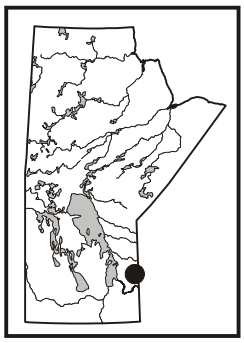
GS-25

REASSESSMENT OF MAJOR GEOLOGIC BOUNDARIES IN THE SOUTHEAST RICE LAKE GREENSTONE BELT (NTS 52L/14)

by M. T. Corkery



Corkery, M. T. 1999: Reassessment of major geologic boundaries in the southeast Rice Lake greenstone belt (NTS 52L/14); *in* Report of Activities, 1999, Manitoba Industry, Trade and Mines, Geological Services, p. 111-113.

SUMMARY

Results of the 1999 mapping in the Garner-Gem lakes area suggest an early east-trending fault system is responsible for juxtaposition of the Garner Lake, Gem Lake and Bidou subgroups. Subsequent north-trending D_{1b} shearing, including the Beresford Lake and Moore Lake faults, overprinted and in some areas obliterated the early contact relationships.

INTRODUCTION

Mapping, geochemical and geochronological programs conducted in the early 1990's under the Canada-Manitoba Partnership Agreement on Mineral Development provided new insights into the complex nature of the Rice Lake greenstone belt. What had been considered to be a structurally complex belt, with relatively simple supracrustal units divided into two major subgroups, produced U-Pb ages that indicate a more complex geologic history. The diversity in ages and recognition of regional and local structural breaks, interpreted to bound terranes of different ages, posed intriguing geologic problems whose solutions require further mapping in key areas. The Garner-Gem lakes area in the southeast Rice Lake Belt (Fig. GS-25-1) was recommended as one of the prime targets for unraveling that geologic history.

This program is designed to: 1) define the nature of the boundary between the Garner Lake, Bidou Lake and the Gem Lake subgroups; 2) document the nature of the contact between younger felsic volcanics of the Gem Lake area and the older sedimentary and mafic volcanic rocks to the north; and 3) document the extent of komatiitic basalts southeast of Beresford Lake.

GENERAL SETTING

The Rice Lake greenstone belt in southeastern Manitoba consists of a polyde-formed assemblage of supracrustal and intrusive rocks. Recent studies indicate a complex sequence of development for the belt: 1) 3.0 Ga granitoid basement north of the Wanipigow River; 2) unconformably overlain by ca. 2.9 Ga platformal sedimentary rocks and possible rift sequence mafic volcanic rocks (Wallace Lake and Garner Lake subgroups); 3) followed by juxtaposition of 2.7 Ga arc volcanic rocks of the Bidou Lake and Gem Lake subgroups; and 4) overlain by basinal sediments (Edmunds Lake formation) deposited during the Kenoran orogeny (Corkery, 1995; Turek et al., 1989; Brommecker, 1991; Brommecker et al., 1993; Poulsen et al., 1993, in prep; Davis et al., 1994; Turek and Weber, 1994). Prior to these studies the belt had been divided into two major divisions: the Gem Lake Subgroup and the Bidou Lake Subgroup (Weber, 1971). The sequence in the Wallace Lake area was separated as the Wallace Lake Subgroup (McRitchie, 1971). A component of the belt consisting of the San Antonio Formation, a subareal sedimentary sequence that unconformably overlies the Bidou Lake Subgroup in the Bissett area, represents the youngest supracrustal rocks in the belt. The regional distribution of major units and structures in the Rice Lake Belt is shown in Figure GS-25-1.

A regional geochemical study (Bailes, 1998, GS-23, this volume) based on high precision trace and REE element analyses of volcanic rocks from the Rice Lake greenstone belt is in progress. In the Wallace Lake mapping project, structural and geochemical programs (Sasseville and Tomlinson, 1999) are being carried out under the auspices of the Western Superior Natmap and LITHOPROBE. These programs will permit

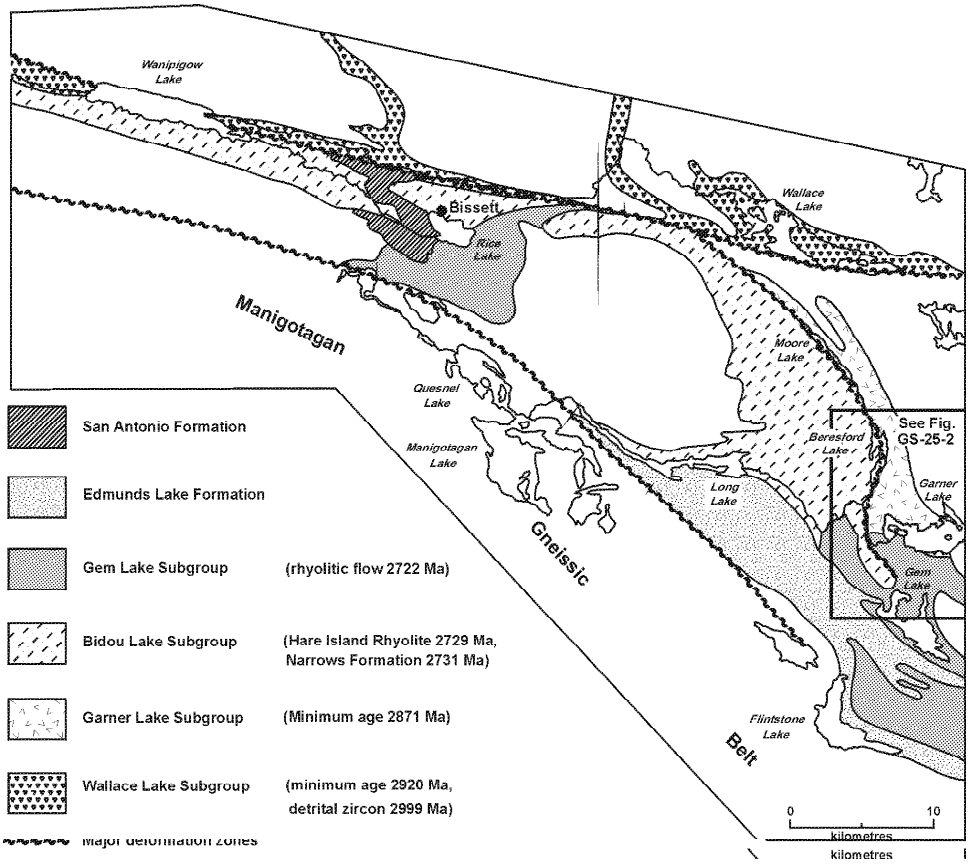


Figure GS-25-1: General geology of the major subgroups of the eastern end of the Rice Lake greenstone belt.

characterization of the various volcanic suites and assist in producing a new tectonic framework for the Rice Lake Belt.

Mesoarchean rocks: Garner Lake and Wallace Lake subgroups

The Garner Lake Subgroup consists of a sequence of metasedimentary rocks overlain by northwest-facing basalts that contain komatiitic flows (Poulsen et al., 1993) and minor iron formation in the Garner Lake area. The sedimentary rocks are intruded by the Garner Lake mafic-ultramafic intrusion (Scoates, 1971). Pegmatitic phases of this intrusion yield a U-Pb age of 2871 Ma (Davis et al., 1994), indicating a minimum age for this sequence. However, Brommecker et al. (1993) suggest that the Garner Lake mafic-ultramafic intrusion represents a fault bounded magma chamber for the komatiitic flows in the overlying basalt sequence, inferring a similar age for the volcanism (i.e., 2871 Ma). This would place the Garner Lake volcanism at least 50 m.y. younger than the > 2920 Ma sequence at Wallace Lake and possibly as much as 120 m.y. younger. This necessitates further geochemical studies to test the magma chamber interpretation and thus determine the relationship between the Wallace Lake Subgroup and the Garner Lake Subgroup.

The newly determined pre-2.8 Ga ages for similar sequences in both the Wallace Lake area and the Garner Lake area strengthens the probable correlation of these sequences as previously suggested by Brommecker et al. (1993) and Poulsen et al. (1994). However, the 2.7 Ga age for volcanism in the Gem Lake area indicates a major break must exist between the Garner Lake sedimentary sequence and the Gem Lake felsic volcanic and sedimentary rocks to the south.

Neoarchean rocks: Bidou Lake and Gem Lake subgroups

The Bidou Lake Subgroup consists primarily of a sequence of intermediate to felsic volcanic rocks interlayered with volcaniclastic and epiclastic metasedimentary rocks with minor basalt flows. Basalt in the core of the Beresford anticline forms the base of the subgroup. The sequence has been interpreted to grade upward into the basinal metagreywacke of the Edmunds Lake Formation. However, this interpretation is put in doubt because a significant time gap (20 to 25 m.y) between the volcanic subgroups and the greywacke sedimentation is indicated by a maximum age of 2705 Ma (Davis, 1995) for detrital zircon in the Edmunds Lake Formation.

Relatively few U-Pb zircon age determinations are available from the Bidou Lake subgroup. A dacite from the Narrows Formation gives an age of 2731 Ma, and another from the Hare's Island rhyolite is, 2729 Ma (Turek et al., 1989). These ages are similar to that (2737 Ma) reported by Ermanovics (1981) for felsic volcanics in the western end of the Rice Lake belt. Several age determinations in the same range as the felsic volcanics have been reported for intrusive phases: e.g., the Ross River quartz diorite (2728 Ma) and the Gunnar porphyry (2731 Ma). A quartz diorite intrusion in the Wallace Lake area dated at 2731 Ma (Turek et al., 1989) indicates magmatic activity in the older plutonic and supracrustal rocks is correlative with the development of the Bidou Lake Subgroup. This cluster of U-Pb ages obtained from the Bidou Lake Subgroup and related intrusive rocks was interpreted to indicate a dominant volcano-plutonic event at 2730 Ma and that the volcanic and plutonic rocks were comagmatic. These observations reinforce the interpretation that the Bidou Lake Subgroup is a relatively simple sequence deposited over a restricted time span.

The Gem Lake Subgroup (Weber, 1971) is characterized by a basalt-andesite-rhyolite and sedimentary rock assemblage. A rhyolite flow from Gem Lake yielded an U-Pb age of 2722 Ma (Davis et al., 1994). This age is 10 m.y. younger than those reported for felsic volcanic rocks of the Bidou Lake Subgroup to the northwest.

RESULTS OF NEW MAPPING

The Garner-Gem lakes area is key to solving many of the problems posed by recent mapping and age determination programs in the Rice Lake Belt. In this area the Beresford Lake and Moore Lake shear zones mark boundaries between the Bidou Lake, Garner Lake, and Gem Lake subgroups, and the younger Edmunds Lake Formation. These and other parallel north-trending major shear zones are controlling features that: 1) separate the older and younger suites, 2) provide a discontinuity along which the metamorphic grade increases, and 3) offset and transpose the major earlier east-trending primary and secondary fabrics. Brommecker et al. (1989) described these shear zones as early D_{1b} structures, related to the oldest recognized deformation within the Bidou Lake Subgroup. However, the map pattern defined by the subgroups (Fig. GS-25-2) between D_{1b} shear zones suggests that the general trend of subgroup contacts is easterly and that D_{1b} shear zones are modifying earlier structures that mark these contacts.

In the Garner Lake area early east-trending layering and foliation dominants the Garner Lake Subgroup. On the north shore of Garner Lake the sediments are intruded by the >2.8 Ga Garner Lake stock. Field evidence indicates that the metasediments were deformed prior to intrusion of the ultramafic intrusion, suggesting that the deformation is Mesoarchean in age. In addition, an east-trending shear zone marks the contact between the Garner Lake Subgroup and the younger Gem Lake Subgroup (Corkery, 1995). All of these east-trending fabrics are dragged in a dextral fashion into the Beresford Lake D_{1b} shear zone northeast of Garner Lake (Brommecker, 1991).

In the Gem Lake area, an east-trending break along the Manigotagan River (Fig. GS-25-2) marks the contact between Gem Lake Subgroup and the Narrows Formation of the Bidou Lake Subgroup. This break is truncated by the northeast-trending D_{1b} Moore Lake shear zone on the west. Structural trends in the Gem Lake subgroup near the Moore Lake Shear zone are northwest, however, lack of exposure makes interpretation of a dextral drag more difficult in this area.

The map pattern (Fig. GS-25-2) does suggest that an early east-trending fault system juxtaposed both the Garner and Gem Lake subgroups, as well as the Bidou and Gem Lake subgroups. The east-trending fault system was subsequently overprinted by D_{1b} shearing.

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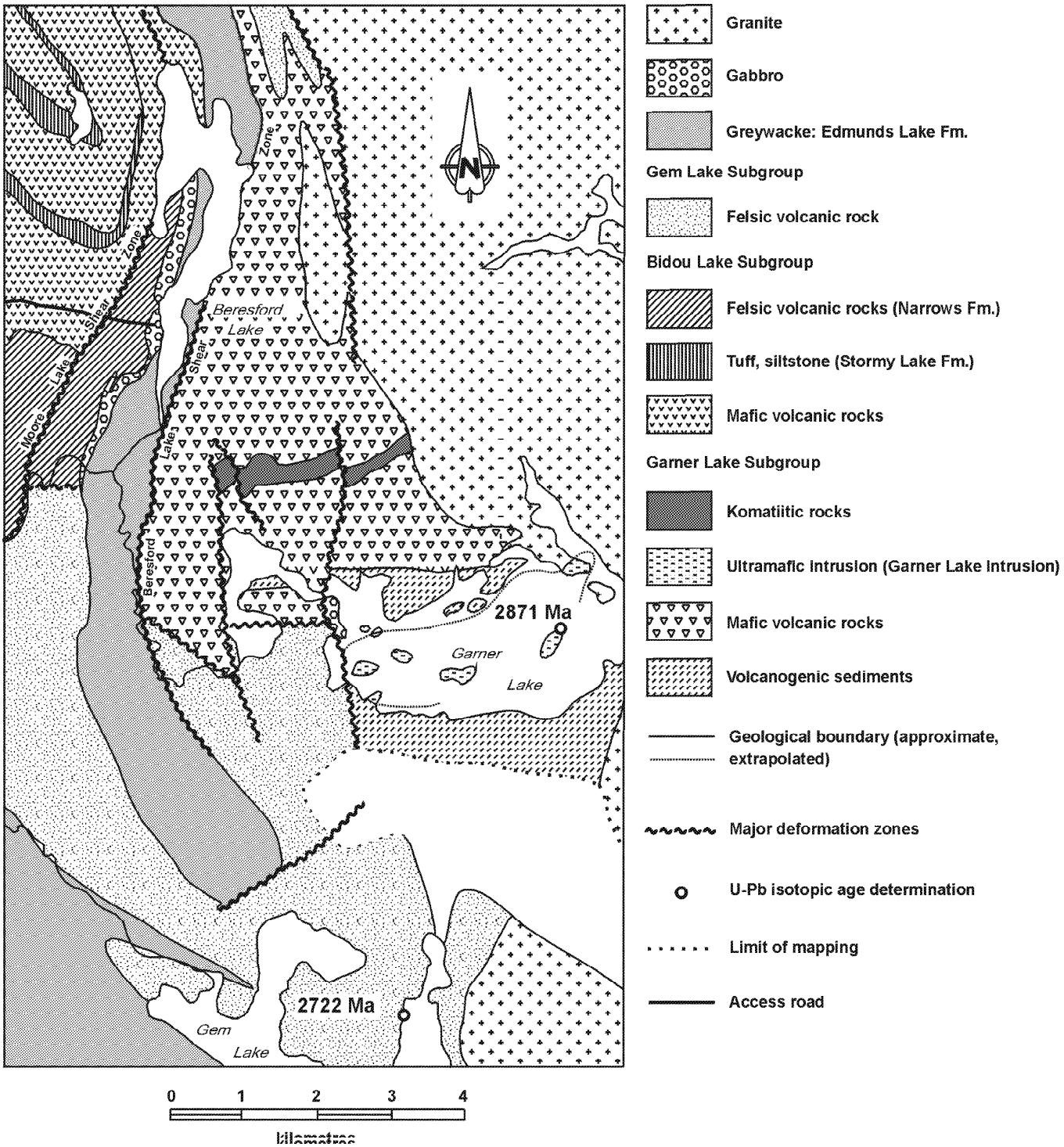

Figure GS-25-2: Sketch map of the Garner-Gem lakes area showing east-trending fault contacts between the major subgroups truncated by D_{1b} north-trending shear zones.

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