PETROLOGY AND DISTRIBUTION OF LITHOLOGIES IN THE AREA OF NORTHERN KAHSHAHPIWI AND SOUTHERN KEEFER LAKES, QUETICO PROVINCIAL PARK, ONTARIO, CANADA

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INTRODUCTION

Kahshahpiwi Lake is located in the Quetico structural belt of the Superior Province of Canada. The Quetico belt is composed of metasedimentary schist, gneiss, migmatites, with later igneous intrusions (Card and Ciesielski, 1986). The structural belts present in the Superior Province are thought to be the product of collisions of Archean volcanic island-arc systems (Percival and Williams, 1989).

The major rock types in the Quetico belt have been recognized and described by Woodard (1992). The 1992 research season concentrated on the character of the junction of the Burntside Lake fault and the Side Lake shear zone. Our research concentrated on the field relationships and origins of rock types in northern Kahshahpiwi and southern Keefer lakes, with an emphasis on two previously undescribed units.

METHODS

The majority of our mapping was done at the sides of the lakes from canoe, and pace and compass mapping to trace contacts into the woods. Kahshahpiwi and Keefer Lakes are unusual in the Quetico because they have large cliffs on the east and west sides, respectively. The near vertical cliffs made access to the land from canoe difficult.

Mapping the shore from canoes had the advantages of high mobility and access to excellent outcrop formed by cliff faces. Inland mapping, however, was difficult because of the lack of landmarks and good outcrop. Areas exposed by blown down trees tended to give the best inland outcrop. Samples were taken of major rock units, and structural features were measured. When we returned to Beloit College, we etched our rocks with hydrofluoric acid and stained the potassium feldspars with sodium cobaltinitrite.

NEW ROCK UNITS

We mapped five units in our area (Fig 1). The leucocratic granite, granitic-rich migmatite, and biotite schist-rich migmatites are described in Woodard (1992). In addition, we mapped two new units, the most extensive was a migmatite (Mm) that contained muscovite (making it easy to differentiate from other migmatites found in the Quetico belt). The second new unit was a hornblende-bearing tonalite (Hb) that occurs at the northern end of our mapping area.

Muscovite-bearing migmatite (Mm)

The muscovite-bearing migmatite is located west of Kahshahpiwi and Keefer Lakes, and was easily recognized in the field by the presence of muscovite ranging in size up to books of five centimeters in diameter. The unit is often coarse-grained, with up to 50% of some areas of exposure being pegmatitic. The leucosome is approximately 45% microcline, 25% plagioclase, 25% quartz, 5% muscovite, with biotite, sphene and almandine garnet. The migmatite also contains mafic rafts and lenses of varied felsic composition.

The mafic rafts were predominately biotite schist, though some schist rafts also contained muscovite and one amphibolite raft observed. The schist rafts also showed Z-fold structures. Feldspar-rich lenses were common adjacent to or in the area of the mafic rafts, and pegmatites were common between lenses and rafts. The overall distribution of the pegmatites is difficult to delineate. Sometimes they occurred as folded dikes in a more fine-grained matrix, but often whole outcrops were massive feldspar, quartz, and muscovite pegmatite. Also characteristic is the presence of almandine garnet and three centimeter diameter books of biotite.

Hornblende tonalite (Ht)

Located in the area of northernmost Kahshahpiwi and south Keefer Lakes, this is the least understood unit in our mapping area. It was first recognized only three days before mapping was concluded.

It is heavily intruded by pegmatitic dikes and irregular masses of granitic composition. The numerous intrusions made recognition of the unit difficult, in some outcrops there was more intrusive material than country rock. Staining with sodium cobaltinitrite showed no potassium feldspar, but sometimes small regions within single crystals would stain, perhaps suggesting sericitic alteration of the plagioclase.

The classification of this unit as a tonalite is a tentative one until thin sections can be examined. The tonalite has easily recognizable aligned hornblende crystals that follow the same regional foliation as other rocks in the area. It appears in hand specimen to contain 60% plagioclase, 20% quartz, 15% hornblende, and 5% biotite. Some areas of the mapped unit may be richer in biotite than hornblende. The unit also contains miarolitic cavities.

LITHOLOGIC CONTACTS

The contacts mapped in this region are listed below from south to north. Many of the contacts shown on Fig 1 represent the center of gradational contacts, as well as inferred contacts under cover.

Granitic-rich migmatite (Mg) / Muscovite-bearing migmatite (Mm)

The gradational contact between the granitic-rich migmatite and the muscovite-bearing migmatite located in the southwestern corner of the map is characterized by a gradual decrease of muscovite content southward, changing to granitic-rich migmatite within a distance of 200 meters. The contact area also has less pegmatite than the remainder of the muscovite-bearing unit, with grain size conforming more to what is normally found in the granitic migmatite.

Leucocratic granite (Lg) / Granitic-rich migmatite (Mg)

The contacts between these two units were only seen on the eastern shore of Kahshahpiwi Lake. Differences between these two units were often subtle. Contacts between the leucocratic granite and granitic-rich migmatite indicate intrusions into post folded material.

Muscovite-bearing migmatite (Mm) / Biotite schist-rich migmatite (Mb)

This contact is shown in outcrop on the small peninsula that extends east from the west side of the north end of Kahshahpiwi Lake. It shows the migmatite with alternating muscovite rich and muscovite poor layers. These layers are approximately 30 to 40 centimeters thick and follow regional gneissosity. The contact area is a small one, and difficult to locate away from the shore.

Hornblende tonalite (Ht) / Muscovite-bearing migmatite (Mm)

In southern Keefer Lake the hornblende tonalite unit alternates with the muscovite-bearing migmatite unit in the area of the mapped contact. From south to north along the shore the outcrop changes from hornblende tonalite to 100 meters of muscovite bearing migmatite, followed by 100 meters of hornblende tonalite, then continuing as muscovite-bearing migmatite.

STRUCTURE

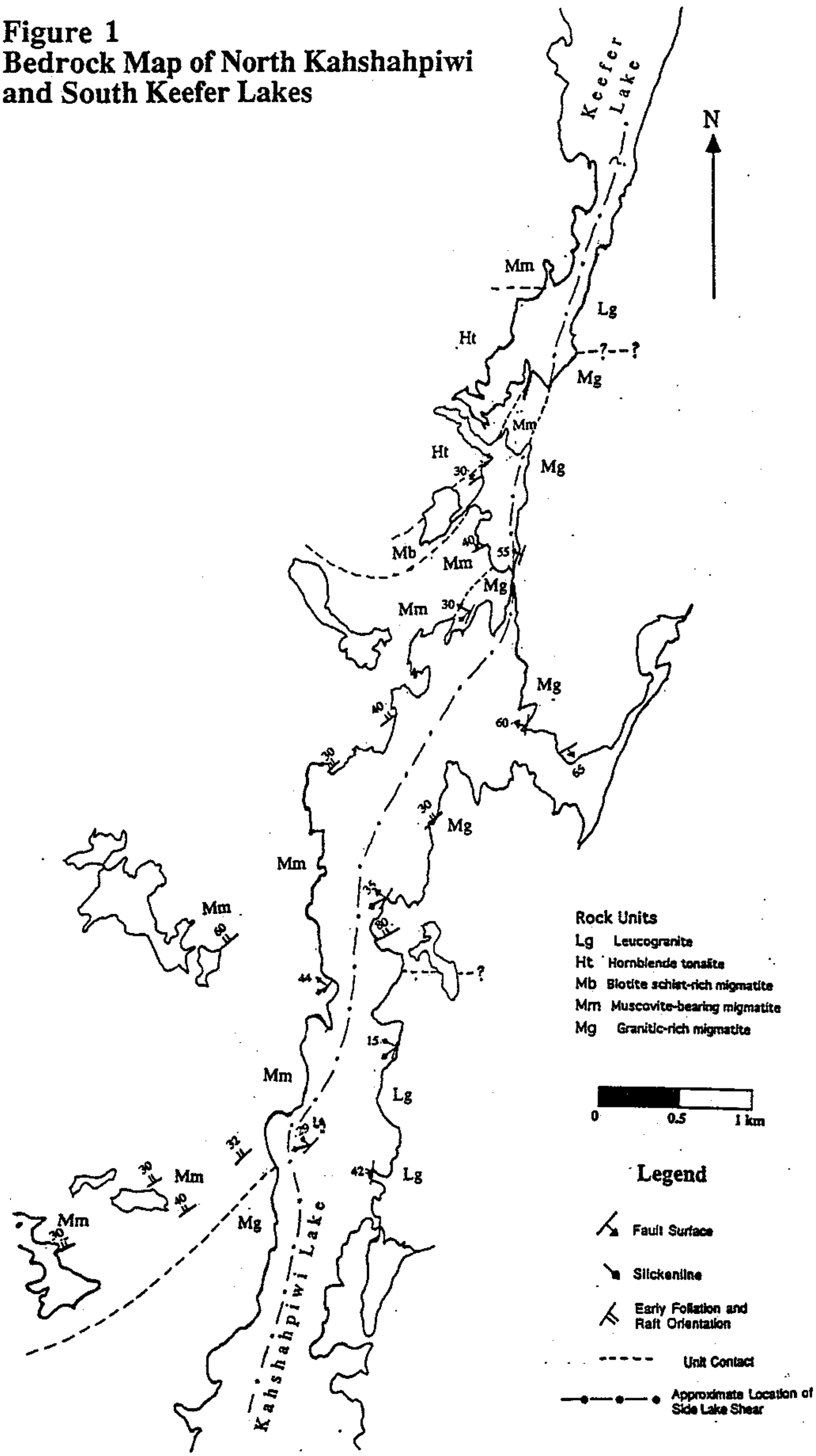
Foliation

The major foliate structures in the mapping area are the Side Lake shear and the original gneissosity of the folded units. The only unit that does not contain the original gneissosity is the leucogranite, and all units are sheared by the Side Lake shear which is characterized by well-developed slickensided foliation planes striking N30°E and dipping 25°-30° NW. The regional gneissosity strikes approximately N60°E, and dips range from 80° NW in the East of the map area to 30° NW in the West.

Mylonites

Mylonites were found along the shores of southeastern and middle western Keefer Lake. On the east side it appears to be heavily sheared leucogranite, lacking the mafic content found in the migmatites and not containing muscovite. The east shore mylonite does not extend more than 250 meters east from the shore. The mylonite on the west side is thicker than 250 meters, and it is not clear what unit the mylonite is related to. The contacts of the hornblende tonalite are truncated by the mylonite on the east shore, and neither the muscovite-bearing migmatite nor the hornblende tonalite unit are present on the eastern side of the mylonite.

Figure 1
Bedrock Map of North Kahshahpiwi and South Keefer Lakes



DISCUSSION AND CONCLUSIONS

Muscovite-bearing migmatite (Mm)

This unit appears to have undergone a period of migmatization similar to that of the granitic-rich and biotite schist-rich migmatites. The gradational contacts seem to imply that the migmatization occurred at the same time for all three units, and that the presence of muscovite could simply be a variation within the same migmatite unit. The alternating of muscovite rich and muscovite poor layers at the contact between the muscovite-bearing migmatite and the biotite-schist rich migmatite could be from original bedding of aluminum rich and aluminum poor sediments. The granitic-rich migmatite dips under the muscovite-bearing unit implying that the muscovite-bearing unit is younger than the granitic-rich migmatite if the gneissosity can be interpreted as bedding.

If the migmatites are in fact metamorphosed sediments, perhaps the muscovite-rich part of the migmatite was formerly more pelitic. The presence of muscovite, biotite, and almandine indicates a large amount of aluminum in the source material. Post-folding metasomatism as a source is unlikely as the muscovite often is deformed and aligned with the gneissosity. The origin of the potassium is probably not then related to the late metasomatic soaking of the area with potassium discussed by Woodard and Weaver (1990).

Hornblende tonalite (Ht)

This unit seems to have a layered contact with the biotite schist-rich migmatite. Some crystals in the unit show igneous-type zoning and crystal form. This and the nature of the contact imply intrusion of this unit into the migmatite before folding. Both the grain size and the miarolitic cavities imply a shallow crustal intrusion for this unit

Side Lake shear zone

The Side Lake shear zone forms a boundary to several of the units. Three main lines of evidence in our area tell us about the nature of the Side Lake shear zone. Side Lake shear foliation and slickensides were found in every rock type in the area. A mylonite seems to be at the center of the shear, including the most intense Side Lake-style deformation.

The contacts of the hornblende tonalite and the muscovite-bearing migmatite do not project through the center of the shear, and neither of these units occur on the east side of the mylonite. We have not recognized these units anywhere on the east side of the shear for a distance of 11 km along the east shores of Kahshahpiwi and Keefer Lakes, implying the significant displacement along the shear zone (fig. 1).

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