

Field and Isotopic Study of Late, Undeformed Pegmatites and Leucogranites in the Glennie Domain and the Hanson Lake Block¹

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An investigation of the field relationships and the isotopic geochemistry of undeformed pegmatites and leucogranites in the Glennie Domain and the Hanson Lake Block was begun during 1992. The Glennie Domain and the Hanson Lake Block are part of the Reindeer Zone, an Early Proterozoic collage of dismembered volcanic and continental arcs that were formed during the Trans-Hudson Orogen (Lewry and Collerson, 1990). The Glennie Domain and the Hanson Lake Block are primarily composed of Early Proterozoic supracrustal metavolcanic and metasedimentary rocks and metaplutonic rocks, and both regions contain several areas that have been identified as Archean windows. The metaplutonic, metavolcanic, and metasedimentary rocks of the Glennie Domain and the Hanson Lake Block are intruded by undeformed leucogranites and pegmatites that have been dated at about 1.78 Ga (Bickford *et al.*, 1990).

Trace element geochemistry of the volcanic and plutonic rocks in the Reindeer Zone shows that these terranes were primarily formed by melting of oceanic crust in a subduction zone with a minimum amount of continental crust involved (Watters and Pearce, 1987). The existence of the Archean basement inliers suggests that the volcanic arc rocks of the Reindeer Zone may have been tectonically emplaced over older continental crust. However, these basement rocks may also be tectonic slivers of continental crust that may have been faulted into place during accretion of the volcanic arc complexes (Lewry *et al.*, 1990).

The purpose of this study is to determine the type of crust that underlies the supracrustal and metaplutonic rocks of the Glennie Domain and the Hanson Lake Block. The undeformed pegmatites and leucogranites will be used as probes of the underlying crust in order to determine the extent of Archean basement that underlies the Glennie Domain and the Hanson Lake Block. Age dating and isotopic analysis of the common Pb and Sm-Nd systematics of the leucogranites and pegmatites, and the country rocks that they intrude, will better constrain the age and type of crust that underlies this part of the Trans-Hudson Orogen.

1. Sampling Program

Geologic mapping and sample collection was completed during June and July, 1992. A total of 14 geochronological and geochemical samples of pegmatite, leucogranite, granodiorite gneisses, metasedimentary rocks, and metavolcanic rocks from the Robertson Lake area in the Glennie Domain were collected for analysis. A more limited sampling program was completed in the Hanson Lake area where 3 geochronological and 4 geochemical samples were collected. Sample descriptions for all the samples are given below. These samples are now being analyzed to determine their age of crystallization and possible magma sources using U-Pb age dating, Pb feldspar systematics, and whole-rock Sm-Nd isotopic ratios.

U-Pb dating of zircon and monazite will be completed on the undeformed leucogranites and pegmatites as well as the country rock to determine age of crystallization. Pb isotopic ratios from separated feldspar from the pegmatites will be analyzed in order to place constraints on the timing of separation from the mantle. Analysis of feldspar Pb from a small number of pegmatites in the Trans-Hudson Orogen have $^{207}\text{Pb}/^{206}\text{Pb}$ ages of 2.525 Ga if the rocks from which the pegmatites formed separated from the mantle at 3.0 Ga. The 1.78 Ga feldspar isotopic ratios are less radiogenic than Pb of the same age that evolved directly from the mantle using the Stacey and Kramers (1975) two-stage Pb evolution model. One possible explanation for the 'retarded' radiogenic Pb signature is that the source rocks from which the pegmatites were derived were subjected to a high-grade metamorphic event between 2.4 and 2.2 Ga during which U was preferentially removed from the system. Sm-Nd isotopic values will be used to distinguish between a mantle source and a crustal source for these post-orogenic magmas.

2. Robertson Lake Pegmatite Field, Glennie Domain

A field of late pegmatite and associated leucogranite in the northern part of the Glennie Lake map sheet (63M-12) was mapped at 1:10 000 scale. The study area is located within the allochthonous Wapassini Sheet, a com-

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plex of metaplutonic gneisses, metavolcanic, and metasedimentary rocks (Lewry *et al.*, 1990). The Wapasinini Sheet lies structurally above the Cartier Sheet and structurally below the Kyaska Sheet.

The pegmatite and associated granites in the Robertson Lake area of the Glennie Domain are exposed over an area of approximately 18 km² between 55° 42' N and 45° N and 103° 40' W and 48° W. This area was previously mapped by Lewry (1977) at a scale of 1:63,360 and Delaney (1986) mapped the eastern and central parts at 1:20 000 scale. These workers identified a large number of mineralogically simple pegmatites in this area. The predominant type of pegmatite is a pink, microcline-quartz ± biotite ± muscovite rock; garnet is only locally present. Field mapping shows that the pegmatites are generally northwest-trending tabular bodies and dykes. Biotite is the major mica in the western part of the study area and muscovite is present in the eastern part.

The pegmatites in this region are associated with feldspar-quartz-biotite leucogranites. The leucogranites are not foliated and in places crosscut the country rocks; in other places they appear to be transitional with foliated granodiorite gneisses. Lewry (1977) interpreted the leucogranites to have been at least partly produced by anatexis of the older gneisses and metasediments. Field observations support this interpretation because of the gradational transition in some outcrops from granodiorite gneisses to leucogranite and pegmatite. This is especially evident in the large granitic body in the central part of the Robertson Lake area. A brief description of the samples collected during the 1992 field season are given below.

HUD 92-100 is from a light pink granitic pegmatite dyke that intrudes mafic metavolcanic rocks on the northwest side of a peninsula in a lake approximately 6 km east of Robertson Lake (55° 44' 08" N, 103° 41' 03" W). The rock is a microcline-quartz-muscovite pegmatite and cross-cuts the foliation of the metavolcanic rocks. A 25 kg geochronological sample was taken in order to date the pegmatite by the U-Pb zircon method.

HUD 92-105 is a light pink microcline-quartz-muscovite pegmatite from a 10 m wide dyke exposed on the northeast arm of the lake 6 km east of Robertson Lake (55° 44' 48" N, 103° 40' 40" W). This undeformed pegmatite intrudes biotite-muscovite metasediments of the Porky Lake siliciclastics. Both a 40 kg geochronological and a geochemical sample were collected.

HUD 92-108 is a fine-grained sample of leucogranite north of the lake 6 km east of Robertson Lake (55° 44' 57" N, 103° 41' 21" W). The sample is from the central part of a 200 m wide pluton that intrudes muscovite-bearing metasediments of the Porky Lake siliciclastics. A fresh 10 kg sample was taken for geochemical analysis.

HUD 92-113 is a pink leucogranite taken from a 50 m wide outcrop of leucogranite and intermixed pegmatite, approximately 530 m northeast of the northern arm of the lake 6 km east of Robertson Lake (55° 44' 58" N, 103° 41' 56" W). The leucogranite body intrudes inter-

mediate metavolcanics of the Pine Lake metavolcanics. A 40 kg geochronological sample was collected.

HUD 92-124 is a sample of an intermediate metavolcanic rock from the western limit of the Pine Lake metavolcanic belt (55° 44' 11" N, 103° 41' 34" W). The rock is a dark-green medium-grained hornblende-biotite-plagioclase schist. A fresh 10 kg sample was collected for geochemical analysis.

HUD 92-130 is a sample of a pink, fine- to coarse-grained microcline-quartz-muscovite pegmatite exposed 100 m from shore on the western arm of the lake 6 km east of Robertson Lake (55° 43' 54" N, 103° 41' 51" W). This undeformed pegmatite is part of a northeast-trending dyke. A fresh 50 kg geochronological and geochemical sample was collected.

HUD 92-170 is a hornblende-biotite-plagioclase-quartz granodiorite gneiss. A 40 kg sample was collected near the shore of a lake located approximately 3 km east of Robertson Lake (55° 43' 57" N, 103° 44' 04" W). The granodiorite gneiss is cut by an undeformed pegmatite dyke and lies just west of the large leucogranite body in the centre of the study area.

HUD 92-177 is a sample of leucogranite from the large granite body in the centre of the study area (55° 44' 10" N, 103° 43' 09" W). The outcrop exposes both granitic and granodioritic phases in gradational contact. A 40 kg geochronological sample was collected for U-Pb zircon dating.

HUD 92-182 is a muscovite-bearing pegmatite from an outcrop from the southern part of the central leucogranite body (55° 43' 40" N, 103° 43' 07" W). The pegmatite grades into a fine-grained foliated granodiorite gneiss. A 40 kg geochronological sample of the pegmatite and a fresh geochemical sample of the granodiorite were collected.

HUD 92-198 is a coarse-grained granoblastic hornblende- and biotite-bearing granodiorite gneiss located on the northwest side of Robertson Lake (55° 44' 36" N, 103° 47' 17" W). The granodiorite gneiss is cut by thin undeformed pegmatite dykes. A fresh sample of the granodiorite gneiss was collected for geochemical analysis.

HUD 92-205 is from an outcrop of coarse- to fine-grained pegmatitic granite and pegmatite. The sample is a microcline-quartz-biotite pegmatite that varies considerably in grain size. A representative sample of the pegmatitic phase was collected from a large outcrop exposed on the east shore of Robertson Lake (55° 44' 32" N, 103° 46' 44" W).

HUD 92-216 is a microcline-quartz-biotite pegmatite exposed 50 m north of the east arm of Robertson Lake (55° 43' 52" N, 103° 46' 03" W). The pegmatite is associated with leucogranite and intrudes biotite-bearing metasedimentary rocks. A sample of the pegmatite was collected for geochronology.

HUD 92-219 is a massive plagioclase-quartz-microcline-biotite leucogranodiorite that forms resistant outcrops on the east shore of Robertson Lake (55° 44' 01"N, 103° 46' 47"W). This light grey rock is unfoliated and appears to intrude the granodiorite gneiss and metasediments in a northwest-trending sheet. A fresh 40 kg sample was taken from an outcrop along the lake shore for geochemical and geochronological analysis.

HUD 92-227 comprises a suite of metasedimentary rocks exposed in a cliff face along the east shore of Robertson Lake (55° 44' 02"N, 103° 46' 51"W). The samples are biotite-rich and include interlayered metavolcanic or metavolcanoclastic horizons. A total of 4 samples from different stratigraphic levels were collected for geochemical analysis.

3. Hanson Lake Block

Samples collected in the Hanson Lake area are described below. Some preliminary work has been carried out on some of them.

HUD 92-230 is a migmatitic hornblende-plagioclase-quartz diorite gneiss from the north end of Jackpine Lake (54° 45' N, 102° 52' W). The gneiss is intruded by numerous beryliferous pegmatite dykes that contain accessory columbite-tantalite, monazite, and spodumene (MacDougall, 1989). A preliminary U-Pb zircon age of 1830 ± 28 Ma was obtained from four fractions from this sample (Figure 1). The significance of this age has not yet been assessed.

HUD 92-231 is a microcline-quartz-biotite pegmatite from the northwest end of Hanson Lake (54° 45' 29"N, 102° 49' 04"W). This pegmatite is associated with leucogranite and intrudes mafic and intermediate metavolcanic rocks. The sample is relatively barren in zircon and further work is required to obtain enough zircons for age determination.

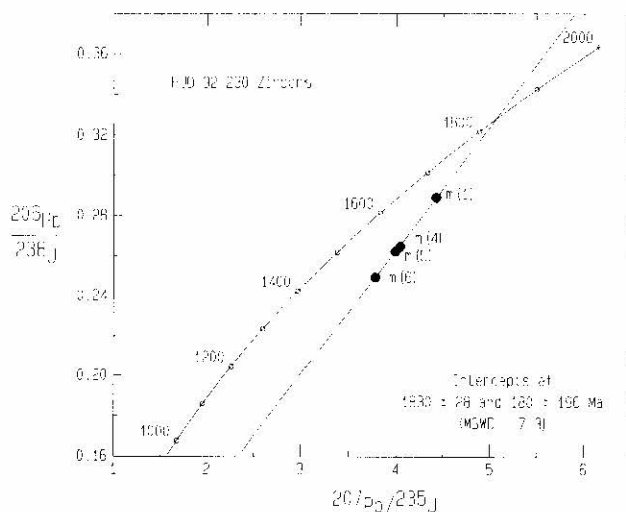


Figure 1 - Preliminary U-Pb concordia diagram for four fractions from HUD 92-230, a quartz diorite gneiss north of Jackpine Lake, Hanson Lake Block. These zircon fractions give an age of 1830 ± 28 Ma.

HUD 92-232 comprises a suite of two geochemical samples from a roadcut on the Hanson Lake Road (Route 106) at the turnoff to Gillingham and Winteringham lakes (54° 48' N, 102° 51' W). The samples consist of a microcline-quartz-biotite pegmatite and a biotite-hornblende gneiss. Garnet is locally present in both the pegmatite and the gneiss.

HUD 92-233 comprises two geochemical samples from a roadcut on Route 106, 5.6 km east of the junction with Route 104. Fresh samples of a biotite-bearing pegmatite associated with the Jan Lake Granite and a feldspathoblastic granodiorite gneiss were collected.

HUD 92-236 is a beryliferous pegmatite exposed on the west shore of the Sturgeon-weir River (54° 52' 42"N, 102° 38' 04"W). This sample was collected from outcrop 577 described by Radcliffe (in Pyke, 1966). This pegmatite also has a low abundance of zircons, but a few have been separated and appear to be suitable for determining an age.

HUD 92-237 comprises a suite of three geochemical samples from an island in Botham Bay in the eastern part of Hanson Lake. The three samples include an unfoliated microcline-quartz pegmatite, a coarse-grained hornblende-plagioclase metagabbro, and a pegmatite that appears to have a weakly developed foliation.

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