GEOLOGICAL INVESTIGATIONS IN THE KNEE LAKE BELT (PARTS OF NTS 53L)

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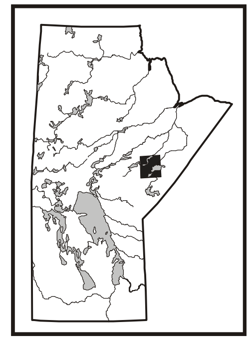

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SUMMARY

Mapping of the Knee Lake belt focused on the northeast in the Gods Lake area in 2000. Results include identification of two distinct, opposing, facing sequences within the Hayes River Group metavolcanic rocks, separated by a northeast-trending dextral fault with north side up, exposing amphibolite-grade rocks on the northwest and greenschist-grade rocks to the southeast. Geochronological studies yielded several important ages: 1) the Oxford Lake Group volcanic subgroup has a 2720 Ma depositional age; and 2) the Oxford Lake Group sedimentary subgroup has a broad range of detrital zircon ages ranging from 2711 to 3647 Ma. Possible sources of ancient ca. 3.6 Ga zircons occur in fault-bounded blocks along the northern margin of the northern Superior Province. Geochronological data from the Knee Lake segment date Hayes River volcanism at 2830 Ma, and sensitive high-resolution ion microprobe (SHRIMP) data on detrital zircons indicate that turbiditic sandstone is synvolcanic and volcanic-derived. Folding of the Hayes River Group predates deposition of coarsening-upward clastic sedimentary rocks and iron-formation, the former containing 2937 to 2822 Ma detrital zircons. The Oxford Lake volcanic subgroup was extruded at 2722 Ma in southern Knee Lake and was followed by deposition of fluvial-clastic, sedimentary subgroup sandstone with detrital zircons ranging in age from 2798 to 2707 Ma.

INTRODUCTION

The bedrock mapping projects of Manitoba's Northern Superior program are primarily designed to better understand the volcanic, structural and tectonic evolution of greenstone belts in the Manitoba portion of the Sachigo Subprovince–Gods Lake Domain. A secondary goal is to place the supracrustal belts in a regional context with the internal and surrounding plutonic and gneiss complexes. Central to this objective is an understanding of the largest contiguous greenstone belt in the Sachigo, the Knee Lake belt (Fig. GS-22-1). This report summarizes new mapping and laboratory results stemming from stratigraphic, geochemical, structural and geochronological studies of this belt (Syme et al., 1997, 1998; Corkery et al., 1999) being conducted as part of the Western Superior NATMAP Project. Preliminary geological maps for Gods Lake (Corkery and Cameron, 2000) cover the areas mapped in the Knee Lake belt in 1999 and 2000.

Mapping at a scale of 1:50 000 in the Elk Island area in 2000 extends the study of the supracrustal rocks in the Gods Lake area to the northeast of Gods Lake Narrows (Fig. GS-22-2). Existing 1:50 000 maps (Barry, 1961; Gilbert, 1985) formed an excellent base within which to integrate new observations.

A unique feature of Gods Lake is that it extends across two greenstone belts (Fig. GS-22-1), thereby providing a continuous section through plutonic and gneiss domains, both within and between the Knee Lake and Munroe Lake belts. A co-operative Manitoba Geological Survey (MGS)–Geological Survey of Canada (GSC) mapping and sampling program was conducted in all major plutonic and gneiss complexes on Gods Lake. This program is expected to provide important data for the Knee Lake belt project and also for a concurrent regional geochemical, isotopic and geochronological transect. The regional transect will focus on development and chronology of plutonic and gneissic terranes in the northwestern Superior Province.

The results of age determinations from samples collected during the past four years of mapping in the Knee lake belt are summarized. In past mapping programs, definition of the major assemblages was based primarily on field relationships. These were not always enough. The use of precision geochronology and geochemistry has provided a new discrimination tool.

Tectonostratigraphy

Supracrustal rocks in the Knee Lake belt have previously been assigned (Gilbert, 1985 and references therein) to two principal stratigraphic entities, the Hayes River Group (HRG) and the Oxford Lake Group (OLG). These groups are the principal focus of our current work, in that they have more potential to host gold and base-metal deposits than the voluminous granitoid terranes in the Superior Province.

The HRG (ca. 2830 Ma at Knee Lake; D. Davis, pers. comm., 1986) is a mainly volcanic sequence dominated by pillowed basalt and related gabbro, minor intermediate to felsic volcanic rocks, and minor volcanogenic sedimentary rocks. In the southeastern Gods Lake area, both the base and the top of the HRG have been intruded by tonalitic to granitic plutons and related gneissic units of the Bayly Lake complex (2783–2730 Ma; D. Davis, pers. comm., 1986).

The OLG (ca. 2706 Ma at Oxford Lake; D. Davis, pers. comm., 1986) is a largely sedimentary succession, up to 12 km thick, which lies unconformably on HRG volcanic rocks at Gods Lake (Gilbert, 1985). It consists of a lower, dominantly 'volcanic' subgroup of limited extent and an overlying, more extensive sedimentary subgroup. The OLG extends along the southern margin of the belt from Oxford Lake to Magill Lake, a distance of 40 km (Gilbert, 1985; Manitoba Energy and Mines, 1987), and discontinuously to the Gods Lake Narrows area. Volcanic rocks in the lower subgroup are shoshonitic to calc-alkalic in character (Hubregtse, 1976; Brooks et al., 1982; Gilbert, 1985). They include fragmental and flow rocks but are dominated by conglomeratic epilastic rocks (Syme et al., 1997). The overlying sedimentary subgroup is dominated by units deposited in a subaerial to locally shallow-marine environment.

ELK ISLAND AND CENTRAL GODS LAKE

Previous Work

Work in the Gods Lake area prior to 1970 was conducted by Wright (1931), Dix (1947) and Barry (1961). The Gods Lake Narrows map sheet by Barry (1961) was a particularly useful geological base for our investigations in the central part of Gods Lake.

The Gods Lake area was remapped in the early 1970s as part of the 'Greenstone Project' (bibliography in Gilbert, 1985). The Gods Lake Narrows area is covered by two three-colour 1:50 000 scale maps (GR83-1-12, -13) and one black and white preliminary map (1973H-12). A review of the exploration history of the area up to 1977 is contained in Southard (1977).

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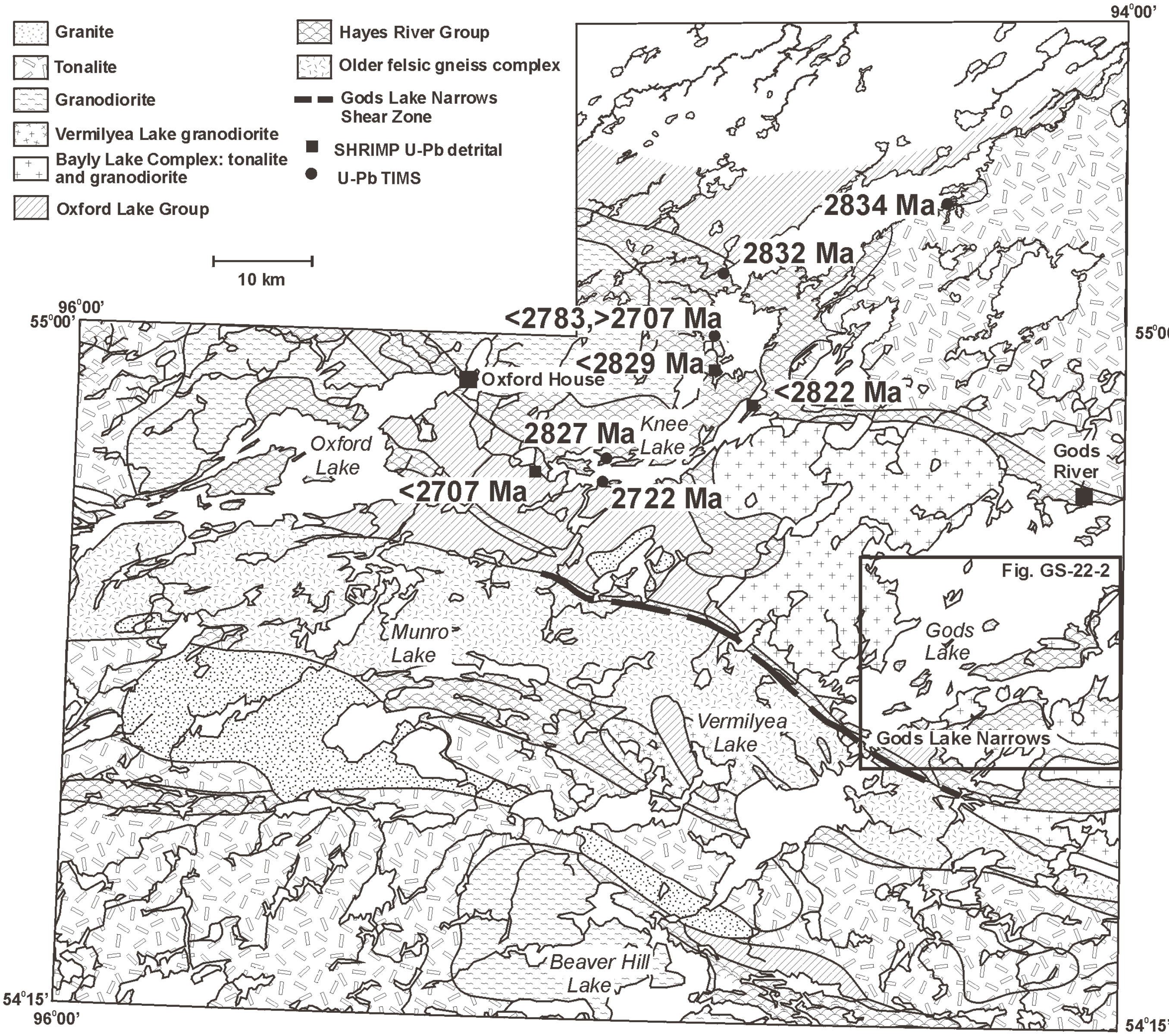

Figure GS-22-1: Regional geological setting and major subdivisions in the Gods Lake region. U-Pb zircon geochronology from this study.

Regional Setting

Northeast of Gods Lake Narrows, HRG mafic volcanic rocks form a homoclinal, northwest-facing, 2 to 3 km thick sequence that extends the full length of Elk Island (Fig. GS-22-2). The sequence is truncated to the south at an angular unconformity by east-striking and south-facing conglomerate rocks of the Oxford Lake sedimentary subgroup. To the southeast, HRG rocks are intruded by granite of the Bayly Lake complex and, on the northwest, the HRG is truncated by a northeast-trending fault zone. Northwest of the fault, a southeast-facing heterolithic sequence of HRG rocks consists of a lower, mainly sedimentary part and a predominantly basaltic upper part.

The OLG, south of the unconformity, is contained in a southeast-trending, southwest-facing belt up to 5 km wide (Fig. GS-18-2). The sedimentary subgroup directly overlying the HRG forms a 1 km thick, largely subaerial succession, which is in fault contact to the south with a second south-facing sequence dominated by a submarine succession of fine-grained sedimentary rocks of Oxford Lake volcanic subgroup affinity.

The southern boundary of the Knee Lake belt is marked by a major, 1 to 1.5 km wide mylonite that extends through Gods Lake Narrows. South of this feature, a 10 km thick, older felsic gneiss complex (U-Pb age of 2883 Ma; Davis pers. comm., 1986) separates the Knee Lake belt from several thin slivers of supracrustal rocks that form the eastern extension of the Munroe Lake belt.

Hayes River Group

Two distinct sequences previously reported as HRG (Gilbert, 1985) occur in the Elk Island area:

1) The Elk Island sequence is a homoclinal, northwest-facing sequence of HRG mafic volcanic rocks that represents a continuation of the basaltic section in the Gods Lake Narrows area (Corkery et al., 1999).
2) The Billy Hole Island sequence is a southeast-facing sequence of coarsening-upward metasedimentary and metavolcanic rocks that occurs directly northwest of the basaltic rocks (Fig. GS-22-2).

Elk Island sequence

In the northwest-facing basalt sequence at Elk Island, primary structures and textures are remarkably well preserved at greenschist-facies metamorphic grade throughout most of the basalt-dominated section (Fig. GS-22-3). There is little or no penetrative fabric in most outcrops. Near fault zones, a narrow strain gradient is exhibited as a relatively abrupt increase in a penetrative fracture cleavage and shear

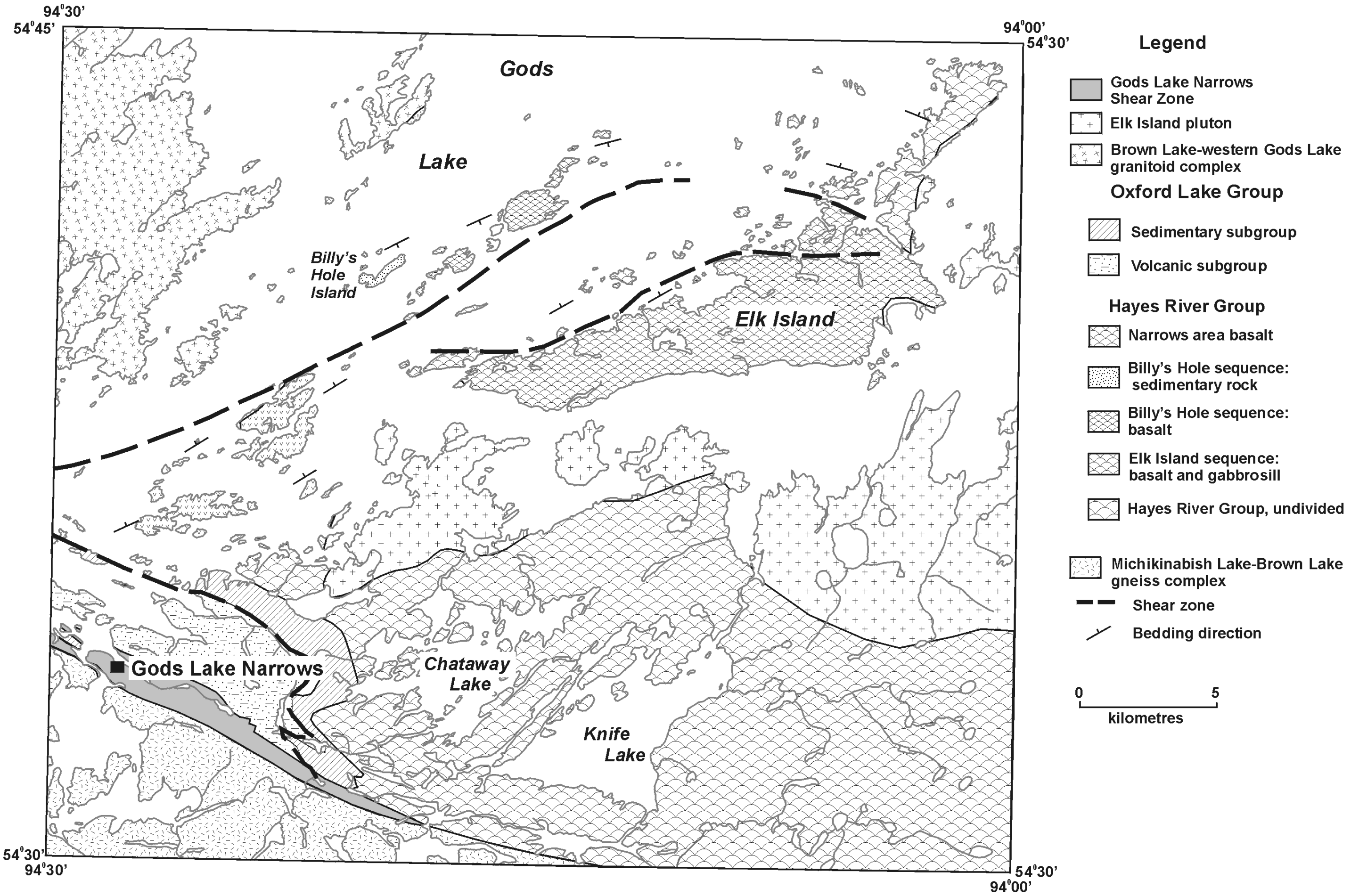

*Figure GS-22-2: General geology of south and central Gods Lake (*modified from *Manitoba Energy and Mines, 1987).*

fabric grading into mylonite. The two major shear zones within the section generally strike northeasterly, with several offshoots that are conformable with the east-striking stratigraphy (Fig. GS-22-2).

The Elk Island sequence is dominated by massive and pillowed, aphyric to sparsely plagioclase-phyric flows and subordinate amoeboid pillow and flow-top breccia. These flows have characteristic beige to medium green weathering colours and are pale to medium green on fresh surfaces. Pillowed flows display thin selvages and contain thick interpillow hyaloclastite or interpillow chert. Pillows typically have vesicular margins and commonly contain 1 mm by 2 to 5 mm radial pipe-vesicles. Numerous synvolcanic gabbro sills and dykes intrude the sequence; these range from minor veins to sills over 100 m thick. Some gabbroic units are associated with thick amoeboid pillow and flow-top breccia units (Fig. GS-22-4) and may represent thick, ponded basalt flows. One such unit extends along the north shore of Elk Island for approximately 4 km in the area southwest of the old Gods Lake gold mine headframe (Fig. GS-22-2).

Billy's Hole Island sequence

A southeast-facing sedimentary and volcanic section, previously mapped as Hayes River Group, occurs northeast of the Elk Island

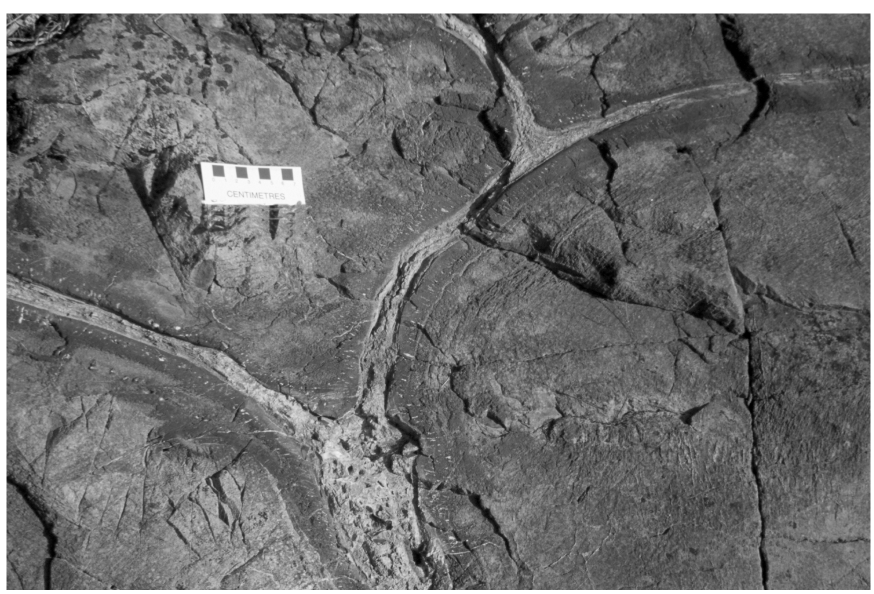

Figure GS-22-3: Well preserved pillowed basalt flow, Elk Island area.

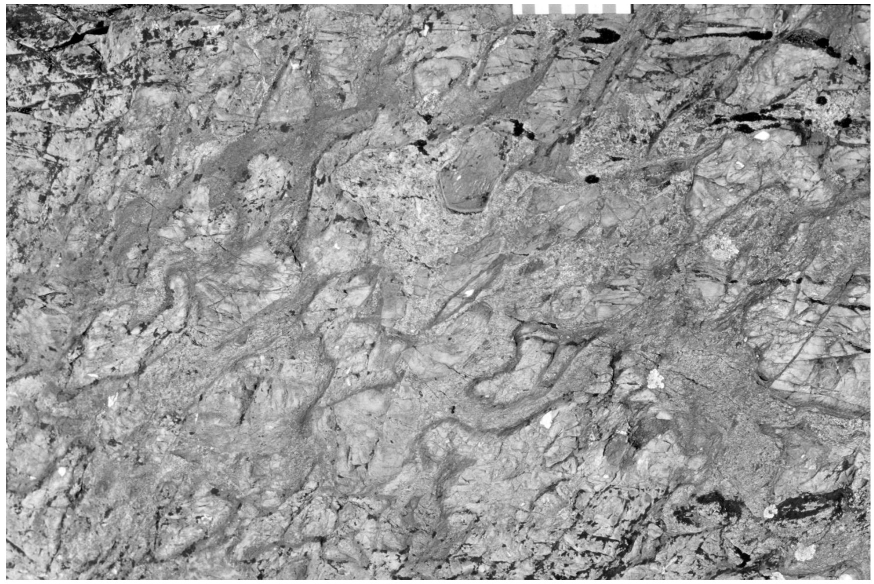

Figure GS-22-4: Thick basalt flow-top breccia with amoeboid pillows, Elk Island area.

basaltic sequence in the vicinity of Billy's Hole Island (Fig. GS-22-2). The volcano-sedimentary section is intruded on the north and west by granite of the Bayly Lake complex (2730 Ma; D. Davis, pers. comm., 1986); the section is bounded on the south by a northeast-trending fault (Fig. GS-22-2). Primary structures and textures are variably preserved at amphibolite facies throughout.

The volcano-sedimentary section is composed of a number of distinct stratigraphic units. These can be broadly grouped into a lower sediment-dominated sequence that is gradational with a mixed epiclastic and volcaniclastic member and an uppermost pillowed mafic volcanic member. The lowermost part of the section is dominated by fine-grained sedimentary rocks: feldspathic greywacke sandstone, siltstone and argillite. These grade upward into medium- to coarse-grained sandstone with interbeds of polymictic pebble-cobble, matrix-supported conglomerate (Fig. GS-22-5) with a significant felsic and mafic volcanic detrital component. Rhyolite breccia, massive rhyolite, and rare massive and pillowed basalt flows are interlayered with the sedimentary rocks in the central portion of the section. These are, in turn, overlain by a 1 to 2 km thick sequence of aphyric and plagioclase-phyric pillowed basalt that constitutes the upper part of the section.

Oxford Lake Group

Both the volcanic and sedimentary subgroups of the OLG are exposed at Gods Lake Narrows. The volcanic subgroup forms a 3 to 4 km thick, fault-bounded panel (Fig. GS-22-2). Although most rocks in this panel are highly strained, primary structures and textures (including graded bedding) in the sedimentary rocks indicate this to be a southward-younging sequence.

In Gods Lake Narrows, the OLG sedimentary subgroup is a simple, 1 to 1.5 km thick, continuous, south-facing sequence of well preserved polymictic conglomerate. A transect through the eastern end of the unit revealed no indication of either fining or coarsening upward.The OLG is not well represented in the Elk Island area; however, several spectacular exposures of the OLG sedimentary subgroup, with an unconformable relationship to the Billy's Hole Island sequence, are exposed (Fig. GS-22-2). Polymictic framework boulder conglomerate, of apparent greenschist-facies metamorphic grade, rests unconformably on an irregular depositional surface (Fig. GS-22-6) of amphibolite-facies grade basalt.

Granitoid Rocks

Most of the granitoid rocks in the Knee Lake–Gods Lake area were interpreted as pre-Oxford Lake Group and assigned to the 'Bayly Lake complex' (Gilbert, 1985). Lack of high-resolution geochemical and geochronological discrimination tools at the time prevented a more sophisticated investigation. In the present study, all major units previously identified have been examined and sampled.

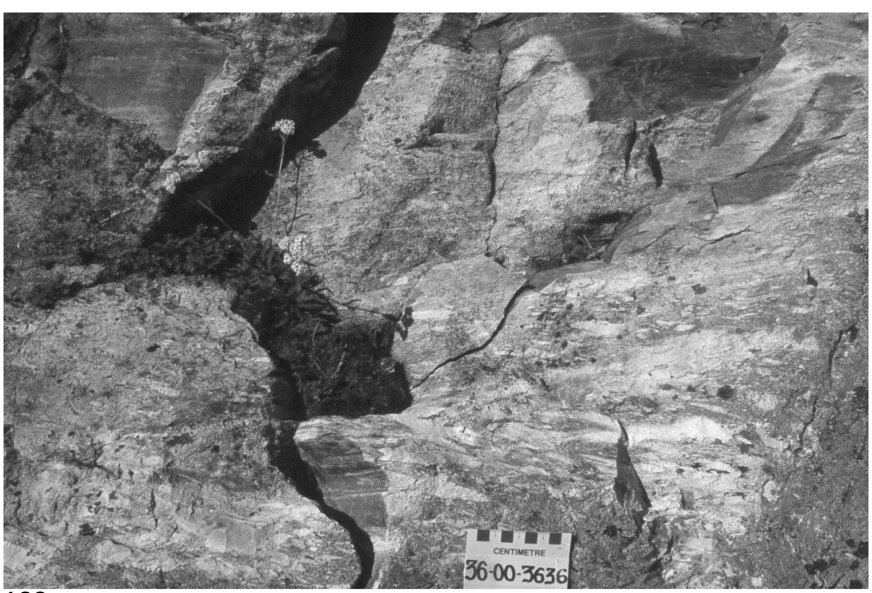

Figure GS-22-5: Polymictic matrix-supported conglomerate, central portion of Billy's Hole Island sequence.

Figure GS-22-6: Polymictic conglomerate of the OLG on an unconformity at the top of the Billy's Hole Island sequence.

Brown Lake–western Gods Lake granitoid complex and Bayly Bay pluton

The Brown Lake–western Gods Lake granitoid complex that dominates northwestern Gods Lake is intruded by the Bayly Bay pluton (Fig. GS-22-2; Gilbert, 1985). However, the granitoid complex and the Bayly Bay pluton both contain xenoliths of an older group of well to strongly foliated to gneissic, biotite-hornblende tonalite to granodiorite gneiss. These rocks are intruded by two younger phases of more homogeneous tonalite to granodiorite (Gilbert, 1985) that were broadly subdivided into 1) fine- to medium-grained biotite±hornblende tonalite; and 2) younger, medium- to coarse-grained tonalite to granodiorite. Both tectonic and intrusive contact relationships have been observed between the Brown Lake–western Gods Lake granitoid complex rocks and the HRG. Geochemical, Nd isotopic and U-Pb geochronological work in progress will determine their tectonomagmatic affinity and should constrain whether this suite is composed of cogenetic granitoid rocks.

Elk Island pluton

Younger, massive to slightly foliated, biotite monzogranite to granodiorite forms an intrusion south and west of Elk Island (Fig. GS-22-2). The intrusion appears to be late, high level and possibly postorogenic or anorogenic. A shallow level of emplacement and erosion is indicated by the presence of spectacular tuffisite breccia in granite shoreline exposures southeast of Elk Island (Fig. GS-22-7). Tuffisite represents a degassing breccia formed during the escape of magma and magmatic gas through congealed upper parts of shallow (approx. 2 km deep) intrusions, at first passively but later with increasingly explosive effects (Hughes, 1971). The Elk Island pluton is probably comagmatic with earlier portions of the OLG, based on 1) the geochronology summarized in the text for the Oxford Lake Group in Manitoba (2720–2729 Ma), plus the age range reported for the Bayley Lake complex (2783–2730 Ma); 2) the 'intracontinental' character of the OLG, as evidenced by calc-alkalic to shoshonitic volcanic rocks and dominantly subaerial sedimentary rocks; and 3) the evolved high-level features of the granitoid intrusions. Granitoid geochemical work in progress may help in understanding the tectonic regime in which the OLG was deposited. These intrusions have a bearing on both the pre- and postemplacement uplift history of the Knee Lake belt.

Michikinabish Lake–Brown Lake gneiss complex

South of the Gods Lake Narrows Shear Zone (GLNSZ), there is a 10 km wide belt of biotite-hornblende tonalitic to quartz dioritic gneiss, a sample of which yielded a U-Pb age of ca. 2.9 Ga (D. Davis, pers. comm., 1986). These rocks display lithological features typical of Archean trondhjemite-tonalite-granodiorite (TTG) suites. The Nd isotopic work in progress on this suite should help constrain whether the GLNSZ juxtaposes different crustal blocks or different crustal levels of the same block.

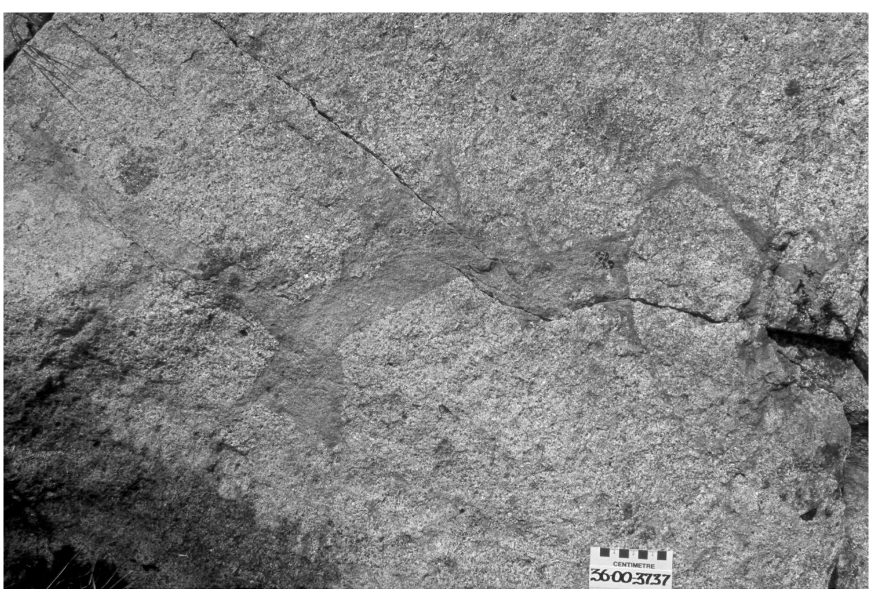

Figure GS-22-7: Tuffisite in the Elk Island granodiorite.

GEOCHRONOLOGICAL RESULTS FROM THE KNEE LAKE BELT

Eight new U-Pb zircon ages were obtained from the Knee Lake area (northwest of Gods Lake) in order to unravel the timing of volcanism and sedimentation in well studied sections of the Hayes River and Oxford Lake groups (cf. Syme et al., 1997, 1998). Initial results of this geochronological investigation are reported here to provide a regional context within which to interpret both the tectonostratigraphy of the Gods Lake area and the two new U-Pb zircon ages from the Gods Lake Narrows segment of the Knee Lake greenstone belt (D. Davis, pers. comm., 2000). Extraction, dissolution and U-Pb analysis of zircon and titanite by thermal-ionization mass spectrometry (TIMS) was carried out on volcanic and plutonic rocks at the Geological Survey of Canada (cf. Percival and Skulski, 2000, and references therein). Detrital zircons from sedimentary rocks were analyzed with the GSC's SHRIMP II facility using extraction and analytical methods described by Stern (1997).

Three samples of HRG felsic volcanic rocks were dated in the Knee Lake area (Fig. GS-22-8). A sample of quartz-phyric, rhyolite lapilli tuff, locally overlain by resedimented volcaniclastic rocks, was collected from the south shore of northern Knee Lake (lat. 55°07'00"N, long. 94°31'37.21"W; Fig. GS-22-1). Four single-zircon fractions were analyzed and three of these yielded a U-Pb age of 2834 +3/-2 Ma (Fig. GS-22-8a). A sample of resedimented felsic lapilli tuff that contained clasts of siltstone, abundant quartz fragments and lithic fragments (including quartz-phyric rhyolite), was collected from the northwestern shore of northern Knee Lake (lat. 55°04'2.70"N, long. 94°45'13.95"W; Fig. GS-22-1). Three single-grain and one multigrain (n=4) zircon fractions were analyzed, and two single-zircon fractions yielded a U-Pb age of 2832 +2/-1.5 Ma (Fig. GS-22-8b). A third sample of flow-banded rhyolite from the HRG was collected from the north shore of Pain Killer Bay, in southern Knee Lake (lat. 54°51'00"N, long. 95°9'00"W; Fig. GS-22-1). This rhyolite occupies the middle formation of the Pain Killer Bay complex (Syme et al., 1997), which consists of a high-level porphyritic felsic intrusion overlain successively by a lower formation of siltstone and feldspathic sandstone, a middle formation of massive and fragmental rhyolite flows, and an upper formation of felsic volcaniclastic-sedimentary and pyroclastic rocks. Five multigrain zircon fractions yielded a U-Pb age of 2827 +5/-4 Ma (Fig. GS-22-8c). These data demonstrate a relatively consistent pattern (within error) for HRG calc-alkaline felsic volcanism at ca. 2830 Ma.

Detrital zircon ages from a synvolcanic greywacke in the HRG provide further constraints on the HRG sources, and the age and duration of Hayes River volcanism. A sample of feldspathic wacke from a turbiditic succession of quartz-poor sandstone and siltstone that overlies the northwestern flank of the Pain Killer Bay rhyolite complex (2827 +5/-4 Ma, above) was collected from the western shore of central Knee Lake (lat. 54°47'48"N, long. 94°47'48"W; Fig. GS-22-1). Twenty detrital zircons from this sample were analyzed with the SHRIMP and yielded a narrow range of ages, from 2853 ± 10 Ma to 2829 ± 9 Ma; the latter represents the average of four analyses of a single grain and is the maximum age of sedimentation (Fig. GS-22-9a). This maximum age constraint is within the margin of error for the age of the Pain Killer Bay rhyolite, and this result is consistent with the notion that sedimentation was approximately contemporaneous with felsic volcanism (Syme et al., 1997, and references therein).

In central Knee Lake, the Opischikona Narrows sedimentary rocks are separated by an angular unconformity from underlying, previously folded volcanic rocks of the HRG (Syme et al., 1997, 1998). This coarsening-upward sedimentary sequence includes a lower unit of chert-magnetite iron-formation and argillite overlain by greywacke, pebbly sandstone and conglomerate. A sample of greywacke from a small island in Opischikona Narrows, central Knee Lake (lat. 55°01'32.43"N, long. 94°47'04.65"W; Fig. GS-22-1) was collected for detrital zircon dating with the SHRIMP. Seventeen detrital zircon grains were analyzed and found to encompass an age range from 2937 ± 12 Ma to 2822 +18/-15

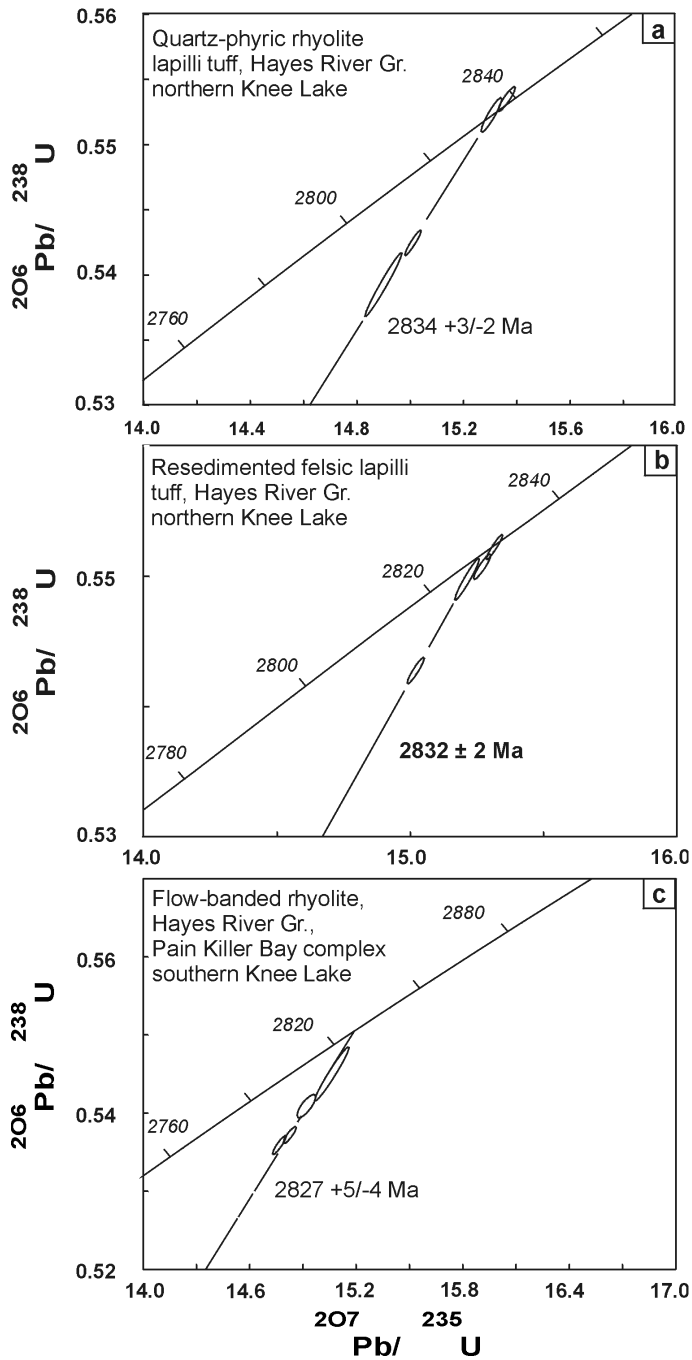

Figure GS-22-8: U-Pb zircon geochronology of the Hayes River Group, Knee Lake segment of the Knee Lake greenstone belt: a) quartz-phyric rhyolite lapilli tuff from northern Knee Lake; b) resedimented felsic lapilli tuff from northern Knee Lake; and c) flow-banded rhyolite from Painkiller Bay.

Ma, the latter being an average of four points on one grain and representing the maximum age of greywacke deposition (Fig. GS-22-9b). The detrital zircon ages reflect sediment sources not only in the immediately underlying Hayes River Group, but from older Mesoarchean rocks as well. Some of the older ca. 2.93 Ga detrital zircons are large (200 µm in length), slightly rounded grains typical of plutonic rocks and may reflect uplift of crystalline basement. In order to constrain a minimum age of sedimentation, a sample of a feldspar porphyry sill that cuts the Opischikona Narrows sedimentary rocks was sampled from central Knee Lake (lat. 55°01'32.43"N, long. 94°47'04.65"W; Fig. GS-22-1). Two single-grain zircon fractions and one multigrain fraction (n=2) were analyzed by TIMS and yielded $^{207}Pb/^{206}Pb$ ages ranging from 2888 Ma to 2783 Ma, the latter providing a maximum age for the sill (Fig. GS-22-9c). Two multigrain titanite fractions were analyzed to obtain a minimum age for the sill; these yielded ages of 2709 ± 12 Ma and 2707 ± 17 Ma, the latter being less discordant and providing a preliminary minimum age for the sill. Opischikona Narrows sedimentary rocks were therefore deposited after 2822 Ma (youngest detrital zircon) and before 2707 Ma (titanite cooling or metamorphic age of crosscutting sill). These data allow for the interpretation that the Opischikona sedimentary rocks represent an outlier of Oxford Lake Group. Further work on the feldspar porphyry sill will refine testing of this hypothesis.

A sample of dacitic lapilli tuff from the volcanic subgroup of the OLG, exposed on an island in southern Knee Lake (lat. 54°50'36"N, long. 94°57'48"W; Fig. GS-22-1), was dated to constrain the age of volcanism. This volcanic rock is part of a sequence of intermediate shoshonitic to calc-alkaline volcaniclastic rocks and mafic lavas on southern Knee Lake. Two multigrain fractions and one single-grain zircon fraction yielded a U-Pb age of 2722 ± 3 Ma (Fig. GS-22-10a). A sample of dacite lapilli tuff located between GLNSZ and conglomerate of the Oxford Lake sedimentary subgroup (lat. 54°34'58"N, long. 94°30'00"W; Fig. GS-22-1), yielded a U-Pb zircon age of 2719.9 ± 1.4 Ma (D. Davis, pers. comm., 2000). Elsewhere in northern Manitoba and Ontario, the Oxford Lake volcanic subgroup has yielded U-Pb zircon ages of 2726 ± 2 Ma on Little Stull Lake (Corkery and Skulski, 1998), greater than 2728 ± 2 Ma on Edmund Lake in the east (Corkery and Heaman, 1998), and 2729 ± 3 Ma for the Gunpoint Group on Cross Lake in the west (Corkery et al., 1992).

A sample of fluvial, crossbedded feldspathic wacke with distinctive heavy-mineral trails was collected from the sedimentary subgroup of the Oxford Lake Group at Trout Falls in the southern Knee Lake area (lat. 54°51'21"N, long. 95°7'30"W; Fig. GS-22-1) for dating of detrital zircons. Twenty-five detrital zircon grains were analyzed with the SHRIMP and yielded ages ranging from 2798 ± 12 Ma to 2707 +9/-8 Ma, the latter representing a maximum age of sedimentation derived by averaging five point analyses on a single grain. Detrital zircons in this sample have ages 1) slightly younger than Hayes River volcanism (ca. 2830 Ma, see above), 2) typical of the volcanic subgroup of the Oxford Lake group (ca. 2730 Ma), and 3) typical of felsic volcanism recorded in the OLG on Oxford Lake (2706 +4/-2 Ma; Syme et al. 1993). A sample of crossbedded sandstone from near the base of the polymictic conglomerate-dominated sedimentary subgroup of the OLG south of the GLNSZ was collected for U-Pb dating of detrital zircons by TIMS (D. Davis, pers. comm., 2000). Five detrital grains yielded ^{207}Pb/^{206}Pb ages

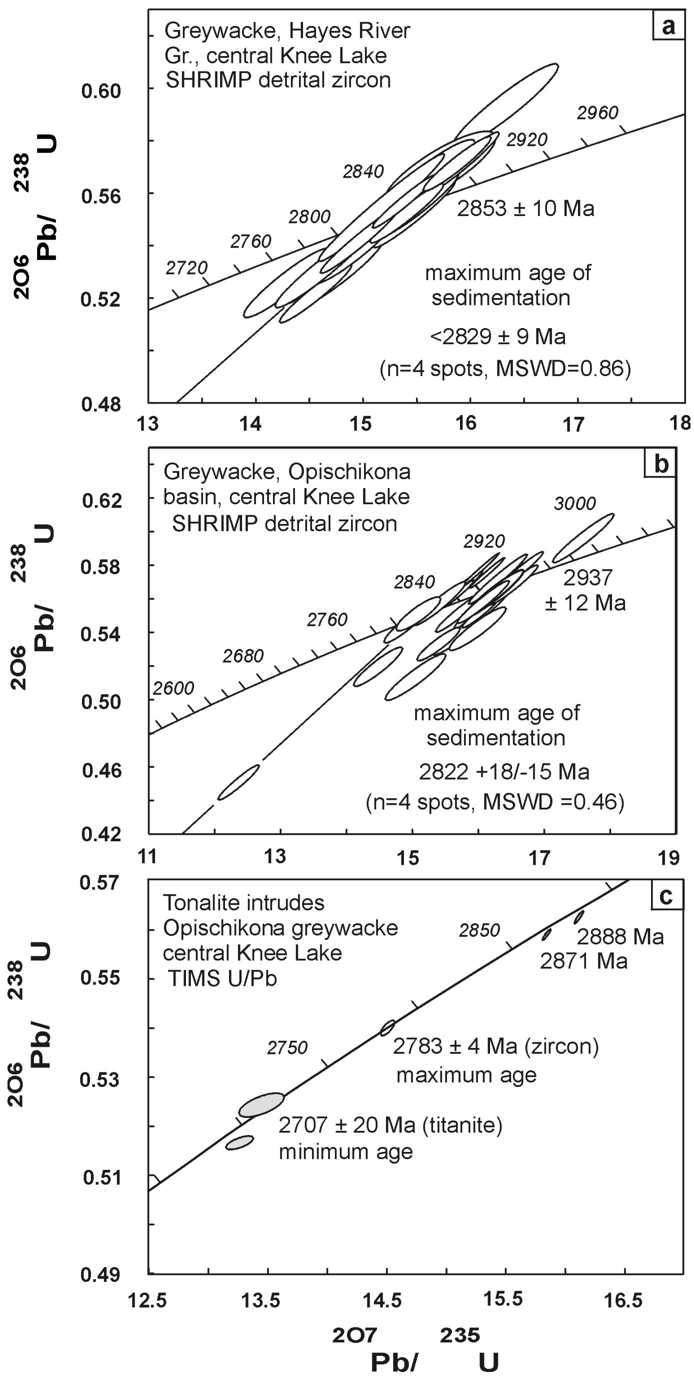

Figure GS-22-9: U-Pb geochronology of a) Hayes River Group greywacke (SHRIMP detrital zircon); b) Opischikona basin greywacke (SHRIMP detrital zircon); and c) tonalite that cuts the Opischikona basin (U-Pb TIMS zircon and titanite).

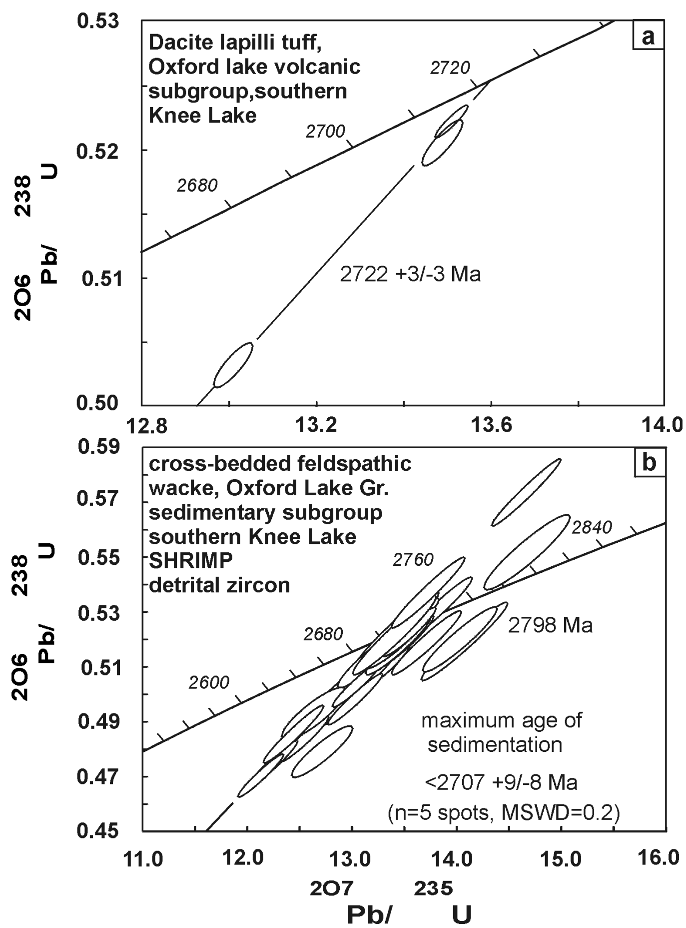

Figure GS-22-10: U-Pb zircon geochronology of the Oxford Lake Group a) dacite lapilli tuff volcanic subgroup (U-Pb TIMS zircon); and b) crossbedded feldspathic wacke, sedimentary subgroup (SHRIMP detrital zircon).

of 3647 ± 2 Ma, 2846 ± 1 Ma, 2827 ± 1 Ma, 2721 ± 2 Ma and 2711 ± 2 Ma, the latter representing the maximum age of sedimentation. Possible sources of ancient ca. 3.6 Ga zircons occur in fault-bounded blocks along the northern margin of the northern Superior Province. At Assean Lake in northwestern Manitoba, a 3.54 Ga (U-Pb zircon age) tonalite gneiss occurs within a widespread zone of granitoid and gneissic rocks with Nd model ages greater than 3.5 Ga (Böhm et al., 2000). In northern Ontario, north of the North Kenyon Fault, granitoid rocks have greater than 3.0 to 3.5 Ga Nd model ages, and 3.57 Ga (SHRIMP) inherited zircon cores occur in 2.81 Ga tonalite gneiss (Skulski et al., GS-21, this volume). Crust of this age is not known south of these two areas, and the first evidence of recycling of greater than 3.5 Ga zircons includes detrital zircon in less than 2.71 Ga Oxford Lake sedimentary subgroup rocks at Gods Lake Narrows (this study), and 3.5 Ga detrital zircon in the correlative (<2704 Ma) Cross Lake Group to the west. These young sedimentary sequences may provide a minimum age for late docking of this older crust with the Superior Province (Skulski et al., GS-21, this volume).

ACKNOWLEDGMENTS

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