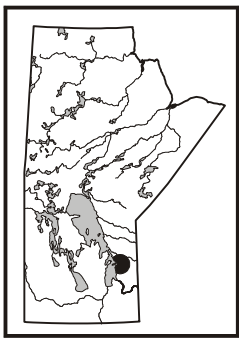
GS-23

GEOCHEMICAL SAMPLING AND GEOLOGICAL RECONNAISSANCE OF THE WESTERN RICE LAKE GREENSTONE BELT

by A. H. Bailes



Bailes, A.H. 1999: Geochemical sampling and geological reconnaissance of the western Rice Lake greenstone belt; *in* Report of Activities, 1999, Manitoba Industry, Trade and Mines, p. 102-105.

SUMMARY

The second year of a geochemical and geological investigation of the volcanic rocks of the Rice Lake greenstone belt has acquired samples from well-exposed sections south of Wanipigow Lake and on islands north of Black Island in Lake Winnipeg. Rocks mapped as felsic metavolcanic rocks in the Wanipigow River Plutonic Complex are of ambiguous origin and, at least locally, include felsic tectonites with syntectonic felsic intrusions. Samples of volcanic rocks collected during this study will be analyzed by ICP-MS methods and compared to Mesoarchean (>2.8 Ga) and Neoarchean (< 2.8 Ga) volcanic suites from the central and eastern part of the belt.

INTRODUCTION

During a 2 1/2 week field program in 1999, 43 least altered samples of volcanic and intrusive rocks were collected from the west end of the Rice Lake greenstone belt. A total of 106 representative samples of volcanic and intrusive rocks have now been taken from the belt. Geological programs in the Wallace Lake (Sasseville and Tomlinson, 1999) and Garner - Gem lakes (Corkery, GS-25, this volume) areas have sampled portions of the Rice Lake greenstone belt not examined during this study.

High precision trace and REE element analyses of volcanic rocks from the Rice Lake greenstone belt will permit characterization of the various volcanic suites. This will allow recognition of their distribution, elucidation of their tectonic framework, and interpretion of the metallogenic setting of contained mineral deposits (mainly lode gold).

REGIONAL SETTING

The Rice Lake greenstone belt and its equivalent in Ontario, the Red Lake greenstone belt, are important Archean lode gold mining areas in the Uchi Subprovince (Fig. GS-23-1). The well exposed, gold-producing central and eastern part of the Rice Lake greenstone belt, from which nearly two million ounces (approximately 60 tonnes) of gold has been produced (Poulsen et al., 1996), has been mapped in detail (Stockwell, 1938; Stockwell and Lord, 1939; Davies, 1950, 1953, 1963; McRitchie and Weber, 1971; Senneshen, 1990; Brommecker, 1991). In contrast, the generally poorly exposed western Rice Lake greenstone belt has been mapped at a more reconnaissance level (typically 2 inches to 1 mile; Davies,1950, 1951; Russell, 1949; Ermanovics, 1970, 1981; Weber, 1971; Weber and Young, 1991) with volcanic rocks only partly subdivided and described.

Recent discovery of older (ca. 3.0-2.85 Ga) Mesoarchean volcanic rocks at Wallace and Garner lakes which do not belong to the dominant ca. 2.73-2.71 Ga Neoarchean volcanic assemblage (Fig. GS-23-2) suggest that supracrustal rocks of this belt may be composed of several distinctive "tectonic assemblages" (Poulsen et al., 1996 and references therein). An important first step towards understanding the western Rice Lake greenstone belt is to establish the distribution of these Mesoarchean and Neoarchean supracrustal assemblages.

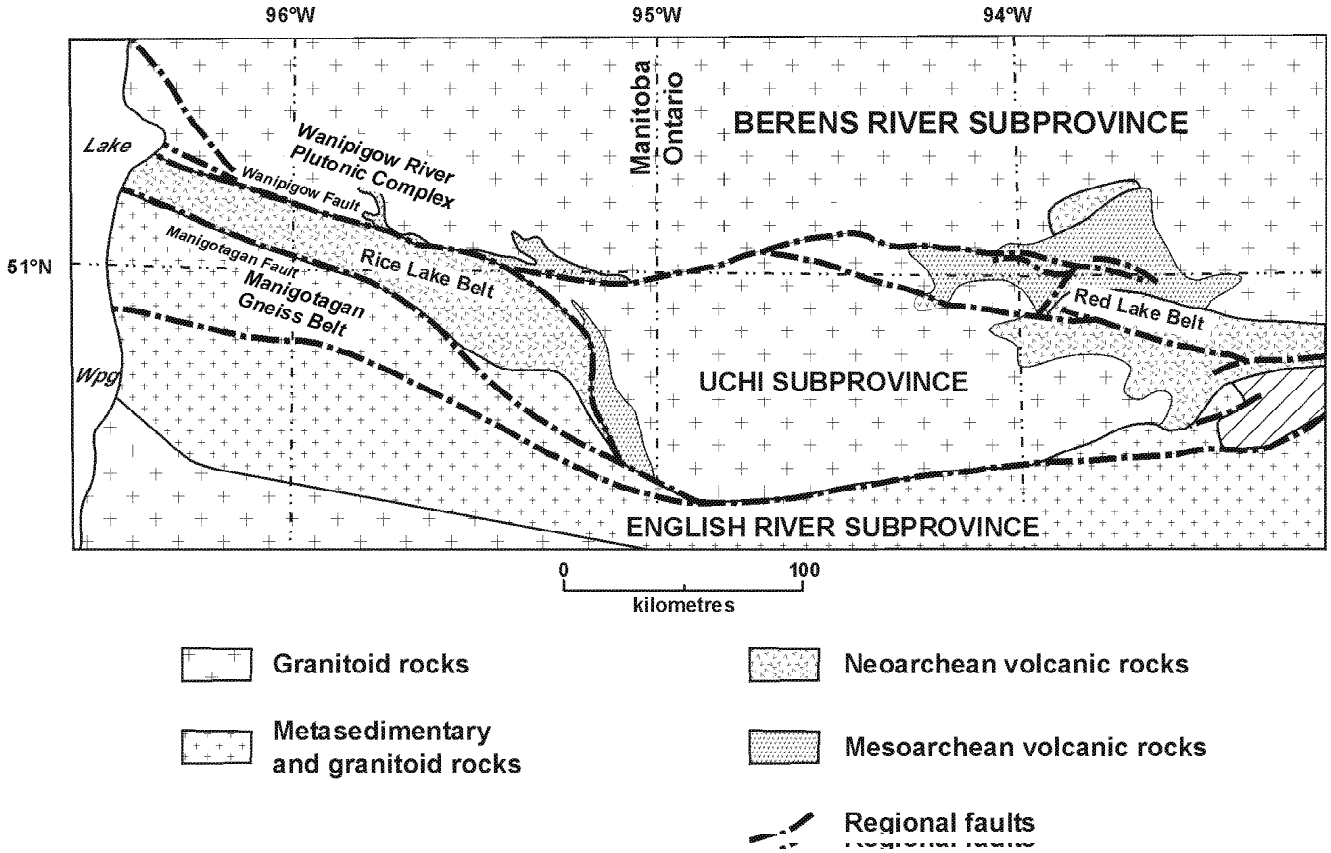


Figure GS-23-1: Setting of the Rice Lake greenstone belt in the western part of the Superior Province (from Poulsen et al., 1996)

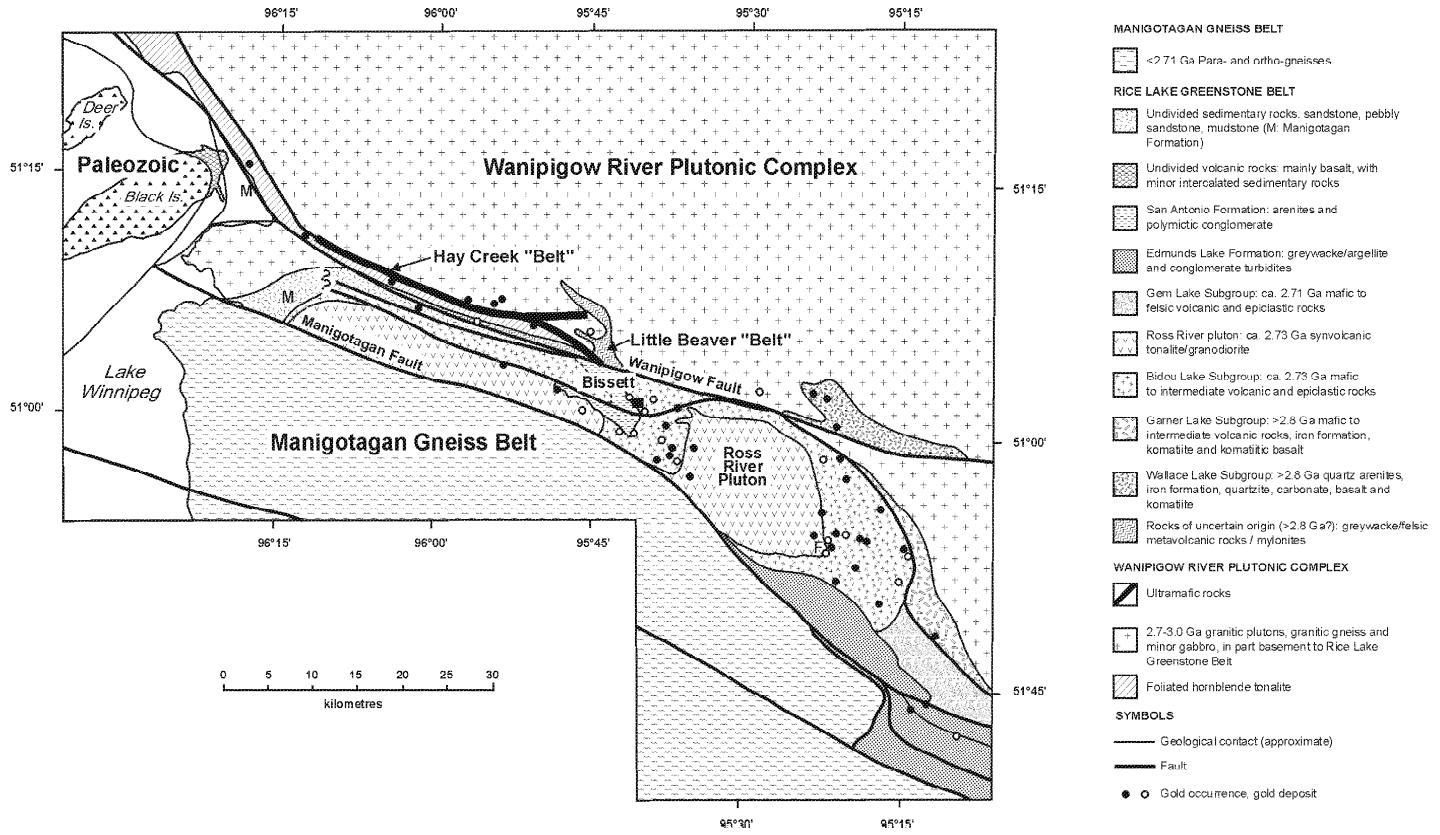


Figure GS-23-2: Regional geology of Rice Lake greenstone belt (modified from Map ER86-1-1, Richardson and Ostry, 1996)

GEOLOGY OF THE WESTERN RICE LAKE GREENSTONE BELT

The western Rice Lake greenstone belt comprises a narrow 3 km wide domain of volcanic rocks, east of Wanipigow Lake, that is succeeded to the west, on Winnipeg Lake, by an over 16 km wide sedimentary-dominated terrane (Davies, 1950, 1951; Russell, 1949; Ermanovics, 1970, 1981; Weber, 1971) (Fig. GS-23-2). Between Black and Deer islands the latter includes >4 km of basalt and minor felsic volcaniclastic rocks (Davies, 1951, Ermanovics, 1970, 1981). At Wanipigow Lake, the greenstone belt is bounded to the south by post 2.73 Ga granite plutons and is in fault contact (Wanipigow fault) to the north with the Wanipigow River Plutonic Complex. The latter contains Mesoarchean plutonic and supracrustal rocks up to 3.0 Ga (Weber, 1991; Poulsen et al., 1993, 1994, 1996; Turek and Weber, 1991, 1994).

Work this year was concentrated in three areas where previous mapping indicated prominent outcrop areas of volcanic rocks:

1) the Wanipigow Lake area where a fault-bounded extension of the 2.73 Ga Bidou Lake Subgroup at Bissett is exposed (Fig. GS-23-3; Weber, 1971),

2) the Black to Deer islands area on Lake Winnipeg where a basalt-dominated sequence includes a rhyodacite dated at ca. 2.73 Ga (reported in Ermanovics, 1981), and

3) the Wanipigow River Plutonic Complex north of the Wanipigow fault where domains of possible Mesoarchean felsic metavolcanic rocks have been reported in the Little Beaver "Belt" (Poulsen et al., 1994, 1996; Corkery, 1995).

Wanipigow Lake area

Exposures of volcanic rocks at Wanipigow Lake are generally less abundant than they are in areas to the east (e.g., at Bissett). However, good exposures are locally available in clear-cut areas southeast of Wanipigow Lake and in burned outcrops west of Wanipigow Lake.

The volcanic rocks at Wanipigow Lake are bounded to the south and north by fault zones and are folded by an east-trending anticlinal structure (Fig. GS-23-3), both features previously identified by Weber (1971). Southeast of Wanipigow Lake the volcanic section is composed of volcaniclastic dacites and andesites, comparable to those that belong to the Bidou Lake Subgroup at Bissett. South of Provincial Highway 304 and southwest of Wanipigow Lake, the volcaniclastic rocks face south and are stratigraphically overlain by a thick sequence of pillowed basalts. The basalts outcrop most prominently west of Wanipigow Lake (Fig. GS-23-3) and are of interest as they have no known stratigraphic equivalents in the central and eastern Rice Lake greenstone belt. They 'wrap around' the intermediate volcaniclastic rocks at the west end of Wanipigow Lake and are also exposed on the south shore of Wanipigow Lake, consistent with the anticlinal structure identified by Weber (1971).

Black Island, Lake Winnipeg

A >4 km thick sequence of relatively undeformed, greenschist facies volcanic rocks is exposed on numerous small islands north of Black Island on Lake Winnipeg. This monoclinal north- to northeast-facing suite of volcanic rocks consists mainly of medium green to buff weathering, aphyric to locally plagioclase phyric, massive to pillowed basalt. It includes minor (<5%) intercalated felsic volcaniclastic units that comprise felsic wackes (with normal size grading, rip ups and scour channels), local intercalated beds of chert, and matrix-supported debris flow conglomerates. The latter contain subrounded cobbles and boulders of both supracrustal and intrusive rocks (this study and Davies, 1950). D. McRitchie (pers. comm., 1999) and Ermanovics (1981) indicate that this sequence also includes serpentinized ultramafic rocks, some of them possibly extrusive.

The relationship of the Black and Deer island volcanic rocks to those exposed elsewhere in the Rice Lake greenstone belt is uncertain due to lack of outcrops exposures in critical areas. In addition, they are surrounded by a large domain of sedimentary rocks of uncertain age, locally referred to as the Manigotagan formation (Ermanovics, 1981, Richardson and Ostry, 1996). These sedimentary rocks appear to be continuous with arenites and feldspathic wackes west of Wanipigow Lake. Although Weber (1971, 1991) suggests that this sequence belongs to the post 2.73 Ga Edmunds Lake formation, Poulsen et al. (1994, 1996) suggest that they could also correlate with the Mesoarchean assemblage at Wallace Lake or the much younger San Antonio formation at Bissett. Chemistry of the volcanic rocks on Lake Winnipeg may help resolve their affiliations with other volcanic rocks in the belt. U-Pb zircon geochronology is needed for the sedimentary rocks to establish their affiliation.

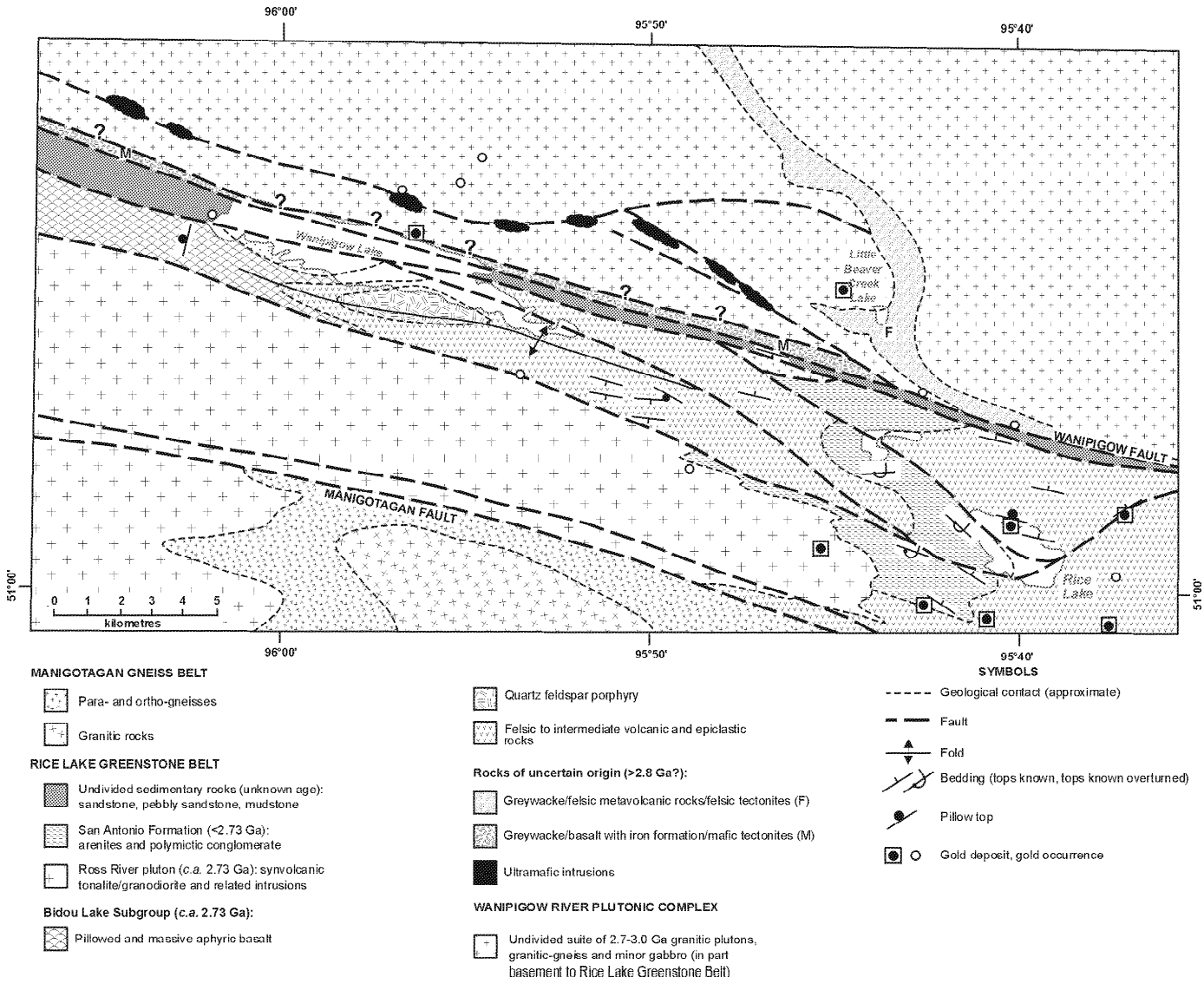


Figure GS-23-3: Geology of the Wanipigow Lake area (modified from Weber, 1971, and Poulsen et al., 1994)

Wanipigow River Plutonic Complex

The Wanipigow River Plutonic Complex, which outcrops north of the Wanipigow fault (Fig. GS-23-3), comprises plutonic rocks ranging in age from 2.73 to 3.0 Ga. The older plutonic rocks in this domain are potentially basement to the Mesoarchean supracrustal rocks exposed at Wallace Lake (Turek and Weber, 1991, 1994; Sasseville and Tomlinson, 1999). The younger intrusions may be synvolcanic, possibly coeval with the Bidou Lake Subgroup volcanic rocks (Poulsen et al., 1996).

The Wanipigow River Plutonic Complex includes rocks that were initially mapped as greywacke (Davies, 1963; Weber, 1971) but more recently have been interpreted to be felsic metavolcanic rocks (Poulsen et al., 1994). They are most prominently exposed in the Little Beaver "Belt" (Figs. GS-23-2, GS-23-3) where they locally include mafic to ultramafic rocks (Poulsen et al., 1994). Corkery (pers. comm., 1999) reports that the ultramafic rocks at one locality display spinifex texture. Supracrustal rocks in the Little Beaver "Belt" may possibly be Mesoarchean in age (Poulsen et al. , 1996).

A brief examination in 1999 failed to conclusively identify supracrustal rocks in the Little Beaver "Belt". Several of the outcrops that were examined appeared to be tectonically laminated rocks, including local syntectonic felsic intrusions that display mylonitized margins. Poulsen et al. (1994) identified synvolcanic sulphide stockworks in the Little Beaver "Belt" but these rocks could also be interpreted as metamorphically recrystallized chlorite-sulphide bearing portions within a felsic tectonite. Although it is premature to identify all of the rocks at Little Beaver "Belt" as felsic tectonites, observations made in 1999 suggest that further examination of these rocks is required. Whatever their origin, they predate metamorphism and have been recrystallized to garnet-bearing, almandine amphibolite facies mineral assemblages.

A second group of potential supracrustal rocks occur in a narrow belt, just north of the Wanipigow fault. They are reported to comprise metavolcanic/metasedimentary rocks with intercalated iron formation (Davies, 1950; Russell, 1949; Weber, 1971). More recent examination of burned exposures on strike, northwest of Wanipigow Lake, by Weber and Young (1991), have identified these rocks as mylonites. Examination of two outcrop areas of this unit north and east of Wanipigow Lake in 1999 failed to locate the iron formation but did identify highly tectonized gabbro and local mylonites.

CONCLUSIONS

Significant geological observations made during this reconnaissance study are summarized below:

1) Volcanic rocks exposed south of Highway 304 at the east end of Wanipigow Lake form a monoclinal sequence that tops to the south. They comprise felsic to intermediate volcaniclastic most closely resembling north-facing Bidou Lake Subgroup rocks exposed 10 km to the east, north of Bissett. Repetition of Bidou Lake Subgroup in an opposite facing section south of Wanipigow Lake indicates the presence of a tight,

east-trending, anticlinal structure (previously identified by Weber, 1971) that must lie north of Highway 304 in the Wanipigow Lake area and south of Rice Lake in the Bissett area.

2) Pillowed basalt flows overlying the Bidou Lake dacitic to andesitic volcaniclastic rocks south and southwest of Wanipigow Lake comprise a previously unrecognized unit in the Rice Lake greenstone belt. Geochemistry of these basalts will present an opportunity to define the tectonic setting of the upper part of the Bidou Lake Subgroup.

3) Volcanic rocks exposed on numerous small islands north of Black Island on Lake Winnipeg comprise a basalt-dominated, subaqueous, monoclinal north- to northeast-facing sequence. It is intercalated with minor felsic turbidites, chert, matrix-supported felsic debris flow conglomerates and, according to previous work by Ermanovics (1981), serpentinized ultramafic rocks. The relationship of these volcanic rocks to those exposed elsewhere in the Rice Lake greenstone belt is uncertain as a large domain of sedimentary rocks of uncertain age surrounds them. A 2732±10 Ma age (reported by Ermanovics, 1981) for a rhyolite in this section suggests that they may at least in part be equivalent to the Bidou Lake Subgroup.

4) Domains in the Wanipigow River Plutonic Complex that are depicted by Poulsen et al. (1994, 1996) as Mesoarchean supracrustal rocks are, at least locally, felsic tectonites and mylonites intruded by syntectonic felsic intrusions and sheets. Original features and textrues in these rocks are commonly obscured by metamoprhic recrystallization to almandine-amphibolite facies mineral assemblages. A more thorough examination and evaluation of these rocks is required to resolve their origin and significance.

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