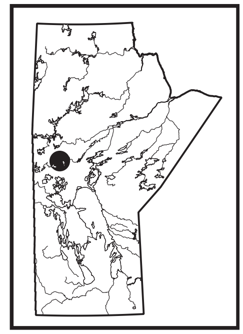
GS-9

Lithostratigraphy and structural geology of the McLeod Road–Birch Lake thrust panel, Snow Lake, west-central Manitoba (parts of NTS 63K16, 63J13)

by K.E. Rubingh[1], B. Lafrance[1] and H.L. Gibson[1]



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Summary

The New Britannia mine is a structurally controlled gold deposit hosted in mafic and felsic volcanic and volcaniclastic rocks. Mineralization is spatially associated with the hangingwall of the McLeod Road Thrust (MRT), and the gold deposits are located at stratigraphic contacts between units of contrasting competency at the intersection of a fault and a secondary structure, typically a fold hinge.

Completion of the 2012 lithostratigraphic mapping of the McLeod Road–Birch Lake thrust panel (MB panel) has identified additional thrust faults, which repeat stratigraphic units of the panel. These structures appear to be truncated by the MRT and have been interpreted as early D_1 structures. The main foliation in the MB panel (S_1) is defined by the flattening of the clasts and is interpreted as a fabric formed during D_1 folding and thrust imbrication of the MB panel. The S_1 foliation is axial planar to the Nor-Acme anticline (F_1 fold) and is consistently parallel to the MRT (late D_1 thrust) contact. These D_1 structures are overprinted by a spaced cleavage (S_2), which overprints the Howe Sound Fault, the MRT and the Nor-Acme anticline. This fabric is correlative with the regional S_2 fabric in the Burntwood Group, and it is inferred that the S_2 fabric in the MB panel may be related to sinistral reactivation of the MRT. A spaced, steeply dipping, S_3 fracture cleavage related to the Threehouse synform (F_3 fold) consistently overprints all fabric elements. Gold mineralization is associated with D_1 structures and there is evidence to suggest that emplacement was late D_1 with later remobilization during D_2.

Introduction

The New Britannia mine has been renamed 'Snow Lake mine' by QMX Minerals Corporation in 2012; however, for consistency with earlier publications, this report will continue to use 'New Britannia mine'. The McLeod Road–Birch Lake thrust panel (MB panel) is a fault-bounded package of mafic and felsic volcanic and volcaniclastic rocks, which hosts four gold deposits: the Birch zone; the No. 3 zone; and the Boundary zone, including the Nor-Acme deposit of the New Britannia mine that produced 1,404,950 oz. (43 699 kg) gold. The Nor-Acme deposit is associated with the Howe Sound Fault, which cuts the MRT (Beaumont-Smith and Gagné, 2008; Galley et al., 1991). However Fieldhouse (1999) interpreted the Howe Sound Fault to precede the MRT. In this study, the Howe Sound Fault is interpreted to be a late D_1 structure. Numerous authors have either studied the geological controls on the gold mineralization (Hogg, 1957; Galley et al., 1988; Bailes and Schledewitz, 1998; Fieldhouse, 1999; Fulton, 1999; Gale, 2002; Beaumont-Smith and Lavigne, 2008) and/or mapped the regional geology of the thrust panel; however, the structural history and structural controls on gold mineralization are as yet undefined.

The MB panel can be internally subdivided into two fault-bounded panels. The upper MB panel comprises the package of rocks between an unnamed stratigraphy-parallel fault that passes through an unnamed lake to the south, and the Birch Lake Fault to the north. The lower MB panel comprises the package of rocks that extends south of the unnamed stratigraphy-parallel fault to the MRT. The lithostratigraphy of the upper MB panel was presented and described in Rubingh (2011).

Fieldwork in 2012 focused on three main objectives: 1) completion of stratigraphic mapping and sample collection for geochemistry of the lower MB panel; 2) correlation of the stratigraphic units as defined by lithostratigraphy and chemostratigraphy in 2011, through mapping the town of Snow Lake and the New Britannia mine property at 1:1000 scale; and 3) property-scale mapping (1:50 scale) of the Howe Sound Fault and the No. 3 zone deposit to determine the structural controls on gold mineralization. The stratigraphic and structural relationships of the rocks in the study area are presented on (Rubingh et al., 2012). An improved lithostratigraphic understanding will aid in determining the internal geometry of the MB panel and will provide an improved framework to help define the structural controls on gold mineralization.

Regional geology

The Flin Flon–Snow Lake greenstone belt (Figure GS-9-1) is located in the internides of the Trans-Hudson Orogen. It is bounded to the east by the Superior Boundary Zone, to the west by the Wollaston Fold Belt, to the north by metaturbidite and sandstone of the

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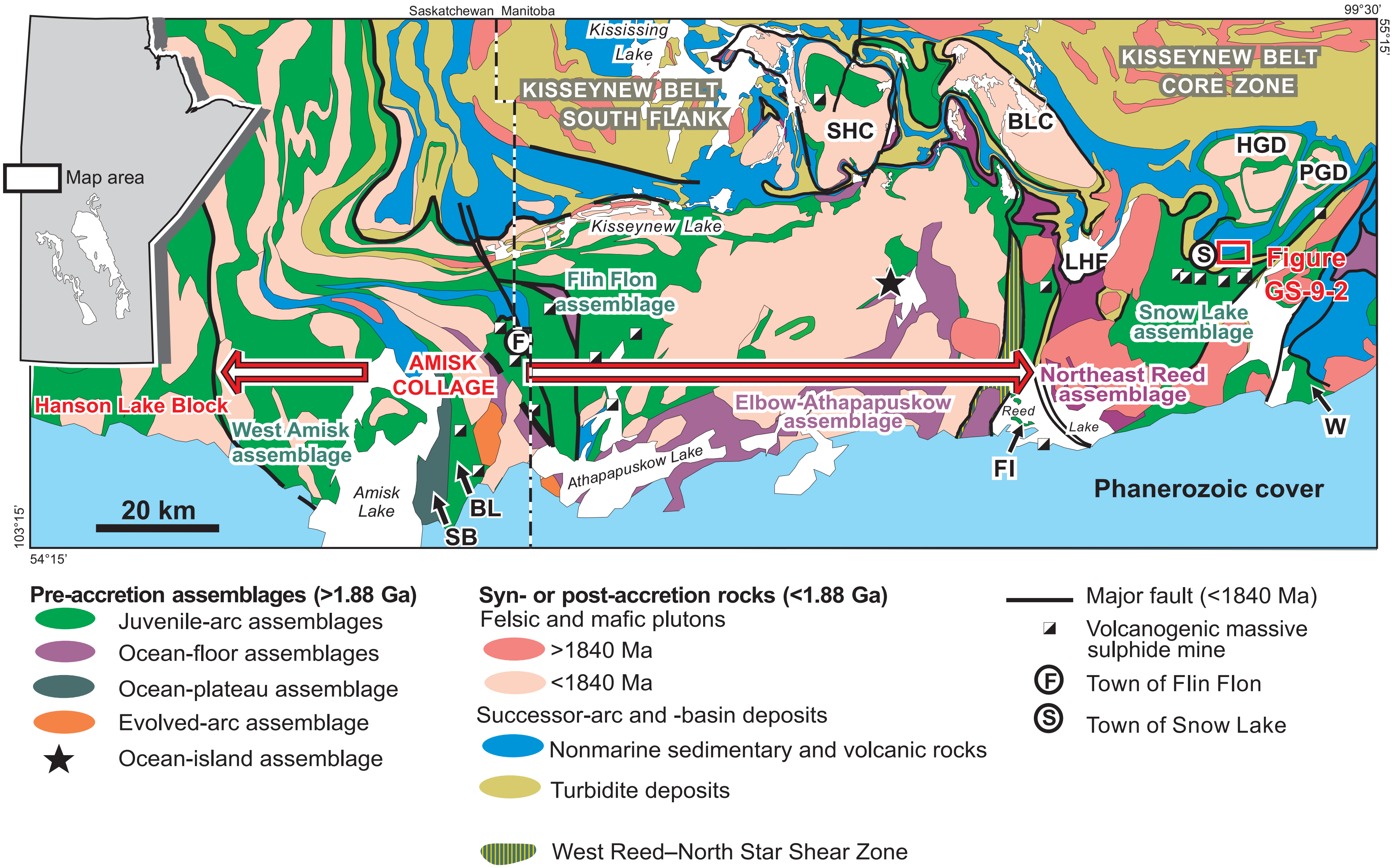

***Figure GS-9-1:** Regional geology of the Flin Flon–Snow Lake greenstone belt (modified after Bailes and Schledewitz, 1998), west-central Manitoba. Abbreviations: BL, Birch Lake; BLC, Batty Lake complex; FI, Fourmile Island; HGD, Herblet gneiss dome; LHF, Loonhead Lake Fault; PGD, Pulver gneiss dome; SB, Sandy Bay; SHC, Sherridon–Hutchinson Lake complex; W, Schist-Wekusko assemblage.*

Kisseynew basin and, to the south, it is buried beneath a Paleozoic basin**.** The belt is an amalgamation of different tectonostratigraphic assemblages that are distinct in terms of geochemistry, metamorphic grade and structural history (Lucas et al., 1996; Syme et al., 1996). The main panel of volcanic rocks, located south of Snow Lake, forms a 6 km thick succession referred to as the Snow Lake arc assemblage (SLA). The SLA consists of three separate sequences that reflect its evolution from a primitive arc (Anderson sequence: mafic and felsic flows) to a mature arc (Chisel sequence: mafic volcaniclastic rocks with minor felsic volcanic and volcaniclastic rocks) to an evolved-arc rift (Snow Creek sequence: mafic flows and pillows; Bailes and Galley, 1996, 1999, 2007). The SLA developed as a result of a fold-and-thrust style of tectonics (Connors et al., 1996; Lucas et al., 1996; Kraus, 1998; Kraus and Williams, 1999; Zwanzig, 1999), in which the north-dipping SLA is overthrust from north to south by panels of Burntwood Group turbidites (ca. 1.86–1.84 Ga), the MB volcanic sequence (interpreted at ca. 1.89 Ga) and Missi Group conglomeratic rocks (ca. 1.86–1.84 Ga; Kraus and Williams, 1999).

The MB panel, as defined by Bailes and Schledewitz (1998), is a north-dipping homoclinal sequence of mafic and felsic volcanic and volcaniclastic rocks that is bounded to the south by the MRT and to the north by the Birch Lake Fault. Imbrication of the panels occurred during southwest-directed transport, historically attributed to D_2 regional deformation, and resulted in the formation of a strong, regional, northeast-plunging stretching lineation; a regional foliation; and the Nor-Acme anticline within the MB panel. These structures and panels were subsequently folded around the northeast-trending D_3 Threehouse syncline (Kraus and Williams, 1999; Beaumont-Smith and Lavigne, 2008; Gagné, 2009).

Metamorphic conditions in the Snow Lake area range from lower to middle amphibolite facies, with a northward increase in metamorphic grade reflecting temperatures in the range 500–700°C and a pressure increase from 4 to 6 kbar (Kraus and Menard, 1997). Mineral assemblages show the progression from the chlorite zone, south of the New Britannia mine, through the staurolite zone at the mine to the sillimanite zone in the Squall Lake area.

Stratigraphy of the MB panel

Structural and lithostratigraphic mapping conducted this field season has a potentially significant implication for understanding the stratigraphic relationships of the mine horizon. The 2012 structural and lithostratigraphic mapping indicates that the thrust panel is more deformed than previously interpreted, as a potential repetition of lithostratigraphic units has been identified within the MB panel (Figure GS-9-2; Rubingh et al., 2012). The following section provides a brief description, from oldest to youngest, of each stratigraphic unit in the MB panel (units 1–7), from the MRT to the Birch Lake basalt (Figure GS-9-2). The description of units 1–7 incorporates 1) the completion of stratigraphic mapping conducted in 2012, and 2) a reinterpretation of stratigraphic mapping from 2011. In the descriptions that follow, all primary pyroxene phenocrysts have been pseudomorphed by hornblende due to peak amphibolite-facies metamorphism; therefore, the pyroxene phenocrysts described refer only to relict pyroxene.

Description of stratigraphic units

Unit 1: Mafic volcaniclastic rocks

Unit 1 is interpreted as a repeated unit within the lower panel (Figure GS-9-2; Rubingh et al., 2012). This unit comprises a single lithofacies of moderately well bedded heterolithic felsic and mafic clasts, which vary from lapillistone to tuff breccia. The volcaniclastic rocks are typically matrix to clast supported, with subangular to subrounded, strongly flattened clasts and a crystal-rich, pyroxene- and plagioclase-phyric matrix. They comprise pyroxene-phyric mafic clasts of similar composition to the matrix, plagioclase-phyric mafic clasts, aphyric to plagioclase-phyric mafic clasts and plagioclase-phyric to aphyric felsic clasts.

Unit 2: Felsic volcaniclastic rocks

Unit 2 is interpreted as a thrust-repeated unit within the lower MB panel (Figure GS-9-2). It comprises two lithofacies: quartz- and plagioclase-phyric felsic volcaniclastic rocks and aphyric to plagioclase-phyric flows/sills. Plagioclase-phyric (5–8%) and quartz-phyric (3–5%) volcaniclastic rocks form a crudely bedded sequence (lapillistone to tuff breccia). Clasts are typically monolithic and of the same composition as the matrix; some are aphyric felsic. The massive, coherent, aphyric to 1–2% plagioclase-phyric rhyolite has a sharp contact with the felsic volcaniclastic rocks and is interpreted as a possible sill.

Unit 3: Heterolithic felsic volcaniclastic rocks

Unit 3 was previously subdivided into stratigraphic units 4, 5 and 6: dacitic volcaniclastic rocks, felsic volcanic and volcaniclastic rocks, and quartz-feldspar–phyric volcaniclastic rocks, respectively (Rubingh, 2011). During 2012 mapping and as a result of preliminary geochemistry from 2011, characteristics of these units have been identified in the lower MB panel; therefore, these units are grouped within a single unit 3. This unit now comprises three lithofacies: dacitic volcaniclastic rocks, with distinctive wispy mafic shards that are interpreted as flattened pumice fragments (Rubingh, 2011); amygdaloidal plagioclase-phyric felsic volcanic flows/sills; and heterolithic felsic volcaniclastic rocks (dominantly quartz-feldspar–phyric clasts, with minor plagioclase-phyric and aphyric to plagioclase-phyric mafic clasts).

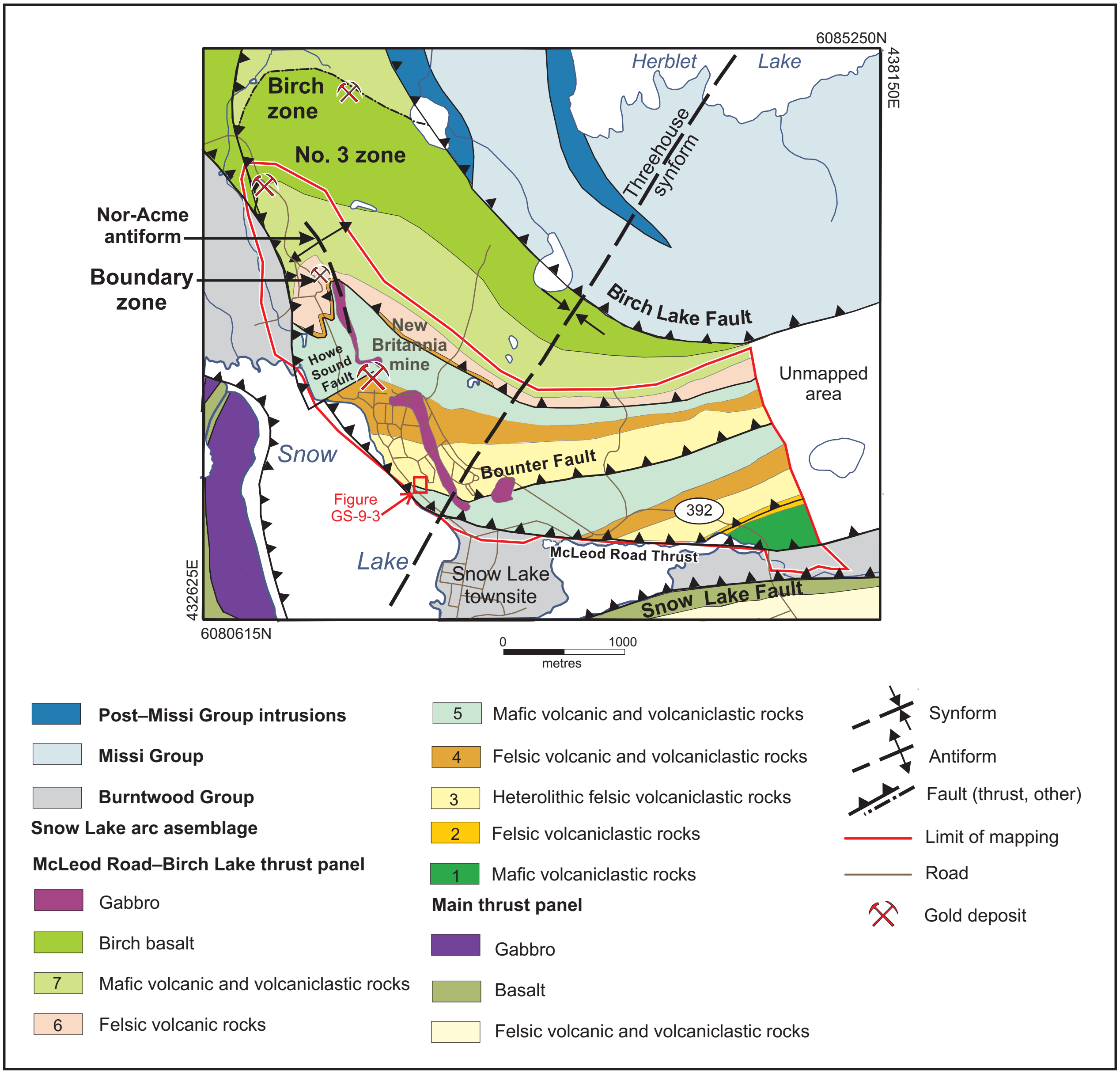

***Figure GS-9-2:** Simplified lithostratigraphy and structural geology of the McLeod Road–Birch Lake thrust panel, Snow Lake area, west-central Manitoba (modified after Rubingh et al., 2012).*

Unit 4: Felsic volcanic and volcaniclastic rocks

Unit 4 was described in Rubingh (2011) as unit 7. This unit was also observed during 2012 mapping, characterized by its plagioclase-phyric composition. It comprises two lithofacies: dominantly plagioclase-phyric (1–5%) rhyolite flows and lesser felsic volcaniclastic rocks. The unit displays flow banding, well-preserved flow lobes, flow-top breccias and local quartz-filled amygdules.

Unit 5: Mafic volcanic and volcaniclastic rocks

Unit 5 was described in Rubingh (2011) separately as units 1, 2, 3 and 8. It comprises dominantly well-bedded, heterolithic, mafic volcaniclastic rocks and minor plagioclase-phyric pillowed flows. Clast composition includes aphyric to plagioclase-phyric mafic, aphyric to plagioclase-phyric felsic, scoriaceous and plagioclase- and pyroxene-phyric mafic. The matrix is crystal rich and comprises pyroxene and plagioclase crystals. Individual lithofacies within unit 5 can be monolithic, but heterolithic clasts are typically observed. Clast size varies from lapilli tuff to lapillistone to tuff breccia.

Unit 6: Felsic volcanic rocks

This unit was previously described in Rubingh (2011) as unit 9. It comprises a single lithofacies: a massive, aphyric, aphanitic rhyolite flow with flow banding and rare quartz-filled amygdules.

Unit 7: Mafic volcanic and volcaniclastic rocks

Unit 7 was described in Rubingh (2011) as unit 10, and it was further mapped in 2012 at the No. 3 zone. It comprises two lithofacies: mafic volcaniclastic rocks and pillowed flows. A distinguishing characteristic of this unit is the coarse pyroxene crystals, which range from 0.5 to 1 cm in diameter. The mafic volcaniclastic rocks vary from lapillistone to tuff breccia, and they are distinct from mafic volcaniclastic rocks of unit 5 because they comprise a pyroxene-plagioclase–phyric crystal matrix with monolithic clasts of a similar composition. The pillowed and massive flows comprise a similar, distinct, coarse-pyroxene-crystal–rich matrix with thin selvages.

Reinterpretation of the MB panel stratigraphy

The lower panel, mapped in 2012, has led to a reinterpretation of the entire panel. There are two distinct sequences of rocks in the MB panel—units 1 and 2 and units 3, 4 and 5—which are interpreted as thrust-repeated packages. Units 6 and 7 do not appear to be repeated within the MB panel. The lower-panel thrust is a different part of the MB panel, with a thrust along the upper contact of unit 2. The upper panel repeats units 3, 4 and 5 along the upper contact of unit 5 (Figure GS-9-2; Rubingh et al., 2012).

In the town of Snow Lake, a structural repetition of the Burntwood Group turbidites has been identified at the base of unit 3 (Figures GS-9-2, -3). This is interpreted as the repeated contact of the MRT. The contact is continuous along strike and was previously interpreted as the Bounter Fault (Galley et al., 1991; Fieldhouse, 1999), a series of anastomosing shears associated with the Bounter occurrences that were considered either as a splay of the MRT or to be truncated by the MRT. There is also

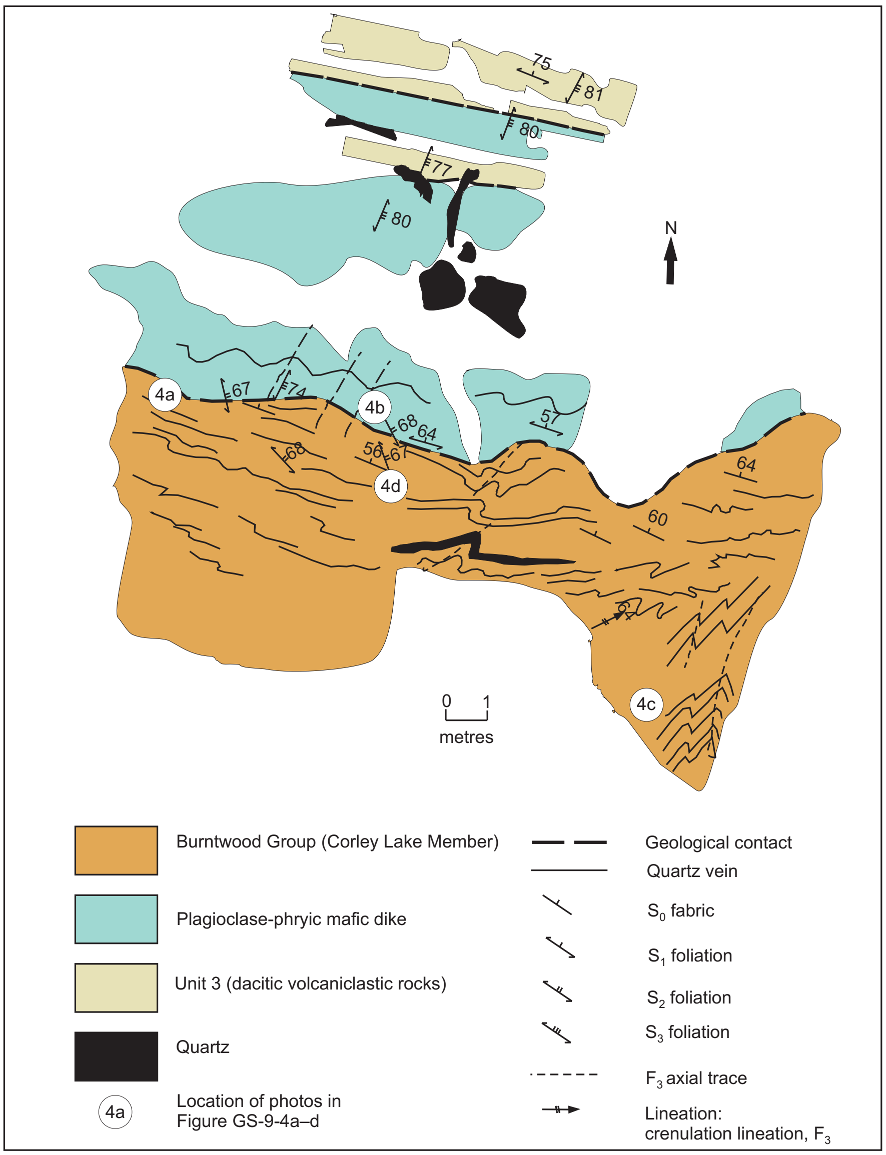

Figure GS-9-3: *Sketch map of the contact of the McLeod Road Thrust and the unit 3 dacitic volcaniclastic rocks intruded by an early mafic dike, Snow Lake area, west-central Manitoba.*

evidence to suggest that unit 4 is repeated above unit 5, in the mine horizon, as a result of a potential thrust repeating unit 4 at the base of unit 6 (Figure GS-9-2).

Structural geology

Previous authors have described four main deformational events in the Snow Lake area (Kraus, 1998; Kraus and Williams, 1999). Three deformational events (D_1–D_3) are recognized in this study, and their relationship to the previous interpretations by Kraus and Williams (1999) and Beaumont-Smith and Lavigne (2008) is presented in Table GS-9-1. The deformational events described by Kraus and Williams (1999) have been simplified into D_1–D_3 events for correlation between authors. Previously, the main fabric identified in the MB panel was interpreted as an S_2 fabric, whereas this study presents this main foliation as S_1, which is not correlative with a macroscopic S_2 foliation in the Burntwood. The main fabric in the Burntwood (S_2) is related to an S_2 cleavage that is a pervasive fabric observed in the MB panel. The S_3 fabric elements identified in this study correlate with those of Kraus and Williams (1999), Beaumont-Smith and Lavigne (2008) and Gagné (2009).

D_1 deformation

This deformation is attributed to south- to southwest-directed thrusting of the MRT, causing early thrust imbrication and formation of the Nor-Acme fold, a drag fold related to thrusting. In the MB panel, the oldest planar fabric attributed to D_1 deformation is the S_1 foliation, defined by flattening of the clasts. The clasts also have a strong stretching lineation (L_1) that plunges moderately to the northeast. The S_1 fabric is related to thrusting along the MRT; the early thrust repetitions, which appear to be truncated by the MRT and may represent an earlier thrusting event, are included as a D_1 deformational event in this report for simplification. A change in orientation of S_1 is documented through the town of Snow Lake, and it is observed that the S_1 fabric rotates and becomes parallel to the MRT. The S_1 fabric is axial planar to the Nor-Acme fold, and displays a counter-clockwise relationship to bedding on the west limb and a clockwise relationship to bedding on the east limb. The Nor-Acme fold is a macroscopic F_1 fold defined by the folding of units 7, 8 and 9. The S-asymmetric drag folds observed along the bedding-parallel contact of the Howe Sound Fault are due to rotation of the S_1 fabric into parallelism with the fault. However, the Howe Sound Fault is interpreted to be a late D_1 structure due to the overprinting relationship of the S_2 fabric.

D_2 deformation

The second deformation event (D_2) has been interpreted in this study to represent sinistral reactivation of the MRT. The S_2 fabric in the MB panel is correlated with the S_2 fabric in the Burntwood Group (Table GS-9-1). In the volcanic rocks, S_2 is a moderately defined northwest- to north-northeast-trending, moderately northeast- to east-dipping, penetrative spaced cleavage, defined by the alignment of hornblende in mafic rocks and biotite in felsic rocks. No macroscopic folds in the MB panel

Table GS-9-1: Comparison of the interpretation by several authors of deformation events in the McLeod Road–Birch Lake thrust panel, Snow Lake area, west-central Manitoba. Bold face indicates principal known structures in each deformational event.

Kraus and Williams (1999)	Beaumont-Smith and Lavigne (2008)	This study (2012)
D_3: macroscopic north-northeast-trending **Threehouse synform** (F_3 fold); chevron folds; S_3 spaced fracture cleavage	**D_3:** macroscopic northeast-trending **Threehouse synform** (F_3 fold); S_3 fabric is a weak to penetrative axial-planar foliation and spaced fracture cleavage	**D_3:** macroscopic northeast-trending **Threehouse synform** (F_3 fold); S_3 fabric is a northeast- to east-northeast-trending, steeply dipping, axial-planar, weakly spaced fracture cleavage
D_2: F_2 isoclinal south-verging folds (**Nor Acme**); S_2 is a weakly spaced, differentiated foliation and alignment of staurolite porphyroblasts; **McLeod Road Thrust Fault** is a north- to northeast-trending, moderately dipping, F_2 thrust fault with a down-dip stretching lineation and sinistral, transcurrent shear-sense indicators that indicate oblique slip	**D_2:** shallow to moderately inclined, open to close, northeast-trending F_2 folds (**Nor-Acme**); axial-planar S_2 foliation; S_2 is a north-dipping, penetrative, slaty to spaced cleavage; **McLeod Road Thrust Fault** is north- to northeast-trending and moderately dipping with a down-dip stretching lineation and sinistral, transcurrent shear-sense indicators that indicate oblique slip	**D_2:** S_2 in volcanic rocks is defined by hornblende mineral alignment as a northwest- to north-northeast-trending spaced cleavage, clockwise of S_1/S_0; it is associated with south-trending, asymmetric, northeast-plunging, shallowly inclined F_2 folds; S_2 fabric in the Burntwood Group is a spaced cleavage defined by biotite and aligned staurolite
D_1: F_1 isoclinal south-verging folds; S_1 is a mesoscopic pervasive fabric; microlithons in staurolite porphyroblasts	**D_1: isoclinal folds**; S_1 is a rarely preserved, layer-parallel fabric adjacent to stratigraphic contacts	**D_1: McLeod Road Thrust Fault**; Howe Sound Fault; F_1 **Nor-Acme fold**; axial-planar S_1 foliation defined by flattening of the clasts; early thrust repetition pre–McLeod Road Thrust Fault

have been identified as being related to D_2 deformation. The mineral lineation (L_2) is rarely observed and it trends north-northeast to east, which is similar to the orientation observed due to the stretching lineation (L_1) of the clasts. The S_2 fabric of the MB panel displays a clockwise relationship to S_1; it overprints the Howe Sound Fault, the MRT and the Nor-Acme anticline. Figures GS-9-3 and -4a both show the contact of the Burntwood Group with a mafic dike, which intruded the inferred MRT contact. The S_2 fabric in the Burntwood Group is post D_1 (Figure GS-9-4d), it clearly overprints the MRT (D_1 thrust) contact (Figure GS-9-3).

Previously identified sinistral transcurrent shear-sense indicators (Table GS-9-1) are interpreted to be related to thrust imbrication of the panel during D_2. In this study, the S_2 fabric in the Burntwood Group undergoes a counter-clockwise rotation as it approaches the MRT; however, it is observed to transect the MRT at an angle of >30° and is therefore not related to initial thrust imbrication of the panel. This S_2 fabric is characterized by S-asymmetric F_2 folds with axial planes parallel to the regional S_2 fabric in the Burntwood Group. Therefore, the S_2 fabric in the MB panel may be related to sinistral reactivation of the MRT.

D_3 deformation

It is rare to observe S_1, S_2 and S_3 together, as the S_3 fabric is weakly developed; however, it is recognized in the hinge of the Threehouse syncline at the contact between unit 4 dacitic volcaniclastic rocks and the MRT (Figures GS-9-3, -4b). The S_3 fabric is a moderate, northeast- to east-northeast-trending, steeply southeast-dipping, spaced fracture cleavage. It is parallel to the axial planes of Z-asymmetric folds, which fold the S_0/S_1 fabric (Figure GS-9-4c); these folds lack a true axial-planar S_3 cleavage. However, a moderate to strong, S_3 penetrative fracture cleavage is observed in dacitic volcaniclastic rocks (unit 4) and in the mafic dike (Figure GS-9-4b).

Gold mineralization

The characteristic features of gold mineralization at the New Britannia mine are consistent across all the deposits. Mineralization is localized at the hinge of the Nor-Acme F_1 fold between two different lithological units, and gold is associated with quartz–albite–iron carbonate veins and fine-grained acicular arsenopyrite (Fieldhouse, 1999; this study). The association with quartz veins is most significant at the No. 3 zone (Figure GS-9-5), where mineralization is associated with a main shear vein and numerous ladder veins at the folded contact between coarse pyroxene mafic volcaniclastic rocks (Figure GS-9-4f) of unit 10 and plagioclase-phyric pillowed flows of the Birch Lake basalt. The No. 3 zone has two surface exposures that show the changing orientation of the main shear structure: in the portal area and at the main quartz-vein showing. The portal area displays a main west-northwest- to northwest-trending shear, whereas the main quartz-vein area shows the shear vein striking due west.

The crosscutting relationships of different structures and fabric elements in the area of the No. 3 zone portal are shown in Figure GS-9-5. Bedding is defined by the normal grading of clasts, which defines bed sets 1–2 m thick (Figure GS-9-4e). The facing direction is weakly defined as north, based on weak normal grading. Beds are folded with an S_1 axial-planar fabric, defined by the flattening of the clasts, but there is no associated penetrative foliation (Figure GS-9-4g). The S_1 fabric is also axial planar to folded, gold-bearing, quartz–albite–iron carbonate veins, indicating mineralization associated with D_1. Counter-clockwise rotation of the clasts into the main west-northwest- to northwest-trending shear fracture indicates sinistral movement. The overprinting relationship between S_2 and the rotation of S_1 into the main shear fracture constrains the timing of the shear fracture to either late D_1 or early D_2 (Figure GS-9-4h).

The S_3 fabric is a steep north-northeast-trending fracture cleavage, which is observed to cut the shear zone and overprint all fabric elements. North-trending shears are associated with the S_3 fabric. East-trending tension gashes, and small-amplitude folds (some of which display Z-asymmetry) with their axial planes parallel to the north-trending shears, are also associated with D_3. The D_3 fabric elements may therefore reorient structures associated with the mineralization. The main vein area of the No. 3 zone exhibits several generations of veins and, on an outcrop scale, the S_1 and S_2 fabrics are both rotated into parallelism with the main shear fracture, indicating a D_2 timing for mineralization.

Discussion

Stratigraphic and structural analysis has redefined the structural history of the MB panel, and early thrust imbrications have been identified in both upper and lower panels. The correlation of these repeated units will be tested using geochemistry to validate this argument. Thrust imbrication of the panel appears to be coincident with thrusting during D_1 deformation and a pervasive S_1 fabric, which is parallel to the MRT and axial planar to the Nor-Acme fold. Movement along the MRT appears to have been reactivated during D_2 southwest-directed thrusting. During D_3, there was an apparent dextral component, as observed by brittle offset of quartz veins at the No. 3 zone and dextral folds at the No. 3 zone portal. Mapping of the No. 3 zone has implications for the timing of gold mineralization, appearing to constrain gold emplacement to late D_1 or syn-D_2 deformation events.

Economic considerations

Gold mineralization at the Snow Lake mine is structurally controlled its spatial occurrence with the hangingwall

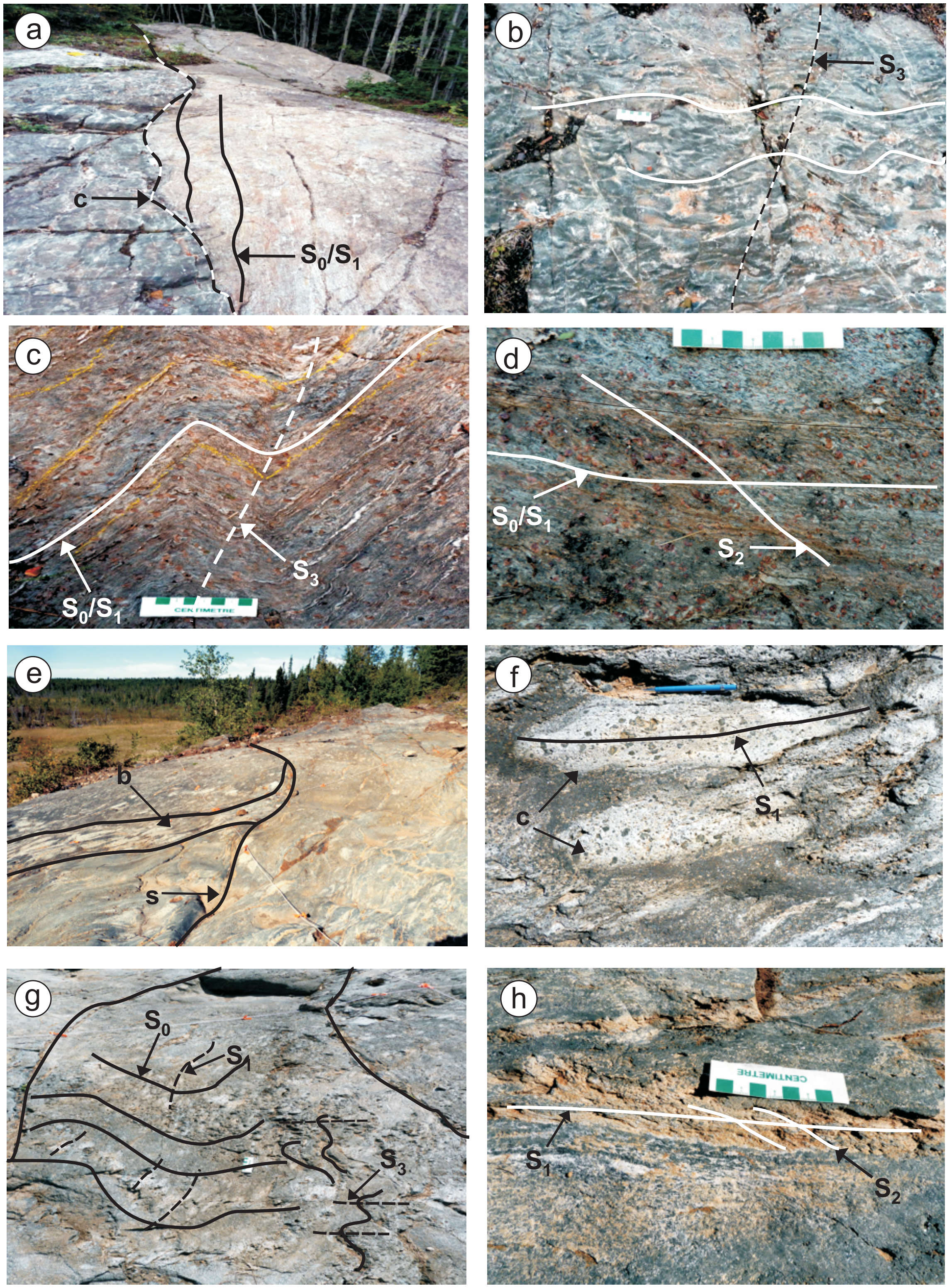

Figure GS-9-4: *Structural features and fabrics on the contact between the McLeod Road Thrust (MRT) and the dacitic volcaniclastic rocks (a–d) and at the No. 3 zone portal (e–h), Snow Lake area, west-central Manitoba:* ***a)*** *bedding and S_1 (microscopic fabric preserved in microlithons) are truncated along the MRT contact (c) by an early mafic dike;* ***b)*** *F_3 open folds fold the mafic dike, as indicated by the axial plane of the S_3 fabric;* ***c)*** *S_0/S_1 fabric is folded during D_3, producing Z-asymmetric F_3 folds;* ***d)*** *S_2 fabric overprinting S_0/S_1 fabrics, close to the MRT contact,* ***e)*** *main shear fracture(s), which offsets bedding (b); orange flags are at 1 m intervals),* ***f)*** *flattening of pyroxene-phyric Threehouse volcaniclastic clasts (c) defines S_1 foliation;* ***g)*** *S_0 defines bedding being folded with S_1 axial plane; S_3 axial planes indicate small tight F_3 folds;* ***h)*** *S_2 cleavage overprints S_1 fabric parallel to margins of an iron-carbonate vein.*

Figure GS-9-5: *Sketch map of the No. 3 zone portal, Snow Lake area, west-central Manitoba.*

of the MRT, and its consistent relationship with lithological contacts and secondary fault structures at fold hinges, is well defined. Improved understanding of the volcanic stratigraphy and structural history of the MB panel has identified early structural repetition within the panel, identified new thrust faults and highlights the importance of another fault, the Bounter Fault, which appears to offset the MRT. This structure is related to known mineralization at the Bounter occurrence along strike. Mineralization appears to be related in time to early D_1 thrust movement and was possibly reactivated during D_2. Further understanding of the internal geometry of the MB panel and identification of major structural breaks will help in developing new guidelines for gold exploration at a property scale.

Acknowledgments

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