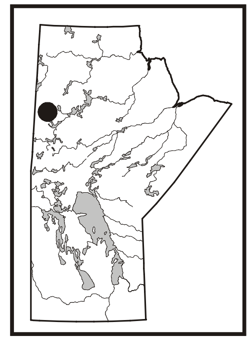

GS-14 PRELIMINARY STRUCTURAL AND GOLD METALLOGENIC STUDIES AT THE BURNT TIMBER MINE AND SURROUNDING AREA, LYNN LAKE GREENSTONE BELT (NTS 64C/10)

by L.R. Jones[1], C.J. Beaumont-Smith and B. Lafrance[1]

Jones, L.R., Beaumont-Smith, C.J and Lafrance B. 2000: Preliminary structural and gold metallogenic studies at the Burnt Timber mine and surrounding area, Lynn Lake greenstone belt (NTS 64C/10); *in* Report of Activities 2000, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 69-72.

SUMMARY

The Burnt Timber deposit is one of several gold deposits along the Johnson Shear Zone, a major east-trending fault zone on the southern margin of the Lynn Lake greenstone belt in northern Manitoba. The deposit is hosted by mafic tectonite of the Wasekwan Group. Gold is associated with silica, pyrite and carbonate enrichment that occurred during dextral shearing along the shear zone.

The Johnson Shear Zone has a strong east-trending shear foliation. This foliation is deformed by chevron folds, which are, in turn, sheared along the shear foliation, forming isolated fold packets in the shear zone. These structures are overprinted by a crenulation cleavage and kinks that formed during later dextral shearing. East-trending cataclasite units and pseudotachylite veins cut across the earlier ductile structures, and are displaced by late, north-trending, sinistral faults.

INTRODUCTION

The Burnt Timber deposit is located 13 km southeast of the town of Lynn Lake (Fig. GS-14-1). Open-pit mining of the deposit began in 1993, and the mine produced approximately 80 000 ounces of gold during the following three years (Richardson and Ostry, 1996). The deposit is hosted by strongly sheared mafic tectonite, which underwent strong silicification, carbonatization and pyritic alteration over a width of approximately 100 m within the 250 m wide Johnson Shear Zone (JSZ). The JSZ is a regional dextral shear zone that predates peak regional metamorphism but cuts across regional F_1 folds of the Lynn Lake belt (Beaumont-Smith and Rogge, 1999). A late brittle fault, the T1 fault, is subparallel to the JSZ. The T1 fault is a north-dipping reverse fault (Peck et al., 1998). The deposit is in the hanging wall of the fault and extends approximately 40 m from the fault.

Because the shear zone has a complex deformation history, involving both dextral shearing and brittle faulting, the timing of gold mineralization and the geometry of the gold-bearing structures have not yet been resolved. Following a preliminary study by Beaumont-Smith and Rogge (1999), the present study was initiated to document the relationships between the structures, alteration and gold mineralization of the Burnt Timber deposit and surrounding area.

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ROCK UNITS

The Burnt Timber deposit is hosted by mafic volcanic rocks of the Wasekwan Group (Bateman, 1945). The rocks are fine-grained, dark green, mafic tectonite, in which all primary structures have been erased by the strong deformation in the shear zone. Near the deposit, the mafic tectonite has alternating dark grey and light grey bands that weather pink and green, respectively, on outcrop surface. The mafic tectonite is locally strongly magnetic due to the presence of magnetite crystals up to 2 mm in size.

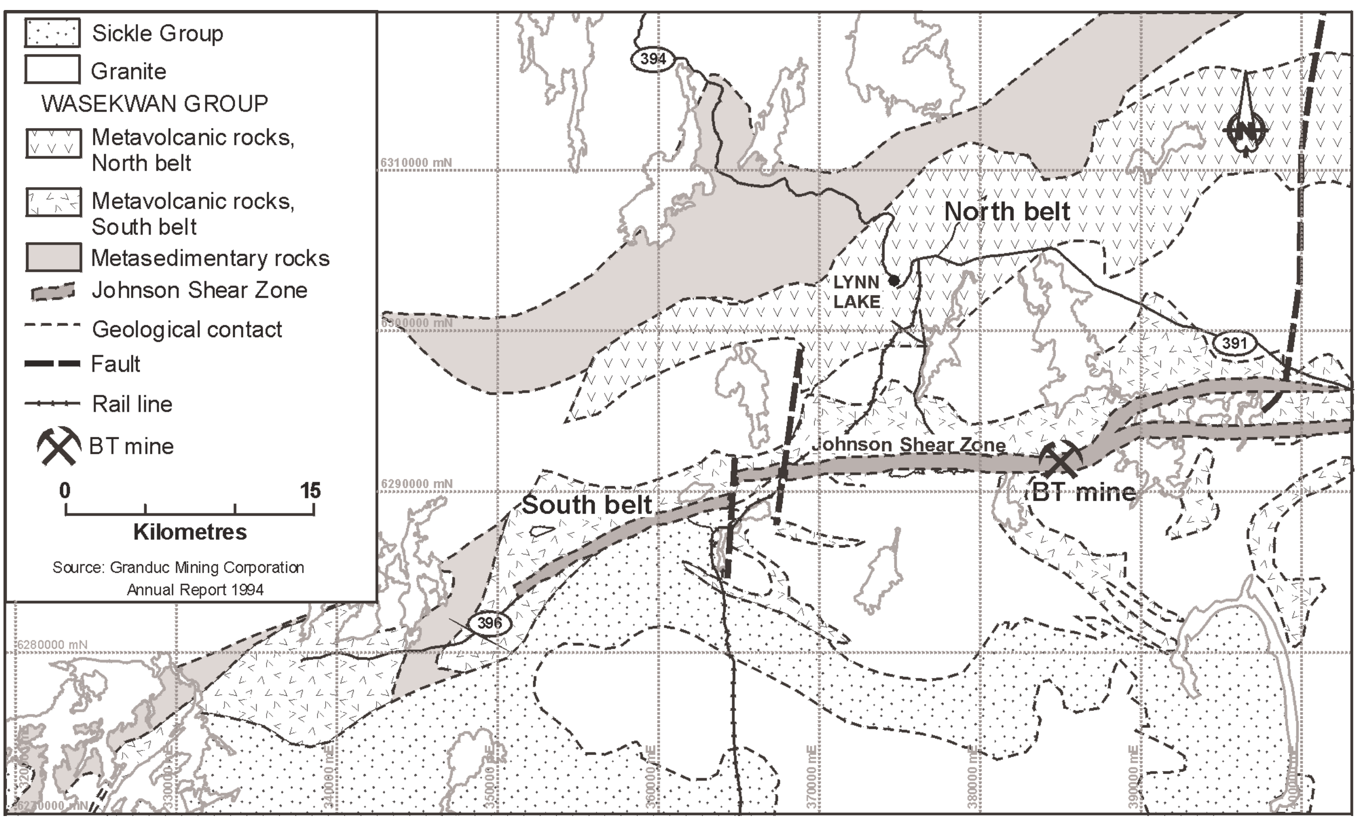

Figure GS-14-1: Simplified geological map of the Lynn Lake belt, showing the location of the Johnson Shear Zone and study area.

To the north and south of the JSZ, the mafic volcanic rocks are fine-grained massive flows with few preserved quartz-filled amygdules. The mafic flows are dark green on fresh surface and light green on outcrop surface. Minor units of mafic volcaniclastic rock and felsic tuff are interlayered with the mafic flows. The mafic volcaniclastic rocks are exposed for more than 100 m across strike. They are finely laminated with alternating, light grey and dark grey layers less than 0.5 cm wide. Younging indicators are rare, but graded bedding on two outcrops suggests that the beds young to the north. To the north of the JSZ, felsic tuff occurs as thin layered units, which are typically less then 4 m thick. The tuff is white on outcrop surface, light grey on fresh surface, and finely laminated to thickly bedded (10 cm maximum thickness). The felsic tuff is cut by a cleavage that refracts toward the bedding as it passes from the more massive thicker beds to the thinner, presumably less competent beds.

South of the deposit, the mafic metavolcanic rocks are cut by a coarse-grained granodiorite of the Pool Lake suite (Gilbert et al., 1980). The intrusion comprises 25% quartz, 60% feldspar and 15% biotite. Biotite is altered to chlorite in the margins of late fractures cutting through the intrusion. North of the Burnt Timber deposit, a poorly exposed, dark grey gabbro contains large amphibole grains up to 2 cm in size. The granodiorite and gabbro are not in contact, so the relative age of the two intrusions is not known.

STRUCTURE

Three of the five deformational events that affected the metavolcanic rocks in the study area are associated with movements along the JSZ. The JSZ formed during the second deformational event (D_2). Dextral shearing during D_2 produced a strong shear foliation (S_2). Dextral shear-sense indicators include 1) asymmetrical, back-rotated quartz boudins; 2) intrafolial Z-folds (Fig. GS-14-2); 3) dextral dragging of S_2 along the margin of competent rock units; 4) dextral offsets of markers; and 5) asymmetrical strain shadow around competent silicified volcanic fragments (Fig. GS-14-3). Near the middle of the JSZ, S_2 is folded by cascades of dextral F_2 chevron folds (Fig. GS-14-4), which are locally sheared by S_2, forming isolated fold packets surrounded by S_2. Ridge-and-groove lineations along S_2 are steeply plunging (60–70°), suggesting that the shear zone underwent dip-slip as well as strike-slip movements.

An early D_1 structure is only observed in the granodiorite intrusion. The intrusion is cut by a penetrative S_1 foliation defined by biotite and quartz ribbons. The S_1 foliation is in turn overprinted by narrow shear zones parallel to the JSZ. This foliation is likely preserved within the more competent granodiorite body because of the partitioning of the D_2 deformation in the less competent metavolcanic rocks.

The third deformational event (D_3) produced dextral F_3 kinks, which overlap in style with the F_2 chevron folds (Beaumont-Smith and

Figure GS-14-2: D_2 chevron folds folding the S_2 foliation in the Johnson Shear Zone.

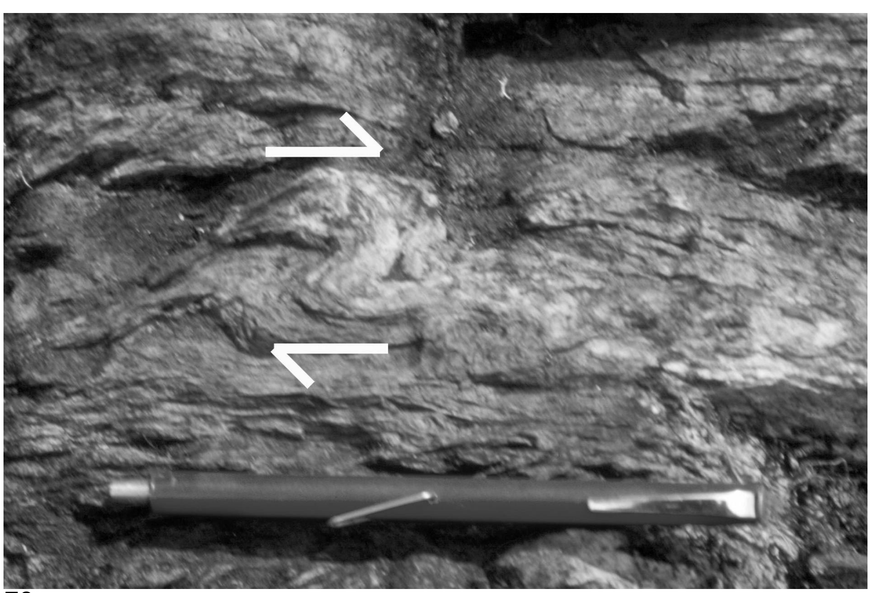

Figure GS-14-3: Asymmetrical Z-fold formed by D_2 dextral movement along the Johnson Shear Zone.

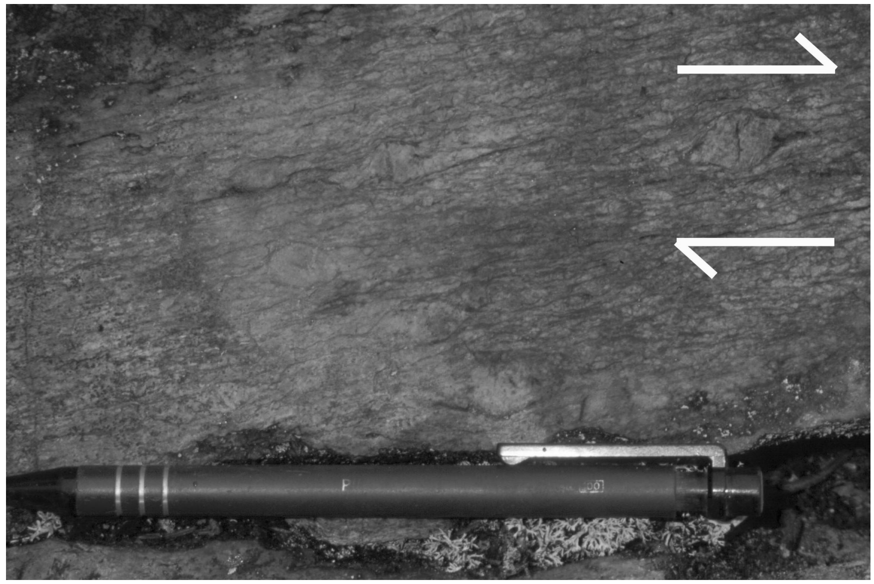

Figure GS-14-4: Dextral asymmetrical strain shadows around competent volcanic fragments in the Johnson Shear Zone.

Rogge, 1999). A crenulation cleavage (S_3) is axial planar to the F_3 folds. The D_3 kinks and folds strike northeast, slightly counterclockwise of F_2 axial planes. The orientation of the F_3 kinks and their overlap in style with F_2 folds suggest that both structures formed during progressive (D_2-D_3) dextral shearing along the JSZ.

The JSZ is overprinted by brittle structures related to two distinct deformation events (D_4 and D_5). The D_4 faults strike east-west and dip steeply to the north. Narrow cataclastic zones, consisting of very small (<1 mm) angular rock fragments and dark pseudotachylite veins with quenched margins, are formed during D_4 faulting. The offset of quartz veins and the dragging of S_2 along minor faults suggest that the faults are dextral. The D_5 faults trend north, dip to the west and clearly displace D_4 pseudotachylite units (Fig. GS-14-5). Where both D_5 and D_4 structures are present on outcrop, the mafic tectonite has been strongly disrupted, as shown by abrupt and discontinuous changes in the trend of S_2 and quartz veins.

The T1 fault cuts across the east- and west-facing walls of the Burnt Timber open pit. The open pit is now flooded, so the fault could not be examined. The fault orientation and reverse slip are consistent with both D_4 and D_5 faulting events, so the fault could have formed during either event.

GOLD MINERALIZATION

Quartz-carbonate alteration of the mafic tectonite occurs across the JSZ. Quartz and iron carbonate veins are folded by F_2 chevron folds and overprinted by the sericitic S_2 shear foliation. In high-grade zones of the orebody, the mafic tectonite underwent strong silicification, pyritization and carbonatization. Sericite along S_2 foliation planes is replaced by chlorite. This supports the conclusions of a geochemical study by Peck and Eastwood (1996), who reported an inverse correlation between gold and potassium values in the orebody.

A spatial relationship between felsic dykes and gold mineralization is observed in several drillholes through the deposit. Gold assay values increase where felsic dykes are present. This suggests a possible genetic association between the dykes and the gold mineralization.

CONCLUSIONS

Mafic metavolcanic rocks in the vicinity of the Burnt Timber mine underwent five deformational events. The JSZ is a regional, dextral, D_2 shear zone. It is overprinted by D_3 kinks and folds, which crenulate and kink the S_2 shear foliation. The final two brittle events (D_4 and D_5) produced cataclasite and pseudotachylite veins, which offset the older ductile structures.

Gold mineralization is associated with quartz-carbonate-pyrite

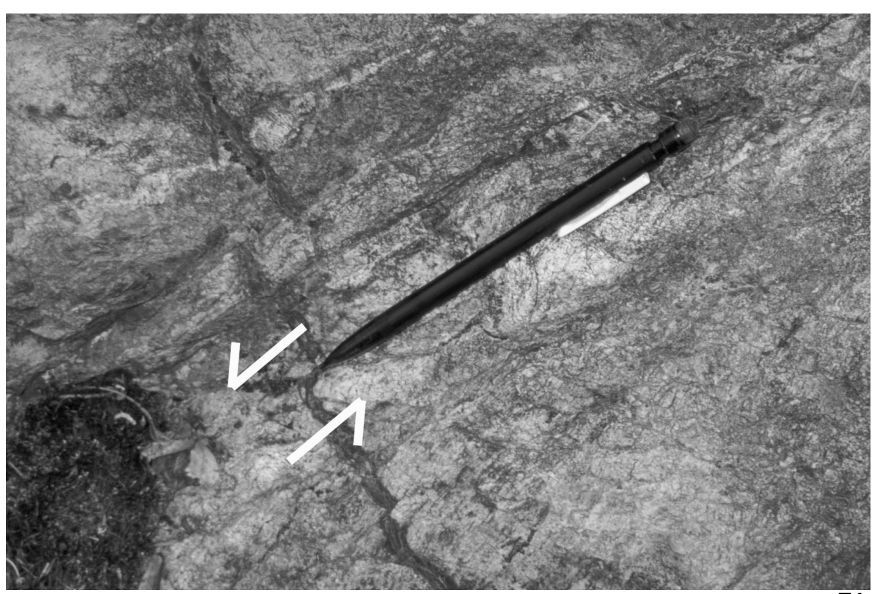

Figure GS-14-5: D_4 pseudotachylite offset by D_5 brittle faults.

alteration of the mafic tectonite in the JSZ. There is also a spatial relationship between gold mineralization and felsic dykes, which may become a key prospecting tool for finding new deposits along the JSZ.

Future work will involve whole-rock geochemistry of the altered mafic tectonite hosting the Burnt Timber deposit, and detailed structural mapping of other gold occurrences along the JSZ.

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