GEOLOGICAL MAPPING OF THE DYKE LAKE - ASTRAY LAKE AREA, LABRADOR TROUGH

by J.L. Evans

INTRODUCTION

Mapping in the Dyke Lake - Astray Lake area was carried out as part of the mapping and mineral evaluation project on the Labrador Trough. The main objectives of this project were to review the stratigraphy, prepare a 1:50,000 geologic map and to evaluate the mineral potential of the area. Particular emphasis was placed on mapping of the Nimish volcanics and defining their stratigraphic relations to the rest of the Knob Lake Group.

Original geologic work in this area was done by the Iron Ore Company of Canada with the reconnaissance work of Fahrig (1949) followed by the detailed mapping of Melihercsik (1952), Kavanagh (1952), Perrault (1952), Stevenson (1952), Sauvé (1953) and Usher (1953). The area has been incorporated into the Geological Survey of Canada 1:250,000 map of Frarey (1957).

GENERAL GEOLOGY

The Dyke Lake - Astray Lake area lies about 100 km southeast of Schefferville in the middle of the Labrador Trough. The region is underlain by Aphebian rocks of the Knob Lake Group which forms the basal unit of the Kaniapiskau Supergroup. The area is unique in that it contains a suite of mafic volcanic rocks, collectively termed the Nimish volcanics, which are interbedded with the sedimentary rocks of the Knob Lake Group. Elsewhere in the Trough the Knob Lake Group is an exclusively sedimentary sequence with volcanic rocks only found in the overlying Doublet Group. These rocks were affected by the Hudsonian orogeny, at about 1,735 Ma (Goodwin, 1970), which caused tight folding, reverse faulting and greenschist grade metamorphism.

KNOB LAKE GROUP

Attikamagen Formation

This is the oldest formation exposed in the area. Since the base of the formation in the area has not been recognized and the upper contact with the Denault Formation is gradational it is impossible to establish its thickness. Throughout most of the area, the formation consists of monotonous, thinly bedded, gray to black shales with locally developed slaty cleavage. West of Marble Lake, the formation becomes calcareous at the top as it grades into the Denault Formation while southeast of Dyke Lake it shows graded bedding and is slightly tuffaceous.

Denault Formation

The Denault Formation dolomites are best exposed in the Marble Lake area but isolated occurrences are found on islands in Dyke and Astray Lakes. A complete section of the Denault is not exposed but the formation is estimated to be at least 500 m thick.

In the northwest corner of the map area, it is a finely laminated, clean to silty, massive dolomite interbedded with shales at the top whereas along the peninsula separating Astray and Marble Lakes it is a coarse dolomite breccia containing angular blocks of laminated dolomite, up to one metre across, in subparallel orientation within a matrix of massive dolomite. The association of finely laminated and coarsely brecciated dolomites with a rectangular fracture pattern imply that the Denault is a diagenetic dolomite which formed in a lagoonal environment by evaporitic precipitation and alteration of calcareous muds. The lithologic variations are taken to represent facies changes reflecting a possible shoreline to the south of the map area.

Fleming Formation

The Fleming Formation was only recognized at a few locations on the Astray Lake - Marble Lake Peninsula. Here it forms ridges whose shape and distribution imply a lenslike distribution for the formation. The lenslike character and gradational contact with the overlying Wishart Formation give a thickness estimate of 0-130 m.

The Fleming Formation is a massive to coarsely bedded chert breccia with angular fragments of massive to laminated, multicolored chert up to half a metre across and smaller amounts of rounded silt to coarse sand size quartz fragments, chaotically set in a massive gray to black chert matrix. No regular variations in grain size or bedding structures were noted within the formation except for the introduction of thinly laminated cherty quartzite beds towards the top of the unit. The Fleming Formation probably represents some form of intraformational conglomerate, but the origin of the chert and nature of the brecciation are uncertain.

Wishart Formation

The Wishart Formation is the most continuous unit in the area, although generally not well exposed. Stratigraphic relations within the Menihek Lake area of the Labrador Trough (Frarey, 1957) show that the Wishart Formation is a transgressive quartzite sequence from west to east with thickness estimates in the Dyke Lake - Astray Lake area varying from about 100 m in the northwest to 700 m in the southeast.

In the northwest, the formation consists of a lower, massive, cherty quartzite overlain by a finely bedded gray orthoquartzite. To the southeast, the formation becomes more feldspathic in composition and consists of a basal member of finely bedded gray feldspathic sandstones and siltstones overlain by an equal thickness of gray finely bedded feldspathic siltstones.

Sokoman Formation

The Sokoman Formation, as defined by Zajac (1974), includes all the sedimentary rocks between the top of the Wishart Formation and the first basal shale unit of the Menihek Formation. This differs from the original Iron Ore Company of Canada definition which classified the basal black ferruginous siltstones, Zajac's Unit I, as the Ruth Formation (Harrison, 1952). The author chose to follow the nomenclature of Zajac (1974) because in the Dyke Lake - Astray Lake area the basal siltstones are very thin, very poorly exposed and do not warrant separate formation status. Similarly, petrologic evidence suggests that these siltstones and the overlying iron formation experienced a similar diagenetic history of reaction with iron rich waters implying that the ferruginous siltstones and cherty iron formation are chemically, mineralogically and genetically related.

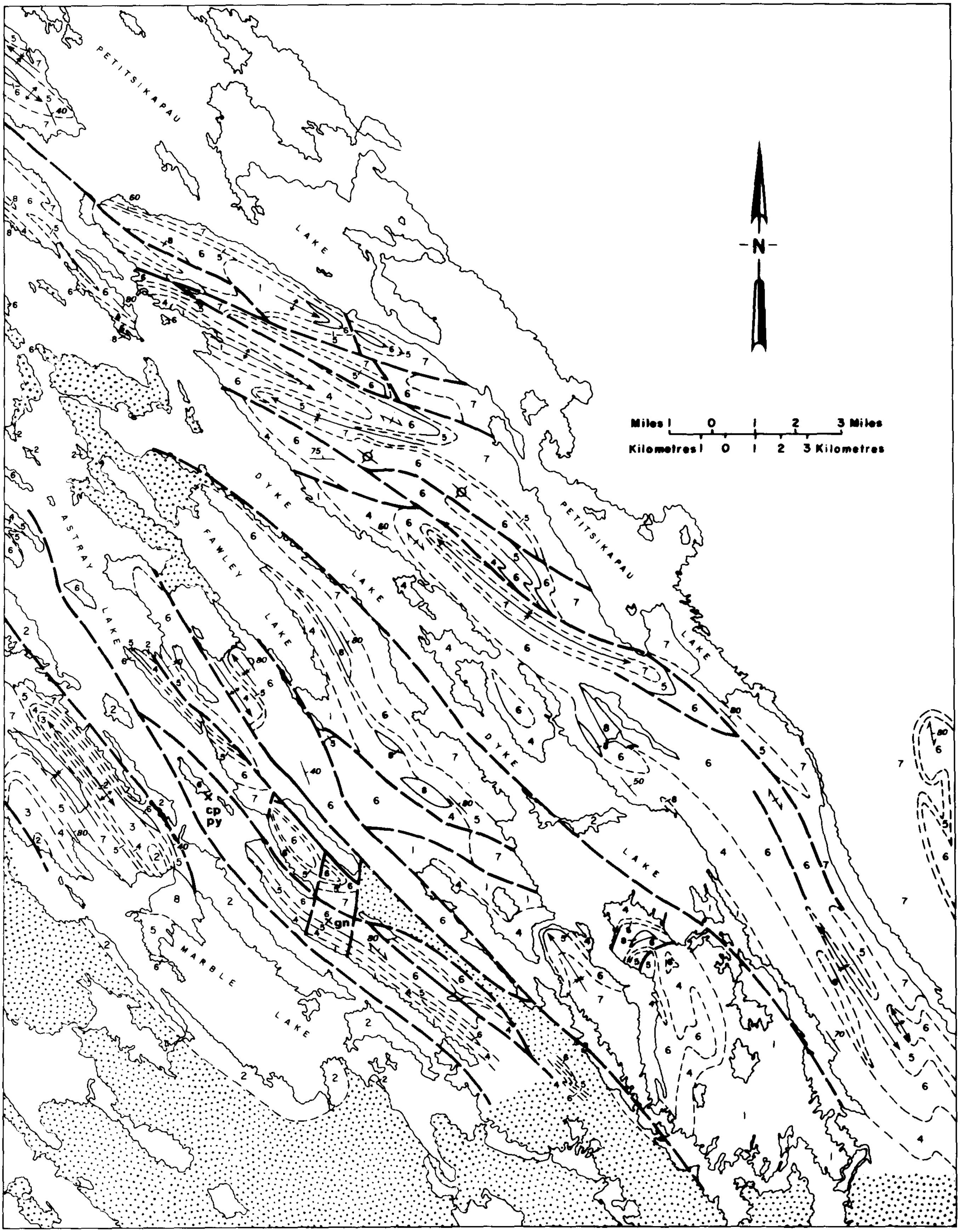
The iron formation of the Dyke Lake - Astray Lake area differs from that of the Knob Lake region in that it occurs interbedded with the Nimish volcanic rocks in contrast to the volcanic-free stratigraphy of the Knob Lake area. In the Dyke Lake - Astray Lake Peninsula, the iron formation occurs immediately below the main body of volcanic rocks whereas in the Dyke Lake Petitsikapau Lake Peninsula it occurs above and intercalated with the volcanic pile. These stratigraphic relations, the lenslike character of the iron formation within the volcanics, and the general poor exposure make thickness estimates difficult, but a minimum of 75 m in the Dyke Lake - Astray Lake section and 150 m in the Dyke Lake - Petitsikapau section has been established.

The internal subdivisions within the Sokoman Formation of the Knob Lake area (Zajac, 1974) may be extended into the Nimish volcanic area. The iron formation generally shows a basic three fold division with complex facies changes occurring over short distances, both along strike and across section. The lower iron formation consists of a basal unit of finely laminated black pyritiferous siltstones and an upper unit of silicate - carbonate facies cherty iron formation. The basal unit is very poorly exposed and thickness estimates range from 0 to 15 m. This is overlain by a silicate - carbonate facies cherty iron formation ranging in thickness from about 25 m in the northeast to 60 m in the southwest. This unit exhibits irregular subplanar beds about 1 cm thick. Occasional thin oolitic horizons are present. The mineralogy is variable with the dominant assemblage being chert, stilpnomelane, greenalite and iron rich carbonate partially or wholly replaced by hematite and goethite. In beds void or low in carbonates, minnesotaite is the dominant iron silicate.

The middle iron formation is mainly an oxide facies rock rich in magnetite and hematite. Thickness varies from approximately 125 m in the northwest to 40 m in the southeast. Bedding within this unit is very irregular with trough cross-beds, rip-up clasts and intraformational conglomerates, the latter often being rich in granular and oolitic jasper.

The upper iron formation member indicates a reversal to more reducing conditions with the dominance of silicate poor, carbonate rich rocks and massive to thick interbeds of lean gray chert. This unit is not well exposed and isolated outcrops imply a thickness of about 20 m in the northwest and 50 m in the southeast.

This simple subdivision of the Sokoman Formation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LEGEND

APHEBIAN

MONTAGNAIS GROUP

8	*Diorite, gabbro.*

KANIAPISKAU SUPERGROUP

KNOB LAKE GROUP

7	**MENIHEK FORMATION:** *Gray siltstones and argillites.*
6	**NIMISH FORMATION:** *Mafic to intermediate lavas, tuffs and agglomerate.*
5	**SOKOMAN FORMATION:** *Banded cherty iron formation.*
4	**WISHART FORMATION:** *Orthoquartzite, feldspathic sandstone and siltstone.*
3	**FLEMING FORMATION:** *Chert breccia.*
2	**DENAULT FORMATION:** *Laminated dolomites, dolomite breccia.*
1	**ATTIKAMAGEN FORMATION:** *Black shales, tuffaceous siltstones.*

SYMBOLS

Bedding (tops known) ....

Pillows (inclined, vertical; tops known) ....

Syncline ....

Anticline ....

Anticline or syncline (arrow indicates direction of plunge) ....

Schistosity (inclined, vertical) ....

Geological contact (defined, approximate) ....

Fault (defined, assumed) ....

Mineral occurrence (cp = chalcopyrite, py = pyrite, gn = galena) .... ×

Drift covered area ....

is complicated by intercalations of the volcanic rocks and an impure clastic facies of the iron formation. The latter consists of detrital quartz, feldspar, magnetite, volcanic fragments and jasper commonly cemented by and interbedded with thin laminae of chert and iron oxides. This facies is most commonly found as large lenslike bodies, about 30 m by 10 m in size, interbedded with mafic pillow lavas in the northeast section of the area and as large homogeneous units along the north-west shore of Petitsikapau Lake. Low angle, planar cross-beds, graded bedding, rip-up clasts and soft sediment deformation features in the finer grained units imply some form of mass flow deposit. This facies of the Sokoman, unique to this area, is taken to represent the effect of periodic Nimish volcanic activity and the slope instability of a volcanic island.

Menihek Formation

The Menihek Formation is very poorly exposed within the area and only outcrops along the west shore of Petitsikapau Lake where it lies on the western limb of the Petitsikapau syncline (Wardle, this volume).

Lithologically, it is similar to the Attikamagen Formation and is composed of gray siltstones with minor argillaceous beds. No tuffaceous horizons are known to occur in the Menihek Formation.

Nimish Volcanics

The Nimish Volcanics occurs as a large lenslike body that runs southeast of Schefferville for about 125 km and covers roughly 400 km^2. In the Dyke Lake - Astray Lake area it is predominantly interbedded with the Wishart and Sokoman formations but possible tuffaceous equivalents are found as low as the Attikamagen Formation. Structural complexities and the inconsistencies of the volcanic stratigraphy make thickness estimates difficult but a maximum of 1 km is proposed.

Two distinct periods of volcanic activity are represented with volcanic rocks occurring mainly above the iron formation in the west and below the iron formation in the east. The volcanic rocks are complexly interbedded with the clastic facies of the iron formation in the north half of the Dyke Lake- Petitsikapau Lake Peninsula.

About half of the volcanic rocks exposed are massive to slightly amygdaloidal, fine grained, green and gray mafic to intermediate lavas. In some of the volcanic horizons a tuffaceous component composed almost solely of rounded red aphanitic jasper clasts up to 5 cm across is present. The origin of this jasper is enigmatic as it could be primary clasts derived from the iron formation or it could represent iron rich cherts formed by exhalative processes associated with the volcanic activity.

Pillow lava is confined to the northwestern part of the area where it is composed of ellipsoidal pillows up to one metre across with irregularly shaped chloritic rims of about 10 cm in width. Epidote, chlorite, quartz and calcite form veins and fill vesicles associated with these structures.

Plagioclase-porphyritic lava is the other dominant lithology comprising 20 percent of the Nimish volcanics by aereal exposure. These lavas have marked lateral continuity and form good marker horizons. Lithologically, they contain subhedral plagioclase phenocrysts up to 3 cm long, locally partially aligned, in a dense aphyric green groundmass. Lavas of this type occur mainly on the Dyke Lake - Petitsikapau Peninsula with few occurrences noted to the west.

The fairly coarse grained textures, remarkable lateral continuity, and general scarcity of pillow lavas, seem to suggest that these are fissure eruption basalts that were extruded into a shallow marine or lacustrine environment.

The remaining 30 percent of the volcanics consist of fragmental rocks ranging from fine grained, cross-bedded, waterlain tuffs to coarse grained, massively bedded boulder conglomerates and agglomerates. Gradations in clast size were recognized in the tuffaceous rocks with a roughly concentric pattern being developed around coarse centres located east of Roger Lake and west of Point Lake. In these centres, coarse jasper and rhyolite rich agglomerates and conglomerates with fragments up to 1 m across are interbedded with intermediate to acidic porphyritic volcanics. Outwards from these centres, the sizes of the clasts decrease markedly. The association of acidic volcanics at the top of a volcanic pile, thick interbeds of structureless boulder conglomerates, and the abundance of jasper and rhyolite clasts within the sediments implies that these areas represent the eroded remnants of subaerial volcanic islands and associated alluvial fans that formed during the final stages of igneous differentiation.

A representative suite of 104 samples of the Nimish volcanic rocks was collected and is presently being analysed to provide more information on the chemistry and origin of these rocks. It is also anticipated that a subdivision of the Nimish Volcanics into separate formations will be made.

Montagnais Group

A series of pretectonic medium to coarse grained diorites and gabbros occur as sills and stocks throughout the area with the best exposures being around Evans Lake. Phases within individual plutons are hard to distinguish with only slight variations in color index noted. Generally, the intrusives show a nonporphyritic, subophitic texture with the mineralogy of plagioclase, clinopyroxene and magnetite remaining fresh relative to the volcanics.

STRUCTURE AND METAMORPHISM

The area is dominanted by a series of northeast trending tight to open, upright to slightly overturned anticlines and synclines separated by high angle reverse faults. These faults occur along the axial planes of folds and also along fold limbs. Movement has usually taken place along one of the less competent shale units. Some component of sinistral strike-slip movement possibly occurred along the faults at the north end of the Dyke Lake - Petitsikapau Peninsula to account for the apparent deflection of the fold axes in that area.

Metamorphism is of sub to low greenschist grade. Poorly developed chloritic fabrics in some siltstones and volcanics are the only microstructural evidence of this metamorphism.

MINERALIZATION

During their mapping project of 1952-53, Iron Ore Company of Canada carried out detailed mapping and some trenching and assays of all the leached sections of the iron formation within the area. Assays from the various localities ranged from 35 to 56 weight percent iron with none of the occurrences being of high enough grade or tonnage to warrant any exploratory drilling.

Within the volcanics, pyrite with minor chalcopyrite fills vesicles on the islands of Astray Lake and galena occurs along fracture planes in the intermediate volcanics west of Roger Lake. Generally, the Nimish Formation appears barren of base metal mineralization.

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