Revised geology of Kawaweyak Lake, Manitoba 2007

Manitoba

Summary

This report summarizes two weeks of fieldwork carried out during the summers of 2006 and 2007 in the northeastern portion of the Paleoproterozoic Kisseynew Domain. The purpose of the project, which is part of a collaborative Targeted Geoscience Initiative III (TGI-3) project with the Geological Survey of Canada, is to determine whether gneiss equivalent to the nickel-deposit-hosting Ospwagan Group, which has an Archean provenance in the Thompson Nickel Belt (TNB), is also exposed within dominantly Burntwood Group greywacke gneiss at Kawaweyak Lake.
Mapping during 2007 showed that psammitic to semipelitic units of quartz-rich, calcareous and biotitic gneiss at Kawaweyak Lake (some of which resemble the Burntwood Group) are in gradational contact with a distinctive amphibolite-iron formation assemblage. This latter assemblage can be traced from the south end of the map area for 6 km northeast along strike to the eastern shoreline of Notakikwaywin Lake. A Nd model age of 2.15 Ga from a sample of the semipelite from the quartz-rich rocks is not consistent with an affinity for the Ospwagan Group but more consistent with belonging to the juvenile Paleoproterozoic Burntwood Group or an assemblage of amphibolite and siliciclastic rocks that generally overlies the Burntwood Group. The amphibolite has minor gold showings south of Granville Lake, northeast of the map area.

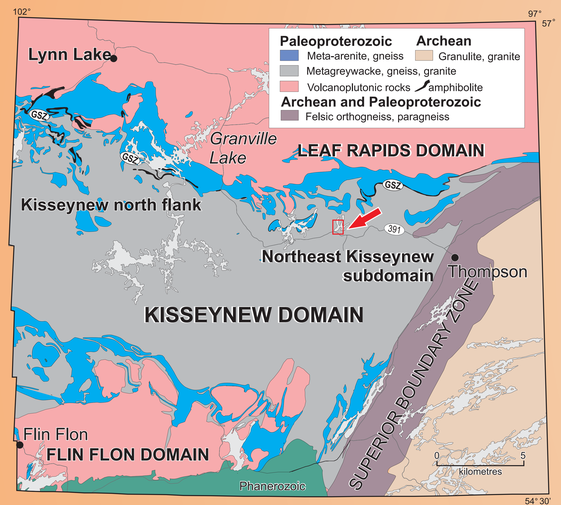
Introduction

Kawaweyak Lake and Notakikwaywin Lakes are located about 80 km west of Thompson along Provincial highway 391 and approximately 12 km northwest of Nelson House, Nisichawaysihk Cree Nation. Figure 1 below indicates the report area with a red arrow. The two lakes are separated by a small channel currently under beaver dam construction. Kawaweyak Lake is translated for the authors by Leroy Hunter (from Nelson House), as Circle of Lakes and Notakikwaywin Lake is translated as Caribou Hunting Lake.

Regional setting

The Kawaweyak Lake area is located within the northeastern part of the Kisseynew Domain that is bounded by the Leaf Rapids Domain in the north, and the Thompson Nickel belt (TNB) in the southeast. The area is part of the internal zone of the Paleoproterozoic Trans-Hudson Orogen (Figure 1). The dominant supracrustal rock of the Kisseynew Domain is the Burntwood Group migmatite gneiss, which is interpreted to have been derived from greywacke-mudstone turbidite deposited within a marine basin (Zwanzig, 1990, 1999). Generally overlying the turbidite is an amphibolite unit, interpreted as arc-related ocean-floor basalt, that extends to the Lynn Lake belt (Tod Lake basalt of Zwanzig et al., 1999; Murphy and Zwanzig, 2007). Intrusive bodies in the Kisseynew Domain include foliated tonalite, granite, diorite and late-stage pegmatite. During 1.851.83 Ga terminal subduction in the Trans-Hudson Orogen, the basin opened (Ansdell et al., 2005) or closed (Zwanzig, 1999), with local obduction of Tod Lake basalt (White et al., 2000) and deposition of the turbidite and related terrestrial rocks (e.g., Sickle Group). Progressive deformation generated large-scale regional nappe-style folds, refolded by northeast-trending crossfolds (Zwanzig, 1990; Murphy and Zwanzig, 2007). Granite and pegmatite intrusion, and metamorphism led to migmatization of the greywacke-mudstone and development of local orthopyroxene and the regional assemblage of garnet-biotite-sillimanite±cordierite. This has produced distinctive grey and white lit-par-lit gneiss in the Burntwood Group.

Figure 1

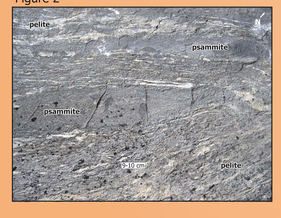


General geology

The map area at Kawaweyak and Notakikwaywin lakes (PMAP 2007-3) includes four main rock assemblages:
1. Burntwood Group gneiss and migmatite;
2. interlayered quartz-rich and calcareous biotite gneiss, and semipelitic to pelitic gneiss;
3. layered amphibolite and gabbro that are spatially associated with calcsilicate-, silicate-sulphide and sulphide-facies iron formation, as well as sulphidic biotite gneiss; and,
4. intrusions of granodiorite, granite and pegmatite

Regional metamorphism peaked at the granulite facies and is displayed in mineral assemblages that include garnet, biotite, sillimanite and cordierite, with local orthopyroxene in the Burntwood Group and the gabbro. Retrogressive garnet has partly replacing cordierite in the Burntwood Group gneiss. All rock types are metamorphosed, but the prefix 'meta' is generally omitted from their names.

Figure 2



Burntwood Group

The Burntwood Group migmatite contains up to 20% granitoid leucosome and consists of alternating medium grey to brown layers produced by metamorphism of a greywacke-siltstone-mudstone sequence (Figure 2). Mineralogically, it contains biotite, garnet and cordierite, with smaller garnets and less biotite in psammitic layers and orthopyroxene in fine-grained leucogranite lenses.

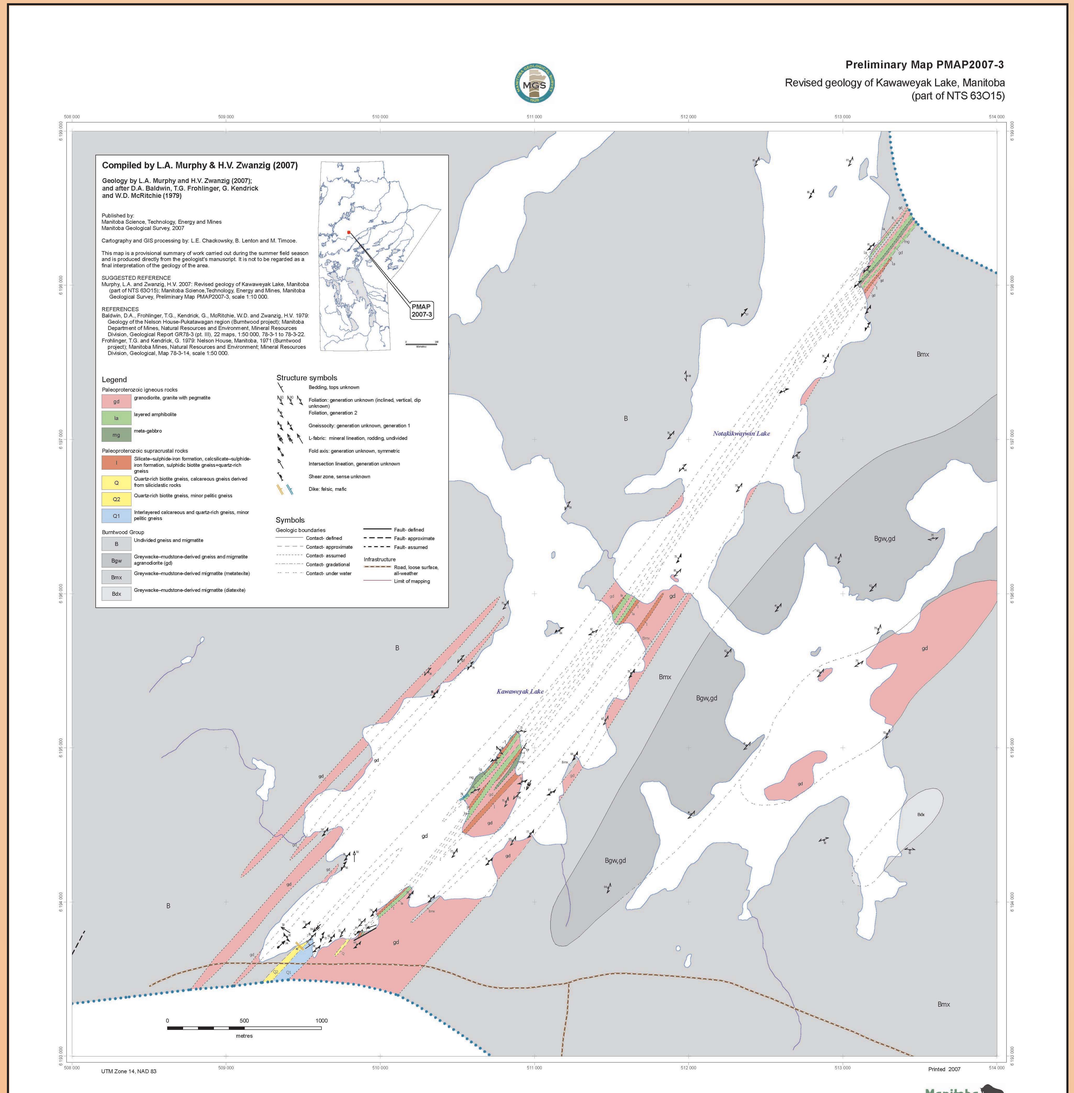


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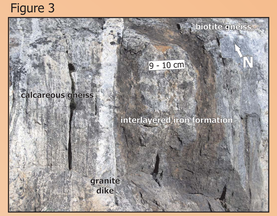
Figure 3



Quartz-rich and calcareous biotite gneiss

The quartz-rich biotite gneiss is typically grey, but also includes light grey to cream calcite-bearing layers and brown biotite-rich layers. This unit of quartz-rich gneiss is interpreted to have been formed from fine-grained sandstone and siltstone (psammite) with interlayered semipelite to pelite, the latter forming the biotite-rich layers. The carbonate may have originated from calcite cement between clastic quartz and feldspar grains. Glassy grey layers, in this metasedimentary succession, are interpreted as protoquartzite. Layering and interlayering occur at a centimetre scale (Figure 3). Quartz and feldspar are the dominant minerals in the gneiss, with lesser biotite, calcite, diopside, garnet and local pyrrhotite.
Neodymium isotope data of a slightly biotite-enriched layer of psammite to semipelite yielded a Nd model age of crustal residence of 2.15 Ga, indicating that the detritus was derived from a juvenile Paleoproterozoic source similar to the internal zone of the Kisseynew Domain.

Layered amphibolite iron formation assemblage

The amphibolite iron formation assemblage is a northeast-trending linear unit exposed in several locations in the map area (Figure 4):
1) at the south end of the area; 2) north along a small peninsula in Kawaweyak Lake; 3) northeast on an island in the centre of the lake; and 4) northeast along the shoreline of Notakikwaywin Lake.
The layered amphibolite comprises well-layered, medium- to fine-grained amphibolite that was possibly derived from pillow basalt (Figure 5), and coarse- to medium-grained layered amphibolite of uncertain origin (Figure 6). The coarse-grained amphibolite was derived from uniform and layered gabbro (Figure 7).
The assemblage also includes four variations of sulphide-facies iron formation and sulphidic gneiss:
1) silicate-sulphide facies iron formation to sulphidic gneiss; 2) calcsilicate-sulphide facies iron formation to sulphidic calcsilicate; 3) semimassive sulphide; 4) sulphidic biotite gneiss.
The well layered amphibolite may contain orthopyroxene-bearing amphibole-rich layers. The orthopyroxene is equant and the amphibole is bladed (Figure 8 with green and red lettering). The gabbroic amphibolite locally contains orthopyroxene rimmed by plagioclase (Figure 9).
The assemblage appears to grade into the calcareous rock, and quartz-rich biotite gneiss. It is in sharp contact with intrusive granodiorite and gabbro.

Figure 4

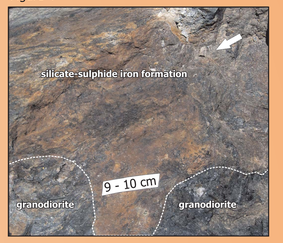


Figure 5

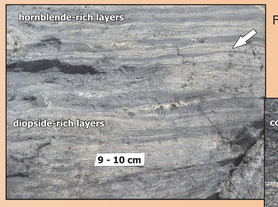


Figure 6

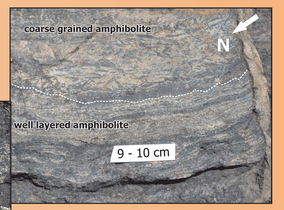


Figure 7

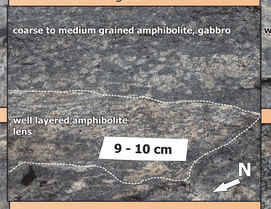


Figure 8

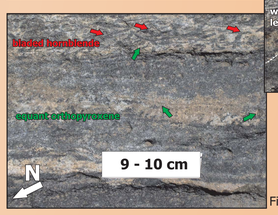
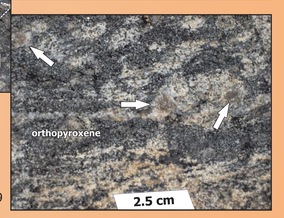


Figure 9



Discussion and economic considerations

Rocks similar to the amphibolite iron formation assemblage overlying the Burntwood Group occur elsewhere in the Kisseynew Domain (Zwanzig, 1990). They are preserved as pillow basalt (Tod Lake basalt*), gabbro and sulphide-facies iron formation associated with siliciclastic sedimentary rocks and calcsilicate rocks *in the Granville Lake structural zone (GSZ in Figure 1) at Granville Lake and the southwest end of the Lynn Lake belt (Zwanzig et al., 1999). That succession has been interpreted as part of a crustal suture extending from an area north of the TNB west into Saskatchewan (White et al., 2000). The rocks are part of the juvenile Paleoproterozoic internal zone of the Trans-Hudson Orogen and unrelated to the TNB.
The Paleoproterozoic Nd model age of 2.15 Ga from the semipelitic gneiss in the study area further supports an origin in the Trans-Hudson internal zone. A sample from quartz-rich calcareous biotite gneiss (calcsilicate) from Wuskwatim Lake yielded a Nd model age of 2.4 Ga, also juvenile Paleoproterozoic (Zwanzig et al., 2006). The latter unit was considered part of the Burntwood Group, an alternate interpretation that is also possible for Kawaweyak Lake because sulphide-facies iron formation is clearly interlayered with the Burntwood Group at Notigi Lake (Murphy and Zwanzig, GS-5, this volume).
The various possible associations of the amphibolite-iron formation assemblage indicate that the tectonostratigraphy of the northeastern Kisseynew Domain is complex and thorough ground-truthing is required before maps can be redrawn based on new aeromagnetic data.
Regardless of its exact origin, the amphiboliteiron formation assemblage is best interpreted as unrelated to similar-looking rocks in the TNB and the adjacent Wuskwatim corridor because these rocks include more pelitic gneiss, yield Archean Nd model ages and are more clearly in fault contact with the Burntwood Group (Zwanzig et al., 2006). If the assemblage at Kawaweyak Lake is equivalent to the assemblage at Granville Lake, it may have economic potential for gold rather than for nickel, since showings containing trace gold occur in similar amphibolite with a sulphidic layer directly south of Granville Lake.

References

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