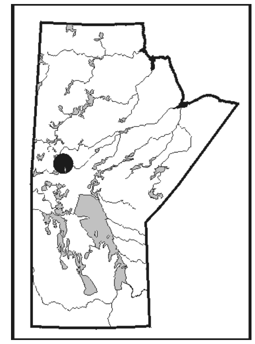
SQUALL LAKE PROJECT: GEOLOGY AND MINERALIZATION IN THE AREA OF SNOW LAKE AND SQUALL LAKE (NTS 63K/16NE)



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SUMMARY

Mapping south and west of Snow Lake, structurally below the Snow Lake fault, has identified lithologies that are similar to the upper part of the Snow Lake volcanic arc assemblage. The presence of early block faulting has disrupted the volcanic stratigraphy, including the northerly continuation of the Photo Lake rhyolite. Large areas of altered rhyolite occurs to the northwest of Tern Lake and west of Snow Lake, and these have been sampled for geochemical anaylsis.

Gold mineralization and related alteration in the hanging wall of the McLeod Road fault appears to have occurred over a very broad time span ranges from pre-metamorphic to post metamorphic. Minor gold/arsenopyrite occurs sporadically in the footwall rocks of the Snow Lake fault.

INTRODUCTION

New mapping south and west of Snow Lake provides a northerly extension for the geological mapping in the adjacent Photo Lake area to the south (Bailes and Simms, 1994; Bailes et al., 1994; Bailes, 1996, 1997; Bailes et al., 1996). The presence of a volcanic host massive sulphide (VMS) orebody in altered felsic volcanic rocks at Photo Lake makes it important to provide a more current geological base than the existing maps (Harrison, 1949), for the areas lying to the north.

Additional mapping was carried out in the area north and east of Snow Lake as a continuation of the mapping in 1997.The mapping supports the more detailed studies dealing with the structural control on gold mineralization by Ian Fieldhouse (M.Sc., University of Manitoba), ore genesis studies by George Gale (Gale, 1997) and ore mineralogical studies by Pam Fulton (M.Sc., University of Manitoba). One gold/arsenopyrite occurrence in the footwall of the Snow Lake fault at Noteme Lake, 1.7 km south of the southern boundary of the map area, was examined and sampled for purposes of comparison with gold deposits in the hanging wall of the McLeod Road fault.

The spatial relationship between gold mineralization and the hanging wall of the McLeod Road fault makes the continuity and timing of this fault relative to other structures important. The interpretation of the McLeod Road fault as a sole thrust that can be traced north and northwest of Squall Lake is based on the regional distribution of a lithologic marker unit and its spatial relationship to the McLeod Road fault in the area of Snow Lake (Bailes and Schledewitz, GS-1, this volume). The McLeod Road thrust is interpreted to be pre-metamorphic because it was deformed during the formation of the syn-metamorphic Squall Lake dome. Mapping during this project shows that the McLeod Road fault is not a simple continuous structure, but rather consists of a number of segments produced by offsets on younger faults.

The timing of deformation in the Canada Creek fault is of particular importance. This structure is either a re-activated imbricate of the McLeod Road thrust, or a younger syn-metamorphic fault. Whereas gold mineralization is widespread in the hanging wall of the McLeod Road fault, the greatest concentration of gold deposits occur in the hanging wall of the Canada Creek/McLeod road fault.

GENERAL GEOLOGY

The project area is located in the east end of the exposed Paleoproterozoic Flin Flon Belt (Fig.GS-2-1). Syme et al. (1995) and Lucas et al. (1996) have shown that the Flin Flon Belt is a structural collage composed of a series of 1.92 to 1.83 Ga tectonostratigraphic assemblages that were juxtaposed during 1.87 to1.84 Ga accretion and 1.80 Ga continental collision.

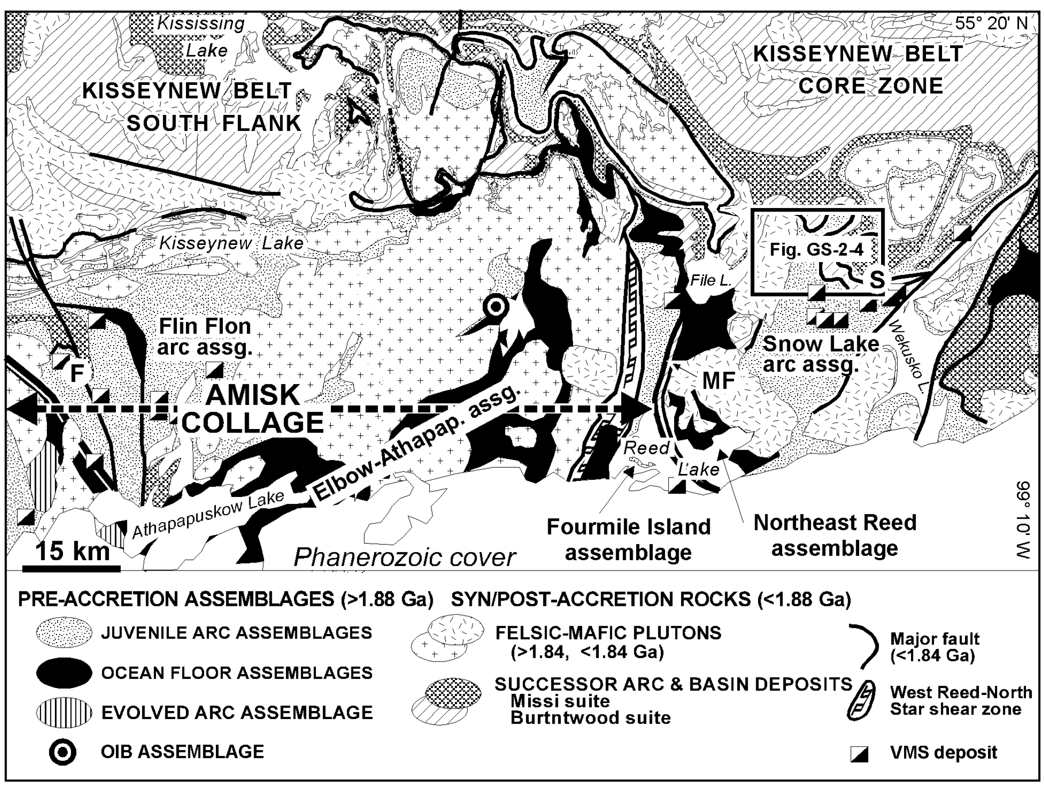

Figure GS-2-1: Geological and geographical setting of the Squall Lake project in the Flin Flon Belt.

In the project area, the basic lithotectonic elements are: Snow Lake arc assemblage, Burntwood Group turbidites, and Missi Group arenites (Fig.GS-2-2). Contacts between these lithotectonic elements have typically been interpreted to be faults (Harrison, 1949; Galley et al., 1988), and this is supported by an age difference of >50 Ma between the volcanic lithologies (Snow Lake arc assemblage at ca.1.891 Ga; David et al., 1995), Burntwood Group turbidites (1.85-1.83 Ga; David et al., 1996; Machado and Zwanzig, 1995) and Missi Group arenites (1.85-1.83 Ga; Ansdell, 1993; Connors and Ansdell, 1994).

Mapping in the project area to date indicates that although major fault slices are identifiable (Fig. GS-2-2) it is far more difficult to establish the continuity and early kinematics of the pre-metamorphic bounding thrust faults (Snow Lake, McLeod Road and Birch Lake) due to subsequent deformation and metamorphism.

RESULTS OF 1998 FIELDWORK

A portion of the area has been remapped (Fig. GS-2-2) and a preliminary compilation map (1998-F-1) has been produced at a scale of 1:20 000. Mapping during this second year of the project extended the upper part of the Snow Lake arc assemblage to the south shore of Snow Lake and west of Snow Lake as far north as the powerline (Fig.GS-2-2). These rocks are in fault contact (Snow Lake fault) with the structurally overlying Burntwood Group greywacke, siltstone and mudstone that contain lower to middle almandine amphibolite facies mineral assemblages (e.g., biotite+garnet±staurolite±sillimanite).

Mapping in the footwall of the Snow Lake fault (D. Schledewitz and A. Bailes) south of Snow Lake and west of Snow Lake (D. Schledewitz) has extended the upper part of the Snow Lake mature arc

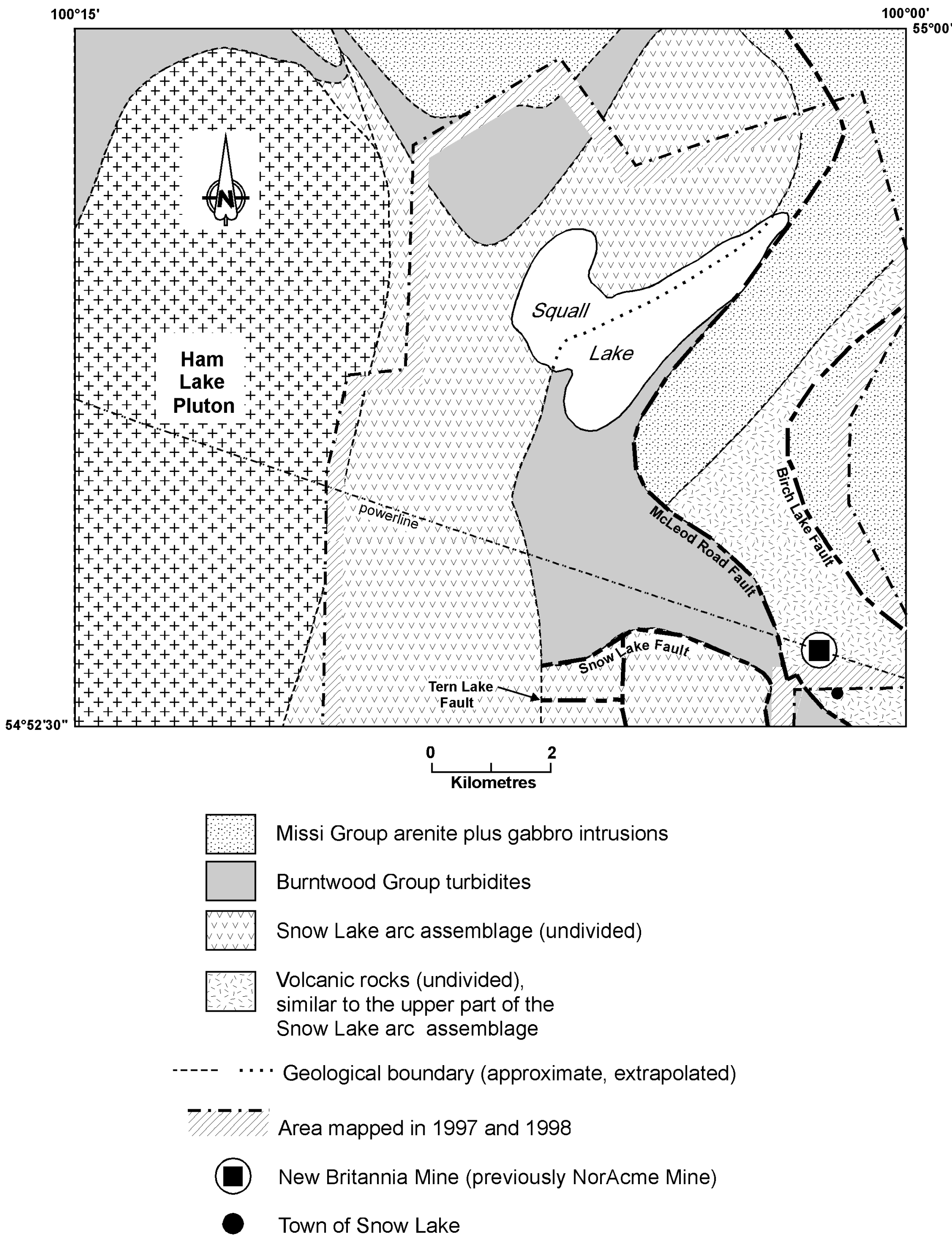

Figure GS-2-2: Outline of the Squall Lake project area showing the distribution of main lithological components and major early faults. Area mapped in 1997 and 1998 is outlined.

assemblage northwards, to the south shore of Snow Lake, and as far north as the powerline west of Snow Lake (Fig.GS-2-2). To date, mapping north of the powerline has not provided the geological observations required to subdivide lithologies. The rocks have simply been mapped as amphibolites and felsic gneisses due to the combination of more intense deformation, recrystalliztion and poor bedrock exposures.

Sampling of felsic and mafic volcanic rocks was undertaken for whole rock, trace element and rare earth element geochemistry. These analyses will be used to identify the nature of the volcanism and to compare this with the geochemical database for the Snow Lake arc rocks to the south.

Present mapping extended the basalt/gabbro complex and the structurally underlying heterolithologic mafic volcaniclastic rocks, initially mapped to the east and southeast of Tern Lake (Bailes et al., 1996), northerly to the south shore of Snow Lake. The mafic volcaniclastic rocks are steeply dipping, upright and top to the east. These rocks are moderately to intensely carbonatized along the southern shoreline of Snow Lake. The proximity of this alteration to the trace of the northerly dipping Snow Lake fault, (Fig. GS-2-2), suggests that it is footwall alteration associated with the overlying fault.

The mafic volcaniclastic rocks are structurally underlain by a complexly faulted and folded volcanic sequence west of Tern Lake. The presence of a early block-bounding fault, the Tern Lake fault, is suggested by the variations in facing directions observed south of Snow Lake and Tern Lake (Fig. GS-2-3). The Tern Lake fault is an easterly-trending structure that is truncated to the east of Tern Lake against the base of the overlying east-facing mafic volcaniclastic sequence.The possible truncation and displacement of the volcanic stratigraphy by the Tern Lake fault is of particular interest since the rhyolite mapped southeast of Tern Lake (Bailes et al., 1994 and 1996) hosts the Photo Lake orebody.

A northeasterly-trending layered mafic intrusion lies immediately north of the Tern lake fault on the strike exstension of the Photo Lake rhyolite. The minimum thickness of the intrusion is 760 m, with gabbro at the base and a quartz diorite phase at the top (to the northwest). This layered intrusion is overlain by interlayered ryholite and mafic heterolithologic volcaniclastic rocks. The rhyolite was sampled for geochemical analyses for comparison with the Photo Lake rhyolite.

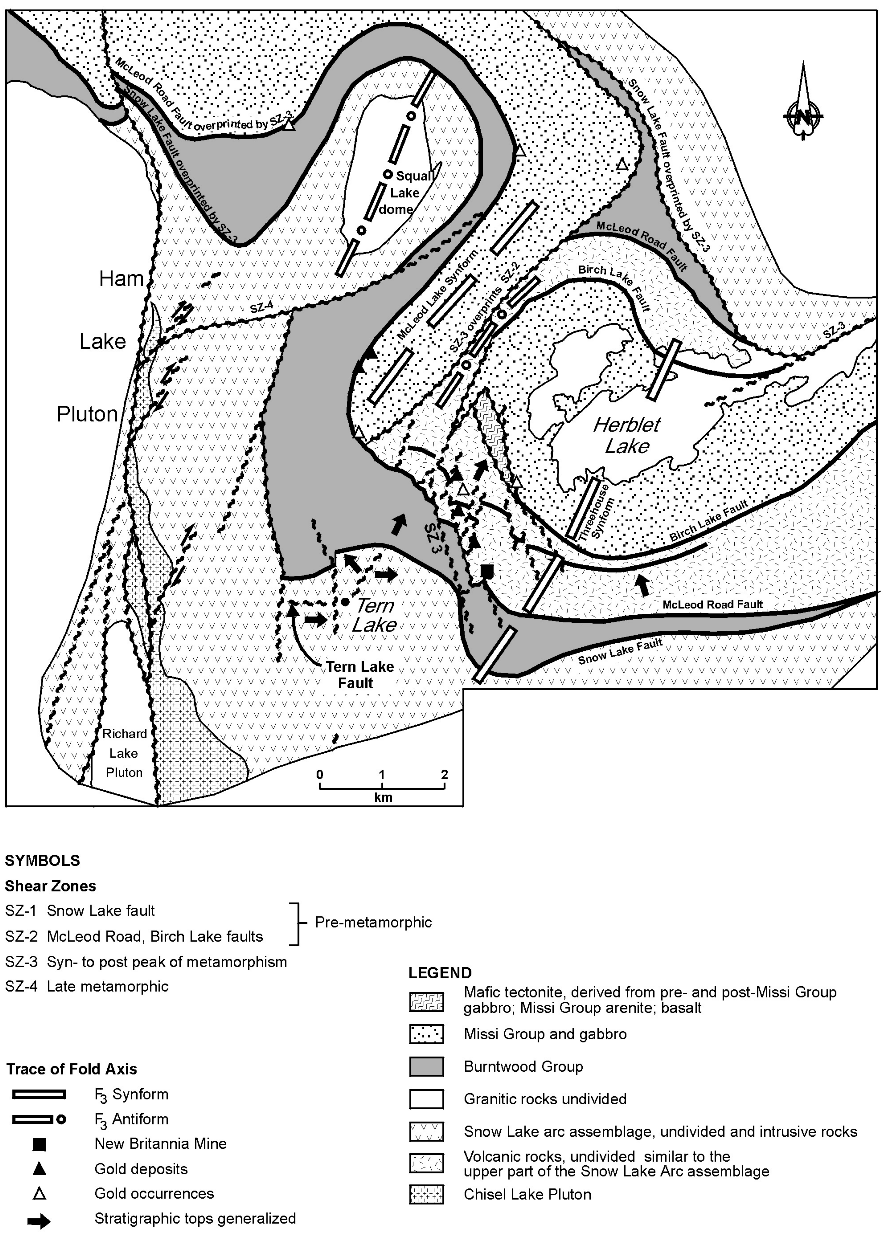

Figure GS-2-3: Simplified geology of the Squall Lake project area showing reinterpreted fault and fold trends.

The western end of the Tern Lake fault is poorly defined. It appears to be truncated by a northerly-trending fault approximately 1.2 km west of Tern Lake. However, the northerly-trending fault, while it is well defined to the south, is not readily mappable to the north beyond the point of intersection with the Tern Lake fault. The rocks to the north of this intersection are highly lineated with moderate to shallow northerly- to northeasterly-plunge and the layering defines z-folds with shallow northeast-dipping limbs and upright northeasterly-striking limbs. The large scale layering in this region is discontinuous. In contrast, 2 km west of Tern Lake the layering is a planar northerly-trending, steeply easterly-dipping, sequence of intelayered mafic volcaniclastic rocks and variably quartz-phyric rhyolites. Stratigraphic tops are indeterminate.

These contrasting styles of structures define a large scale fold. The westerly, outer part of the fold deformed through on going buckle style folding while the inner core of the fold (Tern Lake area) underwent a more complex pattern of faulting and asymetric folding. This variation in the strain pattern may be due to perturbations in part related to early anisotropy such as the presence of early block bounding faults in the volcanic sequence.

Mapping by Bailes and Schledewitz (GS-1, this volume) in the hanging wall of the McLeod Road fault, east of Snow Lake, outlined a westerly-trending, steeply-dipping, north-facing monoclinal sequence. This sequence can be traced into the project area, where the bedding is consistently north-facing and trends northwesterly with moderate northeast dip (Fig. GS-2-3). The layering is intersected by north-north-westerly-trending ductile/brittle dextral faults. The sequence is truncated by a north-northwesterly structure that cuts up section, unlike the low oblique truncations on the semi-conformable McLeod Road fault to the east (Fig. GS-2-4). This structure was identified by Russell (1957) as the Creek fault. "Canada Creek" fault is the current terminology in use by geologists at the New Britannia Mine for this fault and it is the terminology adopted for this report. The Canada Creek fault is either a imbricate

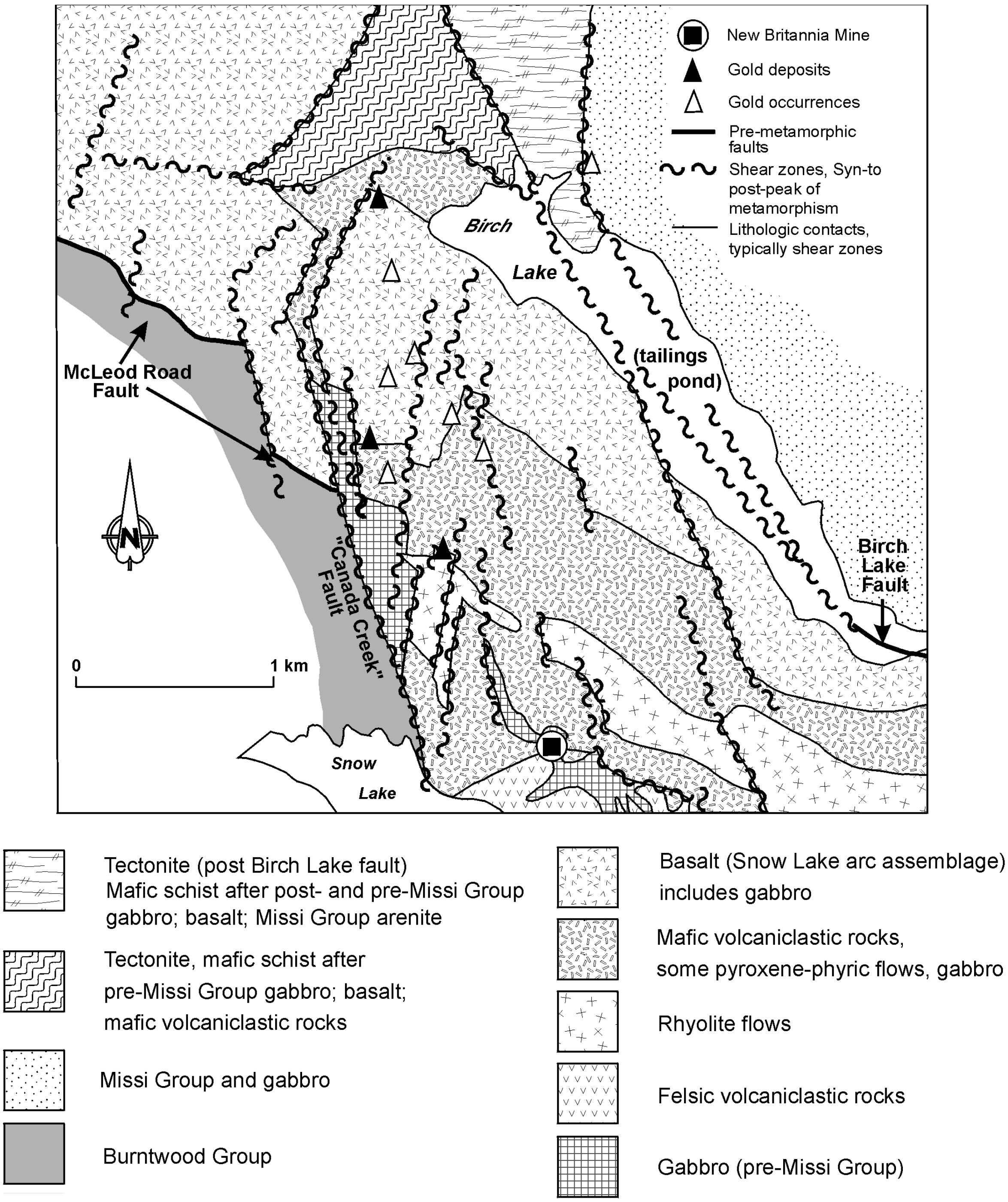

Figure GS-2-4: Reinterpreted geology north of Snow Lake, based on 1997 and 1998 field work, with significant faults and zones of gold mineralization shown.

of the McLeod Road fault, or a syn-metamorphic younger fault related to the deformation of the thrust slices. Directly to the east of the Canada Creek fault (Fig. GS-2-4), the large scale layering is openly folded about north-northeasterly-trending axial planes. Dextral faults occur parallel to the trend of the axial surface. These structures appear to be second order structures associated with the Canada Creek fault. The coincidence of this complex fault pattern with the most abundant and widespread showings of gold/arsenopyrite and the most numerous concentration of economic deposits of gold in the region suggest a genetic link between gold mineralization and this phase of syn-metamorphic deformation.

ECONOMIC GEOLOGY

The Snow Lake area contains the largest Paleoproterozoic lode gold deposit in Canada, the New Britannia Mine. Since reopening the mine with a new mill and smelter in 1995 production has steadily increased to achieve anticipated gold production of 3 100 kg (100 000 ounces) annually (3 165kg (101 753 ounces) in 1997). Drilling in 1998 defined additional reserves beneath the 900 m level. Diluted ore reserves for 1997 were 4 039 055 tonnes (4 452 296 tons) at a grade of 4.65 g/t (0.136 oz/ton). The total gold produced from 1949 to August 1998 is 27 895 kg (896 786 ounces). These figures include production (1995 and 1996) from the Three Zone and Birch satelite deposits north of the New Britannia/Nor Acme main shaft, as well as production from the main shaft (historical data to 1958 from Richadson and Ostry (1996); recent production figures and diluted reserve estimates graciously provided by New Britannia Mines).

The regional extent of gold/arsenopyrite mineralization stretches from the east shore of Wekusko Lake to northwest of Squall Lake.The deposits on the east shore of Wekusko Lake constitute the "Herb Lake" gold camp that produced1 834 kg (58 962 ounces) of gold. The total gold production for the Snow Lake region, including Wekusko Lake (Herb Lake camp) is 29 729 kg (955 748 ounces). This region will soon exceed 1 million ounces of gold produced, justifying ongoing mineral exploration and geological mapping.

In addition to the regionally wide spread nature of the gold mineralization, the time span for the mineralizing processes are potentially also quite broad. Investigations to date are inconclusive: timing of the mineralization ranges from pre-metamorphic (Schledewitz, 1997; but syn-deformation with F2a after the terminology of Kraus and Williams (1998)) to post-metamorphic vein systems in dilatant faults Galley et al.(1986, 1988).

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