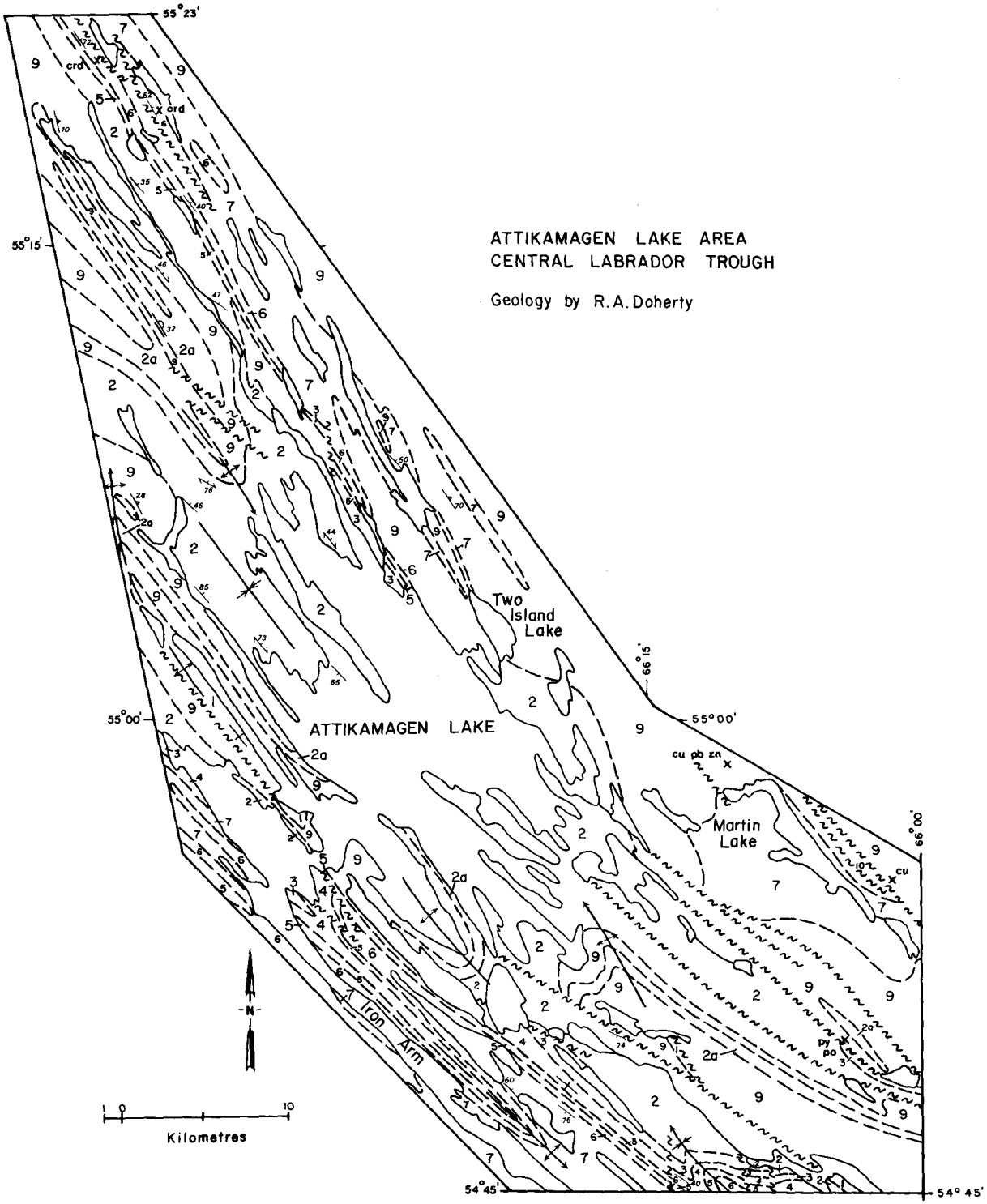
The Seward Formation, comprising arkoses and sandstones, occurs in fault contact with coarse grained gabbro on the west side of Attikamagen Lake. Contacts with the overlying Attikamagen Formation are not exposed but are presumed to be conformable.

Coarse grained white to green arkosic sandstones form the base of the section and grade up into medium grained pink quartzites with well developed paralled lamination and small scale cross-bedding. The sandstones also have a well defined color banding defined by alternation of hematite rich sand and white quartz sand. Locally, the upper 150 m of the formation consists of interbedded dark brown weathering, pink stromatolitic dolomite and hematite rich sandstone. Similar lithologies have been described from Seward Formation outcrops to the north (Baragar, 1967).

Cross-stratification indicates northerly directed paleocurrents. The Seward sandstones in this area are also finer grained and better sorted then their equivalents to the south. This is in agreement with the southerly provenance for the Seward Formation suggested by Wardle and Doherty (1978).

Attikamagen Formation (Unit 2)

Slates, siltstones and graywackes of the Attikamagen Formation outcrop sporadically throughout the central part of the area. They are strongly cleaved and



LEGEND

APHEBIAN

Montagnais Group

10 *Rhyolite, rhyolite porphyry.*

9 *Gabbro, differentiated gabbro sills, glomeroporphyritic sills; may be gabbro flows in part.*

Doublet Group

8 **Murdock Formation:** *Mafic pyroclastic rocks, chlorite schist.*

Knob Lake Group

7 **Menihek Formation:** *Black slate, laminated siltstone and slate, pyritiferous shales, mudstone, chert; gray siltstone and sandstone, minor quartzite; tuff, graywacke, minor agglomerate.*

6 **Sokoman Formation:** *Cherty iron formation; includes ferruginous shales of Ruth Formation.*

5 **Wishart Formation:** *Gray orthoquartzite, siltstone, hematitic sandstone, quartz-potash feldspar granule conglomerate, carbonaceous siltstone, chert.*

4 **Dolly Formation:** *Gray laminated siltstone and shale.*

3 **Denault Formation:** *Massive gray dolomite with chert veins, laminated stromatolitic dolomite, dolomite breccia.*

2 **Attikamagen Formation:** *Gray laminated siltstone, laminated slate, black siltstone, carbonaceous siltstone, graywacke, tuffaceous siltstone;* **2a,** *pillow lava.*

1 **Seward Formation:** *White arkosic quartzite, pink quartzite, hematitic sandstone, pink stromatolitic dolomite.*

tightly folded and it is difficult to estimate a true thickness for the formation.

Basal units comprise rusty weathering black to bluish fissile slates with minor interbedded arenaceous lenses. Sulfide mud nodules and spherical pyrite concretions are also frequently present. Carbonaceous siltstone and quartz-lithic graywacke make up a greater proportion of the formation towards the top of the section. The graywacke is massive, poorly sorted and contains dolomite pods and large 40-60 cm spherical carbonate concretions at a few localities. The presence of graded bedding, flute casts and load casts in some of the siltstone beds suggests a turbidite origin for at least part of the sequence.

Attikamagen Formation pillow lava (Unit 2a)

Numerous mafic pillowed flows are found in the lower parts of the Attikamagen Formation. Individual flows range in thickness from 10 m to more than 50 m. The coarse grained basal sections of flows have well developed columnar joints. Thin pillow breccia horizons occur locally between flows and quartz-calcite filled vugs are common in the centres of the pillows.

The flows are generally aphanitic and gray-green in color. Basal parts of the thicker flows closely resemble some of the medium grained gabbro sills. Distribution of the pillow lavas seems to be limited to the Attikamagen slates; however, similar volcanic rocks are also found directly underlying the Wishart Formation to the northeast of Martin Lake, and intercalated with the Menihek Formation north and southwest of Martin Lake.

Denault Formation (Unit 3)

The Denault dolomite is poorly exposed in the area and may be locally absent. In the eastern part of the area lithologies vary from massive light creamy dolomites to brown weathering light gray dolomites. Stromalitic horizons, cherts and dolomite breccias are common throughout the section.

In the western part of Attikamagen Lake the Denault Formation consists of brown weathering, laminated silty dolomites and medium grained massive gray dolomite. Bedding features in the gray dolomite have been largely obscured by diagenetic recrystallization but disturbed bedding and slump structures are occasionally visible.

Dolly Formation (Unit 4)

Light gray to green laminated siltstones and slates of the Dolly Formation overlie the Denault dolomite in the central part of the Trough. East of Iron Arm a thick section of Dolly Formation separates the Denault Formation from the overlying Wishart Formation. On the western side of the area the Wishart is in direct contact with the Denault Formation and the Dolly Formation is absent.

Wishart Formation (Unit 5)

Gray feldspathic quartzites and intercalated shales and argillites of the Wishart Formation outcrop sparsely over the area and display marked facies variations along strike, especially in the eastern exposures.

On the southwest side of Attikamagen Lake the formation is dominated by brown colored quartzite and intercalated siltstones. On the eastern side of the area the lithologies range from gray impure quartzites to pure white orthoquartzites which are interbedded with increasing amounts of siltstone and argillite towards the top of the section. Black banded chert horizons occur locally as do thin lenses of quartz-potassium feldspar-chert granule conglomerate. Red jasper and hematite bearing sandstones mark the contact with the overlying Sokoman Formation.

The Wishart Formation is regionally disconformable with the underlying units of the Knob Lake Group.

Sokoman Formation (Unit 6)

The Sokoman Formation occurs in a tight, faulted anticline - syncline pair in the southwest section of the area and as a continuous unit in the eastern section, where it extends from Attikamagen Lake to the northern end of the map area. It is normally a resistant unit and forms prominent ridges.

In the west the base of the Sokoman Formation is composed of silicate and minor silicate-carbonate facies iron formation which displays alternating centimetre scale lamination of light to dark green silicate rich chert and brown carbonate rich chert. Laminations are often wavy and discontinuous.

In the eastern exposures the lower part of the formation is formed by thinly bedded red to blue-gray oxide facies iron formation with frequent oolitic and granular horizons. Interbedded with this are thin units of brown silicate-carbonate iron formation. Riebeckite and crocidolite occur abundantly in this part of the iron formation.

The middle iron formation is everywhere composed of medium to thick bedded oxide facies iron formation. The beds show a fairly regular alternation of massive blue-gray hematite horizons with red jasper rich chert horizons. Granular textures, oolites, microconglomerates and cross-bedding are all characteristic features of this unit.

The upper iron formation is dominantly composed of lean carbonate cherts, with pitted weathering surfaces where iron carbonate pisoliths have weathered out.

Ferruginous slate of the Ruth Formation underlies

the Sokoman Formation southwest of Attikamagen Lake but is absent in the east. The Ruth slates have been included in the Sokoman Formation on the accompanying map.

Menihek Formation (Unit 7)

The Menihek Formation marks the top of the Knob Lake Group. Its major outcrop distribution is limited to the east side of the area, with additional minor exposures in the southwest.

The Menihek Formation lithologies on the eastern side of the map area are highly variable and consist of black slate, mudstone, pyritic shales, argillite, siltstone and chert breccia. The Menihek Formation near Two Island Lake is more arenaceous and contains cross-laminated quartzite beds interbedded with thinly laminated siltstones and shales. Tuff, tuffaceous siltstone, minor basic flows, agglomerates and discontinuous lenses of volcanogenic conglomerate occur north of Two Island Lake, indicating concurrent volcanism during the deposition of the Menihek Formation.

In the Martin Lake area, graywacke and carbonaceous siltstone occur in equal porportion with slates.

Doublet Group

Murdoch Formation (Unit 8)

East of Martin Lake a prominent northeast trending fault forms the contact between the sedimentary rocks of the Knob Lake Group and the volcanic and volcaniclastic rocks of the Doublet Group.

The Murdock Formation consists predominantly of meta-mafic volcanics, with the dominant lithology being green chlorite schist.

Montagnais Group (Unit 9)

A thick sequence of pretectonic gabbro sills intrudes the Knob Lake and Doublet Groups throughout the area. These sills commonly have well developed chilled margins against the enclosing sediments.

The thicker sills show a regular differentiation into a lower division composed of porphyritic gabbro and nonporphyritic ophitic gabbro, and an upper division composed of more leucocratic gabbro with irregular mafic pegmatite zones.

Some of the sills are very fine grained, have narrow chill zones, amygdaloidal textures near their tops and occasionally a blocky texture similar to that found in lava flows. It is possible, therefore, that at least some of them may be thick flows.

In the Two Island Lake area thick sills of glomerporphyritic gabbro with coarse grained normal gabbro margins are present in addition to the normal gabbro sills.

Rhyolite (Unit 10)

A fault bounded wedge of pink to red rhyolite and rhyolite porphyry occurs east of Martin Lake. The rhyolite is relatively undeformed and weakly metamorphosed and is probably an extreme differentiate of the Montagnais Group.

ECONOMIC GEOLOGY

The Sokoman Formation contains several areas of leaching and secondary hematite enrichment. No sizeable deposits of hematite ore have been found in the area, however.

The lower iron formation in the eastern part of the area contains common occurrences of fibrous riebeckite (crocidolite), which occurs principally as a cleavage mineral locallized in areas of tight folding but also as a secondary mineral along joints and fault zones. Fibre length averages between 1 and 4 cm, but the crocidolite is hard and probably impure. A rough field estimate indicated the crocidolite formed 10-15 percent of the iron formation for about 50 m along strike in the vicinity of the marked showings. The potential for more sizeable deposits along fault zones in the area appear to be good.

The Menihek Formation slates host a number of showings of massive and disseminated pyrite- pyrrhotite mineralization which appear to be syngenetic. Minor amounts of chalcopyrite and sphalerite are present in addition to pyrite-pyrrhotite in the Martin Lake Showings. Pyrite-pyrrhotite bearing slates are usually marked by *in situ* or transported gossans.

The basal arkoses of the Seward Formation and the black pyritic slates of the Menihek Formation may be potential sites for uranium mineralization. A handheld scintillometer survey, however, did not reveal any anomalous radioactive zones.

Acknowledgements: *The project was undertaken as part of the Labrador Trough mapping program under the direction and supervision of R.J. Wardle. Nelson Avery and Jeff Butt provided capable field assistance during the summer. Wayne and E.J. Tuttle maintained excellent logistical support. Field disscussions with B.J. Fryer and R.J. Wardle proved very useful during the course of field work.*

REFERENCES

Baragar, W.R.A.

1967: Wakuach Lake map area, Quebec, Labrador (23O). Geological Survey of Canada, Memoir 344.

Bloomer, R.O.

1954: Geology of the Martin Lake area, Labrador. Unpublished private report, Labrador Mining and Exploration Company, Montreal.

1955: Geology of the Howse Lake area, Ungava. Unpublished private report, Labrador Mining and Exploration Company, Montreal.

Burgess, L.C.N.

1951: Geology of the area west of Attikamagen Lake, Quebec and Newfoundland. Unpublished private report, Iron Ore Company of Canada, Montreal.

Frarey, M.J.

1960: Geology, Menihek Lakes, Newfoundland and Quebec. Geological Survey of Canada, Map 1087A.

1967: Willbob Lake and Thompson Lake map area, Quebec and Newfoundland (23O/1 and 23O/8). Geological Survey of Canada, Memoir 348.

Frarey, M.J. and Duffell, S.

1964: Revised stratigraphic nomenclature for the central part of the Labrador Trough. Geological Survey of Canada, Paper 64-25.

Grant, J.M.

1977a: A report on ground investigations of airborne geophysical anomalies on Block 134. Unpublished private report, Labrador Mining and Exploration Company, Montreal.

1977b: Diamond drill program, 1977. Unpublished private report, Labrador Mining and Exploration Company Montreal.

Hagen, J.C.

1952: Geology of Iron Arm - Cunningham Lake area, Labrador, Canada. Unpublished private report, Iron Ore Company of Canada, Montreal.

Hoag, R.B.

1971: Report on the Martin Lake area, Labrador and Quebec. Unpublished private report, Labrador Mining and Exploration Company, Montreal.

Hurd, D.W.

1950: Geology of Cormier-Hurst Lake area, Quebec and Labrador. Unpublished private report, Iron Ore Company of Canada, Montreal.

Wardle, R.J., Doherty, A.

1978: The Wade Lake-Timmins Lake area, eastern margin of the Labrador Trough. *In* Report of Activities for 1977. *Edited by* R.V. Gibbons. Mineral Development Division, Newfoundland Department of Mines and Energy, Report 78-1, pages 65-71.