The Role of Brittle-Ductile Deformation and Competency Contracts in Gold Mineralization of the C-Zone at Hemlo

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Abstract

Lithological competency contrasts and brittle-ductile deformation play a role in gold mineralization in the C-zone at the Hemlo gold mine. The mine is located along the Hemlo fault in the Schreiber-Hemlo Greenstone Belt, Superior Province. Oriented samples and mesoscopic structural and lithological observations were taken in an underground heading noted for its abundance of narrow quartz-carbonate veins suggesting brittle deformation. Microstructural analysis showed undulatory extinction in quartz, feldspar, and chlorite, as well as subgrains in quartz and feldspar. These microstructures are evidence for ductile deformation by dislocation creep. Dislocation creep in feldspar indicates this ductile deformation took place under amphibolite facies metamorphic temperatures. These narrow quartz-carbonate veins are commonly folded. Within these folded veins, smoky quartz with undulatory extinction and subgrains are evidence for ductile deformation of these veins. Ductile deformation of these veins indicates that brittle and ductile mechanisms of deformation operated during the same progressive deformation event, rather than forming during a later, cooler brittle deformation event. Darker coloured, biotite-rich units have abundant and highly folded veins. Lighter coloured, feldspar-rich units have fewer and less folded veins. The feldspar-rich lithologies are relatively more competent than the biotite-rich lithologies. Gold mineralization is most abundant in veins in the less strained feldspar-rich unit within quartz-carbonate veins. Gold hosted in quartz-carbonate veins within more competent lithologies is a significant mode of gold mineralization in the C-zone of the Hemlo gold mine.