GEOLOGY OF THE SIMS LAKE - EVENING LAKE AREA, WESTERN LABRADOR

by M.J. Ware

INTRODUCTION

The Sims Lake - Evening Lake area was mapped at 1:50,000 scale as part of the Mineral Development Division's Labrador Trough project. Emphasis was placed on the Sims Formation, a sedimentary sequence up to 700 m thick and covering about 300 km^2 which unconformably overlies the Aphebian Knob Lake Group of the Labrador Trough.

New data arising from the summer's work include: the nature of the contact between the Sims Formation and Knob Lake Group, a sedimentological and stratigraphic analysis of the Sims Formation, a refinement of the structural geology of the Evening Lake area, and the recognition of a new unit, the Tamarack formation, lying between the Knob Lake Group and the Sims Formation.

Original geological investigations in the region were performed by the Iron Ore Company of Canada (I.O.C.) and the Labrador Mining and Exploration Company. Eade (1949) mapped the northern section around Sims Lake and Beland (1949), Baird (1950) and Fraser (1952) described the rocks north and east of Evening Lake. Reconnaissance mapping by Wynne-Edward (1961) and Fahrig (1967) for the Geological Survey of Canada included the map area. BP Minerals Limited recently carried out an exploration program in the western half of the area and provided new information regarding the rocks of the Tamarack River - Evening Lake area (MacDonell and Walker, 1975).

GENERAL GEOLOGY

The oldest rocks in the area are the gneisses of the Eastern Basement Complex (Unit 1), which are sparsely exposed in the northeastern corner of the map area. The development of migmatitic and gneissic fabrics in these rocks predated the deformation which affected adjacent Aphebian rocks and is therefore believed to be a relict Archean feature.

The gneisses are in fault contact with the poorly exposed sedimentary and volcanic rocks of the Aphebian Knob Lake Group. These are intruded by several pretectonic gabbro sills believed to be representatives of the Montagnais Group, also of Aphebian age.

All Aphebian rocks have been varyingly cleaved and weakly metamorphosed in the Hudsonian Orogeny circa 1735 Ma, and are deformed into upright, shallowly plunging, northwest trending folds.

The northwestern part of the map area is underlain by a poorly exposed sequence of sedimentary rocks which were previously included in the Knob Lake Group (Fahrig, 1967). More recent work, however, has indicated that these sediments rest unconformably upon the Aphebian strata and they have therefore been separately named the Tamarack formation (provisional term).

The Tamarack formation and the Aphebian rocks of the area are overlain unconformably by the generally shallowly dipping strata of the Sims Formation, which forms a sequence of conglomerate, arkose and quartzite about 700 m thick and is disposed in four outliers. The three northern outliers, designated from east to west as the MacLean outlier, the Sims outlier and the Muriel outlier, form high flat topped hills and have been weakly deformed into broad northwest trending folds. The Muriel and MacLean outliers have subsequently been intruded by fresh gabbroic sills and sheets of the Shabogamo Gabbro. The southern outlier of Sims Formation, designated the Evening outlier, has also been intruded by Shabogamo Gabbro sills, then cleaved, thrust faulted and deformed into tight east-west trending folds during the Grenville Orogeny, circa 1000 Ma.

Eastern Basement Complex (Unit 1)

White weathering, quartz-plagioclase-biotite-hornblende, granodiorite-tonalite gneisses with thin pods and bands of amphibolite outcrop around MacLean Lake. The gneissic foliation and migmatite textures in most outcrops have usually been tightly folded and partially to completely transposed into a later northwest trending mylonitic fabric.

Knob Lake Group (Units 2-8)

The graywackes and quartz-granule conglomerates of the Seward Formation (Unit 2) are exposed north of the Sims outlier. They bear a strong lithologic resemblance to the lower Seward member described by Wardle and Doherty (1978) in the Timmins Lake area to the northeast.

The Attikamagen Formation (Unit 3), exposed northeast of the Evening outlier, is composed of thinly laminated to thickly bedded black argillites, slates and graywackes which are lithologically identical to the Menihek Formation (Unit 8).

Exposures of the Denault Formation dolomite (Unit 4) are limited to the northeastern corner of the Evening outlier and to the southern margin of the map area.

Approximately 50 m of the red and white feldspathic sandstone of the Wishart Formation (Unit 5) outcrops beneath the Sims Formation's basal unconformity on the northeastern corner of the Muriel outlier.

Interbedded within the Sokoman Formation (Unit 7) north of the Muriel outlier are several basaltic flows of the Nimish Subgroup (Unit 6).

The Sokoman Formation (Unit 7) occurs in three belts in the map area. The one between Muriel Lake and Sims Lake does not outcrop but is associated with a pronounced magnetic anomaly and has been located in shallow drill holes by I.O.C. The belt exposed east of the Sims outlier is cherty oxide iron formation composed of jasper, gray chert and hematite. The third belt lies south of the Evening outlier and is composed largely of schistose carbonate iron formation.

The black slates, argillites and graywackes of the Menihek Formation (Unit 8) are believed to underlie most of the drift and lake covered plateau between the outliers. The fine grained rocks of the Menihek and Attikamagen Formations are differentiated only on the basis of their stratigraphic position.

Montagnais Group (Unit 9)

A medium to coarse grained gabbroic sill of the Montagnais Group intrudes the Menihek Formation east of the Sims outlier. The gabbro is weakly deformed and has a characteristic chlorite-epidote-albite metamorphic assemblage.

Tamarack formation (Unit 10)

This is a new term proposed for a generally gently dipping sedimentary sequence located west of the Muriel outlier. The rocks of the area were originally included in the Menihek Formation by Fahrig (1967) but in later BP Minerals Limited mapping (MacDonell and Walker, 1975) were recognized as probably Helikian and included in the Sims Formation.

On the northwestern side of the Muriel outlier, however, these sediments are overlain with an angular unconformity by the basal conglomerate of the Sims Formation and clearly belong to an earlier period of sedimentation. The name Tamarack formation is proposed for these rocks and is derived from the Tamarack River, which drains the area west of the Muriel outlier.

The lower contact with the Knob Lake Group is unexposed, but since the Tamarack formation contains clasts of several of the typical Knob Lake Group lithologies it is presumed that the two units were separated by an erosional episode. The flat lying weakly cleaved nature of the Tamarack formation also contrasts strongly with the steep dips and strong slaty cleavage usually seen in the Knob Lake Group.

Exposure of the Tamarack formation is generally poor but a rough internal stratigraphy can be recognized. The base of the formation consists of interbedded maroon siltstones, shales and maroon pisolitic dolomites which are best exposed in the western part of the area near Esker. Overlying these rocks is a sequence of red-maroon arkoses and minor granule conglomerate which contains occasional small clasts of jasper, iron formation, chert, and quartzite derived from the Knob Lake Group. These rocks are overlain by red, green and gray argillites which form the top of the Tamarack formation. The minimum thickness of the formation is estimated at approximately 100 m.

Sims Formation (Unit 11)

The Sims Formation in the eastern part of the area rests directly on deformed Aphebian rocks. In the western parts of the area the formation oversteps onto the tilted strata of the Tamarack formation. The contact is not exposed but on the western flank of the Muriel outlier maroon siltstones and pisolitic dolomites of the Tamarack formation dip 25° to the west and are seen about 15 m away from flat lying conglomerate of the basal Sims Formation (section H). Clasts of pisolitic dolomite have also been found in the Sims Formation

conglomerate and there, therefore, appears little doubt that the contact is an angular unconformity.

The stratigraphy of the formation comprises three lithologic members. Stratigraphic relationships within the formation are shown on the accompanying fence diagram. The basal conglomerate member (11a) ranges from 2-30 m thick and is composed of angular to subrounded clasts up to boulder size in a poorly sorted red sandstone matrix. The lithologies of the clasts include jasper, chert, quartzite, vein quartz, iron formation, and rock fragments all of which were derived from the Knob Lake Group. Dolomitic and light colored siltstone clasts are also present and were derived from the Tamarack formation.

The conglomerate passes gradationally upwards into a dark red, cross-bedded arkose member (11b) which owes its color to finely disseminated iron oxide. The arkose member is best exposed along the southern edges of the Muriel and Sims outliers and ranges in thickness from 50 to 150 m. Large scale planar cross-bedding is a common feature and indicates northwesterly directed paleocurrents. Sedimentary structures and textures indicate that both the conglomerate and arkose members of the Sims Formation were probably deposited in a braided fluviatile regime.

Overlying the arkose member is the Sims Formation's quartzite member (11c) which caps the hills of the Muriel, Sims and MacLean outliers. The contact between the arkose and quartzite is transitional over 50 m. The member generally consists of well indurated, pink, orange and white, fine grained, very pure quartzite and is at least 500 m thick on the eastern side of the Sims outlier (section C). Laminated bedding, ripples, cross-bedding and parting lineation are often visible but generally the quartzite is massive. A persistent horizon of granules and pebbles of jasper and vein quartz within the quartzite member was traced throughout all four outliers. The quartzite member is believed to have been deposited in an intertidal to subtidal environment, with a northeast-southwest depositional strike and a northwesterly dipping paleoslope.

Shabogamo Gabbro (Unit 12)

The Shabogamo Gabbro consists of medium to coarse grained, ophitic-textured olivine gabbro which intrudes the Knob Lake Group and Sims Formation in the form of sheets, dikes and stocks. The MacLean outlier sheet is at least 150 m thick and is columnar jointed. Near its upper contact it contains large angular xenoliths, up to 1 m in diameter, of Sims Formation quartzite and granite. The latter xenoliths are presumably derived from the Eastern Basement Complex. A characteristic feature of the gabbro in the Muriel and MacLean outliers is that near the contact with the Sims Formation the plagioclase feldspar assumes a pink coloration due to alteration.

The gabbro in the Muriel outlier and most of the MacLean outlier is fairly fresh and undeformed. The gabbro adjacent to the fault contact with the basement near MacLean Lake, however, is sheared.

In the Evening Lake area the gabbro has been pervasively altered to a chlorite-epidote-albite-carbonate greenschist mineralogy and is locally foliated.

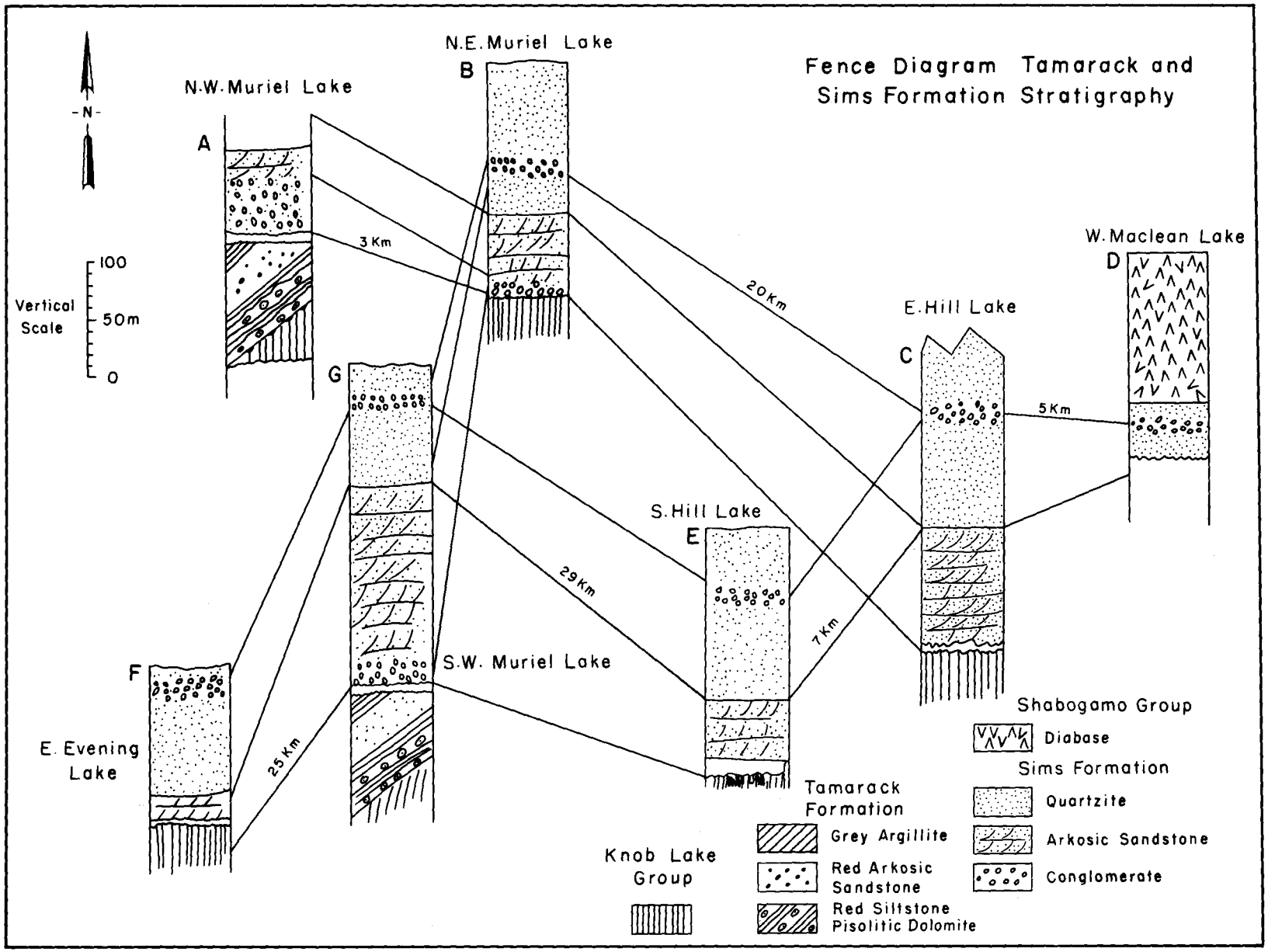
Samples of the Shabogamo Gabbro have been collected for Rb/Sr age dating as part of a separate project.

STRUCTURE AND METAMORPHISM

The rocks of the Knob Lake and Montagnais Groups were deformed into vertical northwest trending folds during the Hudsonian deformation. The same episode of deformation is believed to have produced the mylonitic fabrics in the gneissic rocks of Unit 1 and the fault contact between these rocks and the Knob Lake Group. The shales of the Attikamagen and Menihek Formations in the northern part of the area generally have a well developed axial planar slaty cleavage. Other formations of the Knob Lake Group, however, only locally show penetrative Hudsonian fabrics. The intensity of fabric development increases to the east towards the fault contact with the basement. In the southern part of the area, around Evening Lake, the Knob Lake Group rocks possess a single east-west trending slaty cleavage. This cleavage is parallel to that in the overlying Sims Formation and is assumed to be a Grenville fabric. It appears, therefore, that Hudsonian deformation was very weak or absent in the Evening Lake area.

The Sims Formation in the Evening Lake area was deformed during the Grenville event into tight folds, which are overturned to the north, and plunge gently to the west. Northerly directed reverse faults are present on fold limbs. A penetrative east-west trending axial planar slaty cleavage is present in the Knob Lake Group shales and slates and occasionally in the gabbro. Shear fabrics are occasionally present in the Sims Formation's quartzite member.

The Tamarack formation possesses a moderately developed, steep, northwest trending fracture cleavage. The overlying Sims Formation of the northern outliers is deformed into broad, open, northwest trending flexural folds and is only rarely cleaved. It is clear that the Tamarack formation was tilted and deformed to some extent prior to deposition of the Sims Formation but it is not clear whether it was also penetratively deformed at this time. It is more probable that the cleavage in the



Tamarack formation was produced during the same episode of deformation that folded the Sims Formation.

The eastern edge of the Sims Formation, and the Shabogamo Gabbro near MacLean Lake, have also been deformed along the fault contact with the basement.

One interpretation of the age of the deformation in the Tamarack and Sims Formations is that these sediments and the Shabogamo Gabbro are of very late Aphebian or early Helikian age and were affected by a late phase of the Hudsonian Orogeny. An alternative, and probably more plausible, interpretation is that the deformation is of Grenville age and related to reactivation of underlying Hudsonian structures. Grenville fabrics in the area usually have an east-west trend but Rivers (1978) has recognized northwest trending F_3 fold structures in the Wabush area to the southwest. It is possible, therefore, that these structures are also present in the Muriel-MacLean Lake area.

A more accurate assessment of the age of this deformation will have to await the age determinations presently being carried out on the Shabogamo Gabbro.

Metamorphism in both the Hudsonian and Grenville events reached the greenschist facies. Grenville metamorphic grade appears to increase to the south since phyllites and fine grained schists are generally prevalent in the Knob Lake Group south of the Evening outlier.

AGE OF THE SIMS AND TAMARACK FORMATIONS

Since both the Tamarack and Sims formations unconformably overlie the deformed Knob Lake Group and were deformed by Grenville structures, their age must be Helikian. The Sims Formation lithologies compare fairly closely with those of the Neohelikian Seal Lake Group but the stratigraphy of the two areas does not correlate.

The unconformity between the Tamarack and Sims formations indicates an intra-Helikian disturbance in the area which may correlate with the Elsonian disturbance of circa 1370 Ma (Stockwell *et al.*, 1970). An intra-Helikian unconformity of this age is also present between the Neohelikian Seal Lake and Paleohelikian Bruce River Groups in eastern Labrador (Smyth *et al.*, 1975).

ECONOMIC GEOLOGY

Minor pyrite showings were found in the black argillites of the Attikamagen, Menihek and Tamarack Formations and within the Shabogamo Gabbro.

The area has potential for unconformity related uranium mineralization. A handheld scintillometer survey of the area, however, revealed no anomalously high radioactivity.

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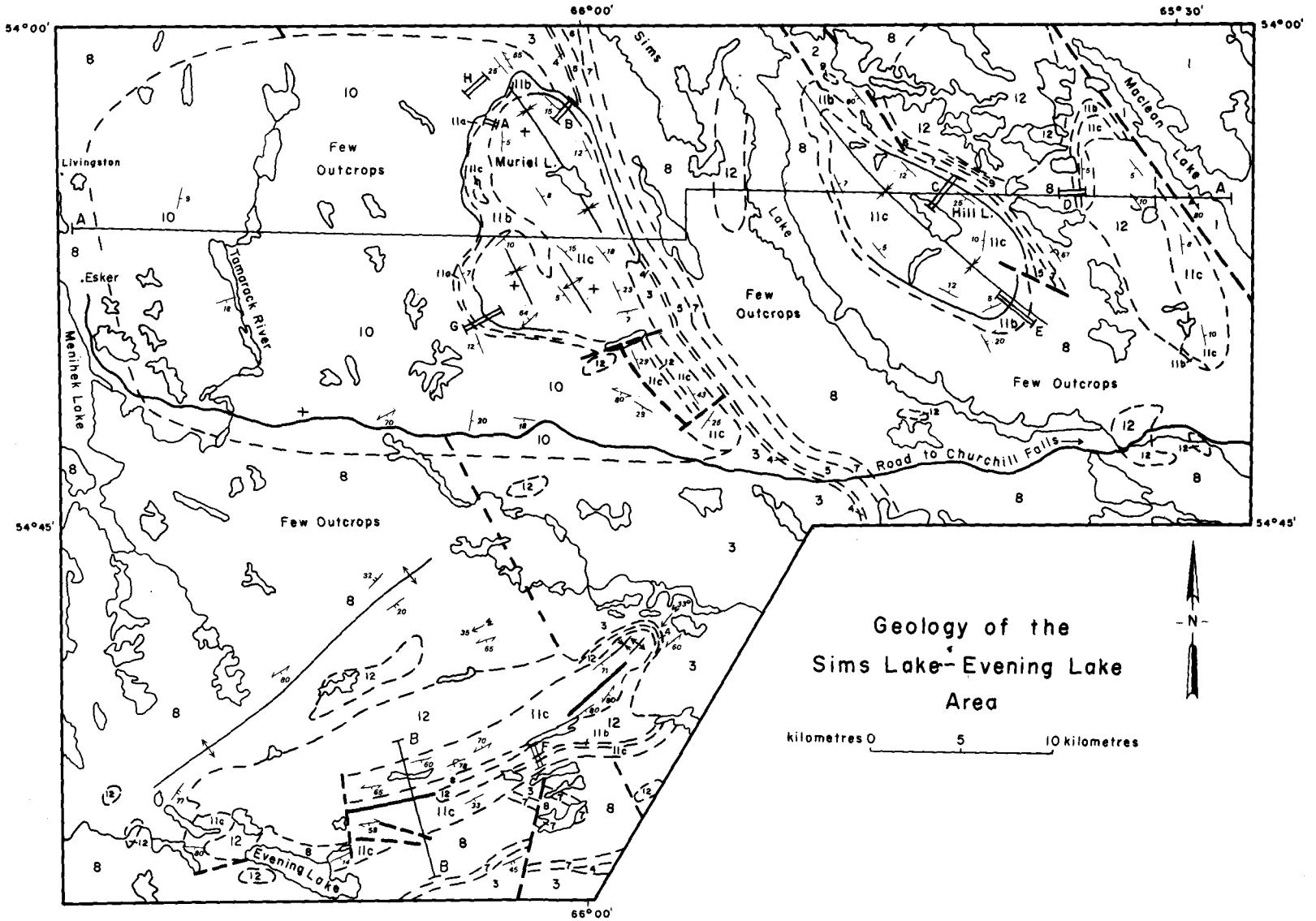

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LEGEND

HELIKIAN

12 **Shabogamo gabbro:** *Gabbro, diorite*

11 **Sims Formation: 11a,** *Polymictic conglomerate;* **11b,** *arkosic sandstone;* **11c,** *quartzite with minor granule conglomerate.*

10 **Tamarack formation:** *Pisolithic dolomite, arkose, argillite.*

APHEBIAN

Montagnais Group

9 *Gabbro, diorite.*

Knob Lake Group

8 **Menihek Formation:** *Black shales and argillites.*

7 **Sokoman Formation:** *Banded cherty iron formation.*

6 **Nimish Subgroup:** *Mafic lavas.*

5 **Wishart Formation:** *Quartzite and feldspathic sandstone.*

4 **Denault Formation:** *Dolomite and chert lenses.*

3 **Attikamagen Formation:** *Black shales, argillites and minor graywackes.*

2 **Seward Formation:** *Graywacke and quartz conglomerate.*

ARCHEAN

1 **Eastern Basement Complex:** *Granite and granite gneiss.*