The Silidor Deposit, Rouyn-Noranda District, Abitibi Belt: Geology, Structural Evolution, and Paleostress Modeling of an Au Quartz Vein-Type Deposit in an Archean Trondhjemite

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Abstract

Late orogenic gold-bearing quartz vein deposits within the Rouyn-Noranda mining district occur mainly within Archean tonalitic plutons of the Blake River Group (southern Abitibi belt). The Silidor deposit is a representative example of a pluton-hosted lode gold deposit. The Silidor mine contained 2.95 million tons (Mt; mined and estimated reserves), grading 5.1 g/t Au (~15 t Au). The mineralized zone is 900 m in length and has a vertical extent of 900 m, an average thickness of 3.5 m, and trends northwest-southeast with a dip of 50° to 70° NE. Its alteration envelope consists of a red hematite-altered trondhjemite. Measured δ18O values for quartz veins (7.7–10.9‰) and δ34S values for pyrite (–6.1 to –9.4‰) imply oxidizing conditions during gold deposition. The mineralized zone comprises: vein quartz (white, gray, and smoky varieties), beige mineralized trondhjemite, and green carbonate-sericite-fuchsite breccia, which resulted from shearing and metasomatism of an early northwest-southeast dioritic dike.

A quantitative microtectonic study (>400 measurements) was carried out on the Powell tonalitic sill in the Silidor mine area to reconstruct the deformation before, during, and after the mineralizing events. The reduced stress tensors display large variations in s1 orientation, trending successively northwest-southeast, northeast-southwest, and finally north-south. The Silidor deposit is the result of several vein-filling events, which occurred during evolution from strike-slip faulting to reverse faulting regimes, with s1 remaining northeast-southwest but with exchange of orientation of s2 and s3. Such variations may reflect an oblique collision and processes of stress permutation.

Paleostress mapping of Archean terranes can be used as a targeting tool for mesothermal lode gold deposits. Reduced stress tensors were used for the computation of paleostress maps, using a distinct element model. The Silidor Au quartz mineralization appears on these paleostress maps in an area characterized by low mean stress throughout the deformation history of the area near the Horne Creek fault. This study emphasizes the role of second-order faulting in the location of low- and high-pressure zones in the Archean crust and the possible role of a tectonic indentor in the location of Au mineralization.