Structural and geochemical studies at the Mosquito creek gold mine Cariboo District, British Columbia

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The Mosquito Creek Gold mine (MCGM)near Wells, east-central British Columbia, comprises Au-bearing pyritic lenses and quartz veins in the Barkerville Terrane. The low metamorphic grade (greenschist facies) host rocks include clastic sedimentary rocks with subordinate carbonate rocks and meta-volcanic rocks. The 15+ km long Cariboo Gold Belt (CGB) follows the NW-SE striking contact between the pale quartzite, phyllites, and minor limestone and mafic volcanic rocks of the "Baker Member" (to the NE), and the dark quartzite and phyllites of the "Rainbow Member" (to the SE). This sequence dips 30-60° NE, is interpreted to comprise the overturned SW limb of a regional anticline. Asymmetric, Z-shaped folds with shallow NE-dipping axial planes and with hinges plunging 20° to the NW, parallel to the prominent regional lineation.

The Mosquito Creek, Island Mountain and Cariboo Gold Quartz mines produced about 40 tonnes of Au along a 3.5 km segment of the CGB. Gold was produced from quartz-pyrite veins concentrated in the "Rainbow member", and from pyritic lenses (so-called "replacement" ore) commonly associated with asymmetric fold hinges in limestone bands near the Baker- Rainbow contact. The deposits resemble (other) mesothermal type vein deposits (high ave. Au:Ag ratio of 8.5; similar vein fluids) but differ somewhat in geological setting (mostly metasedimentary wallrocks; veins not clearly associated with a major fault).

The two principal types of gold-bearing veins are: (1) diagonal quartz-pyrite-sericite veins (070-090; subvertical), oblique (at high angle) to the prominent lineation, and (2) orthogonal quartz-carbonate- pyrite-galena-sphalerite veins, perpendicular to the lineation. Both are extensional in origin. The orthogonal veins are younger and crosscut variably deformed diagonal veins. Structural analysis suggests that these veins formed during late stages of deformation of the terrane.

The origin of the pyritic orebodies has generally been considered post-folding replacement of limestone along fold hinges intersected by diagonal veins. Dolomitization and/or silicification of the limestone does occur on the fringes of orebodies, and scheelite occurs in both diagonal veins and pyritic orebodies. However, detailed studies at MCGM indicate that: (1) pyritic ore predates the crosscutting diagonal veins which include fragments of pyritic ore; and (2) the pyritic ore predates at least some of the asymmetric folding, as they are themselves folded, and locally transposed by the axial cleavage of these folds. These relationships suggest that perhaps not all the sulphides are of the same age; pyrite deposition may have originally predated much or all of the deformation.

Preliminary fluid inclusion and stable isotope (O, C, H and S) studies indicate that: (1) low salinity, H_2O-CO_2 fluids formed both types of veins; and (2) fluids record extensive water/rock reaction (and had high $\delta^{18}O$). Deformation, fluid-flow, and at least some mineralization and alteration were all interrelated.

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