THE HEGGART LAKE FORMATION, BRUCE RIVER GROUP, MORAN LAKE AREA (13K/7, 10), LABRADOR

by D. Chaulk

INTRODUCTION

Geological mapping of the Central Mineral Belt of Labrador by the Mineral Development Division began in 1974 (Smyth *et al.*, 1975). The aims of the work at that time were to establish the stratigraphy, structure and metallogeny of the Croteau Group and its relationship to the surrounding rock groups, and to incorporate this information with the numerous unpublished company maps of the area with the intent of publishing 1:100,000 geological maps (Smyth *et al.*, 1975). As a result of the initial work in the area, the Croteau Group of Fahrig (1959) and Williams (1970) was redefined as two new groups; namely, the Moran Group and the Bruce River Group. The Aphebian Moran Group (subsequently named the Moran Lake Group by Smyth *et al.* (1978)) consists of a basal unit of marine sedimentary rocks and an upper unit of mafic volcanic rocks which unconformably overlie Archean granitoid rocks of the Nain Province. The Moran Lake Group is unconformably overlain by the Paleohelikian Bruce River Group, which comprises three major subdivisions, defined by disconformities or contrasting lithologies (Smyth *et al.*, 1975; 1978) The lowermost division, called the Heggart Lake Formation, consists of a series of quartzites, sandstones and conglomerates which unconformably overlies the Moran Lake Group. A middle division of tuffaceous sandstones with minor conglomerates, termed the Brown Lake Formation, disconformably overlies the Heggart Lake Formation. The upper division of mafic to felsic flows and ignimbrites with minor tuffs, agglomerates and tuffaceous sandstones is named the Sylvia Lake Formation.

The objectives of the writer's work in the 1978 field season was to attempt to define a stratigraphic sequence within the Heggart Lake Formation, investigate its relationships to the underlying and overlying rock units, and to determine the environment of deposition and paleogeography of the Heggart Lake Formation.

GENERAL GEOLOGY

Pre-Bruce River Group rocks (Units 1 to 5)

These have been previously described by Smyth *et al.* (1975; 1978) and Ryan (1977) and the descriptions need not be repeated here.

Bruce River Group

Heggart Lake Formation (Table 1)

The Heggart Lake Formation (6) outcrops as a Y-shaped prism trending northeastward between Moran Lake and Brown Lake in the north central portion of the Labrador Central Mineral Belt. Work during 1978 has shown that the formation can be conveniently divided into two separate packages for descriptive purposes; one southeast from Moran Lake and the other northwest from the Junior Lake granite (Figure 1, Table 1). Within these packages are several distinct members, each of which shall be described individually in this report. No names are proposed for these subdivisions. The names used (*e.g.* quartzite, sandstone or conglomerate) for each unit mean only that those rock types are predominant in that unit.

Southeast from Moran Lake

In the Moran Lake area the Heggart Lake Formation rests unconformably on pillow lavas of the Moran Lake Group (4). The basal member (6a) of quartzites and sandstones is approximately 3000 m thick and can

be traced from Spinney Lake, in the southwest, northeastwards to the Kaipokok River and further north out of the map area. This unit grades from a fine grained, usually massive, tan to pink colored quartzite near the base, up into a fine to medium grained, thinly bedded, pink to red sandstone. The sandstone is gritty to conglomeratic in places, especially towards the top of the unit. The weathered surface of these rocks is usually tan to gray, but in some places a red color is predominant.

Two large tongues of conglomerate (6b) and two lentils of red mudstone (6c) occur within the quartzite-sandstone unit. The conglomerate, which is exposed between Louis Lake and Silas Lake and east of Louis Lake, is usually a massive, red, clast supported, polymictic, pebble to cobble bearing rock, with clasts being subrounded to well rounded. The most common clast compositions are granite, sandstone, quartzite, mafic and felsic volcanics and vein quartz, with lesser amounts of jasper, argillite, red mudstone, quartz-feldspar porphyry, feldspar, dolomite and chert. The matrix varies from a red, mauve, pink, gray to green sand, the color differences appearing to be a result of varying degrees of oxidation.

Two dark red, massive to thinly bedded, mudstone lenses are exposed southeast of Moran Lake; other small lenses have been observed east of Spinney Lake.

Very few sedimentary structures other than bedding were observed in the basal Heggart Lake Formation, but Ellingwood (1958) has noted cross-bedding and ripple marks near Louis Lake.

Overlying this basal quartzite-sandstone unit is a mauve to red, clast-supported to matrix-supported, poorly sorted, polymictic pebble to boulder conglomerate (6d) approximately 2750 m thick. This conglomerate caps the basal unit from Spinney Lake northeast out into the Kaipokok River valley. Parts of this member also outcrop southwest of Silas Lake and north of Brown Lake but at both these localities the conglomerate is fault bounded. It also outcrops east of Alvin Lake in the southern part of the map area, where it is fault bounded on three sides but on the upper part it has a disconformable contact with the overlying Brown Lake Formation (Smyth *et al.*, 1975; Ryan, 1978b). Two small lenses of a similar conglomerate outcrop within the Brown Lake sandstones south of Ferguson Lake and appear to represent wedges of the Heggart Lake Formation juxtaposed against the younger formation by reverse faults.

The clasts of this conglomerate are, on the average, larger than those in the previously mentioned conglomerate and range in size from less than 1 cm up to 60 cm. However, the lithologies represented are similar, with the most abundant clasts being granite (some aplite), quartzites, sandstones, mafic and felsic volcanics, quartz and lesser amounts of jasper, argillite, red mudstone, quartz-feldspar porphyry, feldspar, dolomite and chert. The matrix of this rock is commonly a reddish colored sand, the color being related to the amount of hematite. This conglomerate has a gradational contact with the underlying sandstones in its southwestern part, but in the Kaipokok River area there appears to be a disconformable contact. The upper contact with the unit to the southeast seems to be a faulted one along its whole outcrop length.

Very few sedimentary structures are preserved in this conglomerate due to a pervasive shearing chiefly associated with faulting, but at one location north of Conglomerate Lake trough cross-bedding was observed, indicating that the member faces to the southeast.

Northwest from Junior Lake Granite

The second package of Heggart Lake rocks occurs north of the Junior Lake granite. The Junior Lake granite (5), a hornblende-biotite granite, is believed to postdate the Moran Lake Group (Smyth *et al.*, 1977, Ryan, 1978a). It is unconformably overlain by the Heggart Lake Formation, the base of which is a 200 m thick medium to fine grained arkosic sandstone and granular "granite wash" (6e) which outcrops adjacent to the granite southwest and east of Heggart Lake and east of Pat Lake. An unconformable contact involving westward facing rocks was observed east of Pat Lake (B. Ryan, personal communication, 1978) but in many places a mafic dike follows the sediment-granite contact. Along most of the outcrop length north of the Junior Lake granite, the sediments generally dip steeply towards the granite. Although no primary structures were observed to indicate the "younging" direction, it is postulated on the basis of the westerly facing unconformity that most of the rocks north of the Junior Lake granite are overturned, being southeasterly dipping but facing northward away from the granite. The granite wash is composed of quartz, feldspar and mafic minerals derived from the Junior Lake granite, but scattered throughout the rock are clasts of quartz, sandstone, feldspar porphyry and jasper.

Overlying the granite wash, and overstepping it locally, is a gray to buff, poorly sorted, mostly matrix-supported, pebble to boulder conglomerate (6f). This unit is faulted against schists and gneisses (1) of the Kaipokok River valley in the northern part of the map area and extends southwest to Alvin Lake, where it is in fault contact with the overlying Brown Lake and Sylvia Lake Formations. To the northwest it is juxtaposed against the Moran Lake "package" of Heggart Lake rocks by a series of faults extending from Spinney Lake to Conglomerate Lake. This conglomerate also outcrops along the southern contact of an older pink leucogranite (2) from Alvin Lake to Brown Lake and two small

"SOUTHEAST FROM MORAN LAKE" Section from Moran Lake to Conglomerate Lake		"NORTHWEST FROM JUNIOR LAKE GRANITE" Section from Junior Lake Granite to north of Square Lake	
Approximate thickness (metres)	Unit	Approximate thickness (metres)	Unit
2750	Upper red polymictic conglomerate with minor sandstones	- -	Upper red polymictic conglomerate
			fault
3000	Quartzite and bedded sandstones, lenses of conglomerate and mudstone. Minor mafic and felsic volcanic rocks.	?	Gray granitic conglomerate
		1020	Red-mauve sandstone
		820	Gray granitic conglomerate
		200	Granite wash
	unconformity		unconformity
	Moran Lake Group Volcanics		Junior Lake Granite

Table I: Stratigraphic compilation of the Heggart Lake Formation

N.B.: These thicknesses as shown are only approximate and the units could be thinner or thicker depending on initial depositional variations and the amount of partial removal or repetition of the stratigraphy due to faulting.

outliers of the conglomerate rest on the leucogranite north of Ferguson Lake. The clasts of this conglomerate range in size from less than 1 cm up to 80 cm in diameter and are usually subangular to subrounded. Clasts derived from the adjacent leucogranite sometimes comprise about 60-70 percent of the rock, and form the largest boulders. Other clasts found in the rock are sandstone, quartz, and mudstone with lesser amounts of feldspar porphyry and rare clasts of jasper, mafic and felsic volcanics and diorite. The matrix of this rock is usually a coarse arkosic sand or grit but in a few locations black mud is predominant. The weathered surface of this rock is generally rough with many clasts eroded out.

A unit of sandstone (6g) within the conglomerate outcrops from Square Lake in the southwest to Conglomerate Lake in the northeast. The weathered surface of this sandstone is generally a gray to pale red color and is usually smooth. It is a fine to medium grained massive rock but locally becomes gritty and conglomeratic; a few black mudstone lenses were observed. Scattered clasts in the sandstone are chiefly jasper, quartz, granite, and mudstone.

The Junior Lake package, like the Moran Lake package, is generally devoid of any primary small-scale sedimentary features, the cleavage having obliterated much of the finer details. Graded bedding was observed in several locations but it proved unreliable as a definite "tops" indicator.

Relationship between the two packages

Although no direct continuity is apparent between the two packages of rocks described above because of faults juxtaposing them in the central part of the map area, certain units within them can be considered, as a first approximation, to be facies equivalents of each other, forming contemporaneously in two separate areas (Table 1). The whole Heggart Lake Formation in this area appear to be in the form of a tight syncline whose southeastern limb on the Junior Lake granite is largely overturned and is in fault contact with the western limb, which rests on pillow lava and youngs to the south. The major fault between Spinney and Conglomerate Lake corresponds roughly to the axis of the syncline.

Brown Lake Formation

The Brown Lake Formation (7) disconformably overlies the Heggart Lake Formation (Smyth *et al.*, 1975; 1978) and outcrops in the Silas Lake and Alvin Lake areas and south of Ferguson and Brown Lakes. This formation consists of a basal polymictic pebble to boulder conglomerate and an upper unit of varicolored tuffaceous sandstones. In the Silas Lake area the contact between the Brown Lake and Heggart Lake Formation is a fault. East of Alvin Lake a disconformity separates the two, and in the Ferguson-Brown Lakes area the Brown Lake Formation is partially in fault contact with the basal conglomerate of the Heggart Lake Formation. However, in some areas the contact seems to be gradational through a progressive decrease in conglomerate at the expense of sandstones.

Sylvia Lake Formation

The Sylvia Lake Formation (8) is a series of extrusive igneous rocks with intercalated tuffaceous sandstone and some intrusive phases outcropping in the southwestern portion of the map area between Silas and Alvin Lakes.

For a detailed description of this formation the reader is referred to Smyth *et al.* (1975), Ryan and Harris (1978), and Ryan (1978b).

Post-Bruce River Group rocks

A red quartz-feldspar porphyry (9) was observed to outcrop as two linear bodies intruding Heggart Lake conglomerate and Brown Lake sandstones southwest of Ferguson Lake. This porphyry may possibly represent an intrusive phase related to the acid volcanism in the upper Bruce River Group (Smyth *et al.*, 1975).

Numerous bodies of gabbro, diorite and diabase occur in the map area. The gabbros(10) occur mostly as plugs but there are some sills. The diabase normally occurs as dikes and sills which are locally abundant intruding the Heggart Lake Formation.

FAULTS

Three dominant fault trends are apparent in the map area. In descending age these are a north-south trending series, an east-west series and a northeast-southwest series.

The north-south trending faults do not appear to disrupt the internal stratigraphy of supracrustal rocks of the area. The major effect appears to be movement in association with some of the east-west faults, which juxtapose Hudsonian schists and granites against Heggart Lake Formation east of Moran Lake. The major east-west faults are found north of Conglomerate Lake, north of Silas Lake and in the central part of the map area. These faults appear to truncate the north-south trending faults, especially north of Conglomerate Lake. The two faults north of Conglomerate Lake have modified the stratigraphy by bringing into contact a linear block of the gray granitic conglomerate of the eastern package of rocks and the basement to the north, and the upper red polymictic conglomerate of the western package of rocks to the south. It is possible that these faults could have moved in conjunction with the

north-south fault in this area, causing the basement to be juxtaposed against the two conglomerates. In the Silas Lake area, an east-west fault has caused the Brown Lake and Sylvia Lake Formations to be juxtaposed against the Heggart Lake Formation. Another major east-west fault is present in the central map area, extending from west of Moran Lake to Conglomerate Lake. This fault offsets the Moran Lake Group and truncates the conglomerate unit found in the basal member of the Heggart Lake Formation.

The northeast-southwest trending faults appear to be the youngest. These faults are found throughout the Heggart Lake Formation and probably have caused internal modifications of the stratigraphic succession within the formation, making true thicknesses difficult to determine. Pervasive shearing associated with these faults has obliterated almost all of the sedimentary structures in the conglomerates, making it very difficult to obtain tops indicators or bedding planes. These faults are commonly high angle reverse faults; in the Conglomerate Lake and Ferguson-Brown Lakes areas they have brought pre-Bruce River Group rocks into contact with the Heggart Lake and Brown Lake Formations, respectively.

A major northeast-southwest trending fault south of the Junior Lake Granite is the northeasterly extension of the Bruce Lake Shear Zone (Smyth *et al.*, 1975). This fault separates the Heggart Lake and Brown Lake Formations east of Maude Lake. From here it swings eastwards, passing through Ferguson and Brown Lakes.

DISCUSSION

The distribution of rocks within the Heggart Lake Formation indicates a coarsening upwards sequence which can be interpreted in terms of alluvial fan development. The sedimentology of the formation suggests its evolution by sheetflood sedimentation and debris flows. No direct evidence for braided stream deposits was recognized, but such processes may have been active.

Although no paleoflow directions were obtained in the basal sandstones, it is assumed that they have been derived from the granitoid rocks of the Kaipokok Valley. There is an absence of clasts of the underlying volcanics except directly at the contact between the two. The rocks are fairly mature sands, as is apparent from sorting, roundness and an abundance of quartz compared to feldspar. These sandstones suggest initial deposition of the Heggart Lake Formation as a shallow marine sequence.

The basal sandstone member contains two lenses of conglomerate whose clasts have been largely derived from the rocks found to the west, suggesting that the coarser material was derived from the west, possibly as a sudden influx into a shallow basin which was otherwise restricted to finer sediments.

Concomitant with the formation of the sandstones and conglomerates above the mafic volcanics, the Junior Lake Granite was exposed and underwent local weathering, the debris from which accumulated on the granite as a granular "wash". Above the wash occurs a gray granitic conglomerate; its paleoflow directions (based on variations in clast size) exhibit a radiating pattern from the Junior Lake Granite,suggesting that the granite was a positive paleotopographic feature. In places this conglomerate overlaps the granite wash and rests directly on the granite. The conglomerate is probably a result of a series of debris flows, since clasts decrease in size with increasing distance from the granite.

A red-mauve sandstone fringe within the gray conglomerate, extending from Square Lake to Conglomerate Lake, is believed to be a sheetflood deposit possibly of similar age to the upper part of the sandstones in the Moran Lake area. Deposition of the gray conglomerate continued and it overlaps the sandstone to the northeast and southwest. Above the sandstones it becomes coarser grained, a feature which may be attributed to a large, fast, influx of debris from the east-southeast, causing a reversal in the mean clast size (coarsening upward). Such features might be expected in an area where uplift was contemporaneous with sedimentation.

Finally, a red polymictic conglomerate appears to have blanketed the whole area, moulding itself around the highland areas and extending as far east as Brown Lake. Paleoflow directions indicate that this conglomerate was derived from the west and it is very similar in clast content to the conglomerate unit in the basal sandstone member at Moran Lake. This conglomerate becomes more mature from west to east with clasts becoming smaller, better sorted and more rounded.

MINERALIZATION

The map area contains numerous small showings of base metals (Douglas and Hsu, 1976) as well as four known occurrences of uranium. Three small new base metal showings were discovered in 1978.

In the porphyritic amygdaloidal dacite (8d) southeast of Silas Lake, a small galena showing was found in a quartz filled fracture. This showing consists of scattered small crystals of galena embedded in the quartz and surrounding volcanic rock. A mafic dike cutting conglomerate west of Square Lake hosts pyrite and malachite-azurite staining. A small showing of malachite, azurite and pyrite was found associated with epidote veins in a fine grained mafic plug northeast of Alvin Lake.

There are four major uranium occurrences found in the map area. Three are located south of Moran Lake and are known as the A,B, and C zones (Bernazeaud, 1965); a fourth occurs south of Brown Lake.

The "A" zone, located south of the eastern extension of Moran Lake, is found in shear zones in the upper red polymictic conglomerate of the Heggart Lake Formation (Smyth and Ryan, 1977).

The "B" zone occurrence is located east of Louis Lake and consists of Heggart Lake conglomerates and sandstones cut by gabbroic intrusive rocks of at least three ages, the uranium mineralization being associated with the oldest (Kontak, 1978).

The "C" zone found near Lake 202, southwest of Louis Lake, comprises Heggart Lake sediments and altered mafic volcanic rocks bounded to the north and west by upfaulted blocks of Moran Lake Group volcanics. The uranium mineralization is associated with sheared Moran Lake Group volcanic rocks and with volcanic breccia horizons in the Heggart Lake Formation (Kontak, 1978). The "C" zone is presently being investigated by Shell Canada Resources and Commodore Mining.

For a more detailed account of the A,B, and C zones, the reader is r to the descriptions of Kontak (1978).

The Brown Lake uranium showings occur in sheared Heggart Lake conglomerate and Brown Lake sandstones, the latter cut by mafic dikes hosting copper mineralization (Ryan, 1977).

CONCLUSIONS

It is very difficult to decipher the Heggart Lake Formation or measure true stratigraphic sections because faulting has repeated or removed parts of the section and a strong cleavage has obliterated almost all sedimentary structures (see Table I for stratigraphic sections). Therefore, the interpretation presented here should be considered to be only one of several possibilities.

In summary, the distribution of rock units within the Heggart Lake Formation suggests that the Paleohelikian paleogeography was characterized by one or more northeasterly trending graben structures between rapidly rising topographic highs, probably due to block faulting contemporaneous with sedimentation. The basal sandstones (6a) of the Moran Lake package appear to have been derived from a granitoid terrain similar to that of the Kaipokok Valley to the north, suggesting a southeastward advancing sand blanket which covered a slowly rising area. Intercalated conglomerate (6b) units within this sandstone seem to be debris flows derived from the west. Facies equivalent units in the eastern package are the granite wash (6e) and gray conglomerate (6f) with intercalated sandstones (6g) above the Junior Lake Granite (5).

The upper red polymictic conglomerate (6d) appears to have been derived from the west. It was deposited as a thick blanket over the whole region, moulding itself around the topographic highs. It was probably initiated by a second period of rapid uplift preceding the eventual onset of volcanism.

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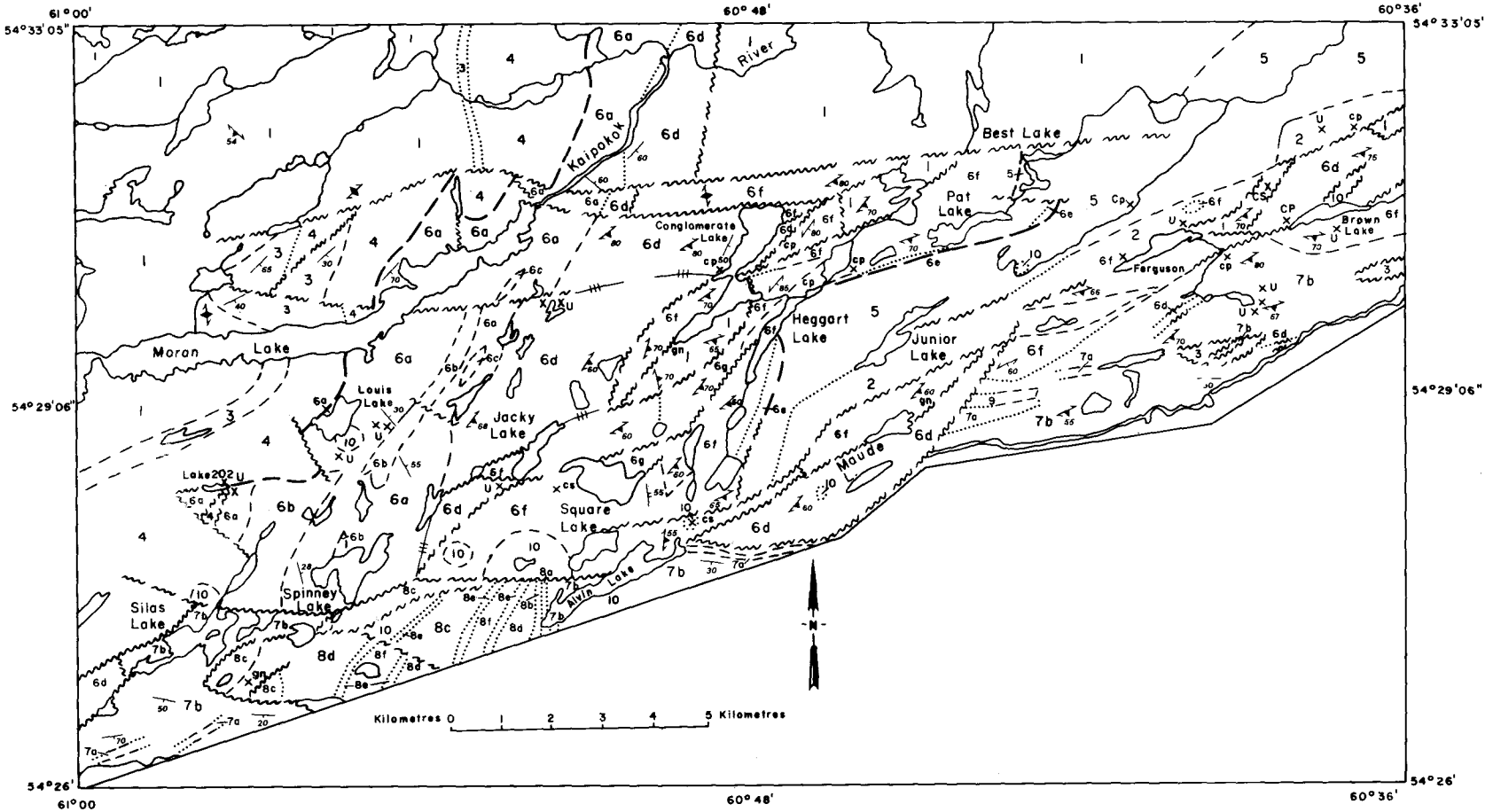

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LEGEND

PALEOHELIKIAN OR YOUNGER

10. *Gabbro to diorite plugs and sills.*

9 *Red quartz-feldspar porphyry (rhyolitic).*

PALEOHELIKIAN

Bruce River Group

8 **Sylvia Lake Formation: 8a,** *Rhyolite flow breccia;* **8b,** *massive mafic flows;* **8c,** *massive, intermediate to felsic flows;* **8d,** *porphyritic amygdaloidal andesite;* **8e,** *tuffaceous sandstones;* **8f,** *coarse plagioclase porphyritic andesite, in part intrusive.*

7 **Brown Lake Formation: 7a,** *Mauve-red cobble to boulder conglomerate;* **7b,** *varicolored tuffaceous sandstones.*

6 **Heggart Lake Formation: 6a,** *Massive to thinly bedded, pink to red quartzite and sandstone with intercalations of* (**6b**) *conglomerate and* (**6c**) *red mudstone;* **6d,** *red-mauve polymictic conglomerate with minor sandstone;* **6e,** *granite wash (arkose);* **6f,** *gray-buff granitic cobble to boulder conglomerate with* (**6g,**) *intercalated sandstones.*

POST-APHEBIAN PRE-PALEOHELIKIAN

5 **Junior Lake Granite:** *Buff to white hornblende-biotite granite.*

APHEBIAN

Moran Lake Group

4 *Mafic volcanic flows; pillow lavas predominant.*

3 *Laminated siltstone and mudstone, slate, argillite, phyllite, minor dolostone and chert.*

APHEBIAN AND OLDER

2 *Weakly foliated pink leucogranite.*

1 *Foliated granite, quartzofeldspathic gneiss, minor amphibolite and schistose metavolcanic (greenstone) belts.*