

Structural Analysis of the Archean France River Shear Zone and Its Gold Mineralization, Chibougamau, Superior Province, Québec

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The Chibougamau mining camp (CMC), located in the northeastern part of the Archean Abitibi greenstone belt, has been the second largest mining district in Quebec from 1955 to 2008 (60.09 Mt of ore which produced 994,802 t Cu, 160 t Au and 102 t Ag). Known for its Cu-Au vein deposits, the CMC hosts shear zone-related, gold-bearing veins in volcanic and sedimentary rocks metamorphosed to greenschist facies. Existing regional studies have demonstrated the spatial relationships between this type of Au deposit and regional E-trending shear zones; however, the precise temporal relationship between deposits and shear zones has not been documented. This study evaluates the relative timing of regional deformations and gold-bearing quartz vein emplacement through a detailed structural analysis of the France River shear zone, a typical shear zone in the CMC which hosts gold-rich veins in the Monexo property, 30 km northeast of Chibougamau.

The France River shear zone, approximately 450 m wide, shows an anastomosing pattern of deformation corridors and is characterized by folds, a penetrative schistosity (S_2), and a nearly down-dip mineral and stretching lineation (L_2). Subsequently, the shear zone was affected by a strike-slip D_3 deformation characterized by a more localized crenulation cleavage and a sub-horizontal stretching lineation (L_3). Shear bands and rotation of extensional veins suggesting dextral motions are the main kinematic indicators associated with the D_3 deformation.

The structural and metallogenic evolution of the France River shear zone can be interpreted in a continuous deformation model. The D_2 deformation is associated with north directed compressive stress that generated regional folds and faults. The localization of D_2 deformation resulted in the development of discrete shear zones that facilitated the emplacement of dikes and sills of quartz-feldspar porphyry and gabbro. These intrusions predate a dextral strike-slip D_3 deformation that is constrained to the France River deformation corridor. Late quartz veins cut across all lithologies and are variably affected by D_2 and D_3 , suggesting that the bulk of the gold mineralization is late- D_2 /syn- D_3 .