Stratigraphic and Structural Setting of the Hemlo Gold Deposit, Ontario, Canada

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Abstract

Results of detailed surface and underground mapping and a compilation of data from the three gold mines in the Hemlo area, Ontario, are presented. In particular, the lithostratigraphy of the area is established, the nature of the lithologic units spatially closely associated with the ore and the protolith of the ore are determined, and the deformation history and the three-dimensional geometry of the area are elucidated. The genesis of the gold deposit is discussed in context of these results.

Four generations (G₁ to G₄) of ductile structures, as well as brittle faulting, are recognized. G₂ deformation is the strongest and the geometry of the Hemlo camp is dominated by macroscopic (camp-scale) “S”-shaped F₂ folds. The two ore zones at Hemlo, the main and lower ore zones, are spatially associated with the two limbs of a newly recognized camp-scale F₂ fold, the Moose Lake fold, and the orebody is folded by F₃ at outcrop scale, mine scale, and possibly camp scale. G₄ deformation is most intense in the Hemlo shear zone, interpreted to be a sinistral transpressional zone. The Hemlo gold deposit is hosted in the shear zone, mainly in the segment that trends east-southeasterly where deformation is stronger. The main gold mineralization at Hemlo occurred before G₂ or early during G₂ deformation and before peak metamorphism. The latter took place during late G₂ to after G₂ deformation.

The ore and alteration zones are dominantly, but not exclusively, spatially associated with the stratigraphically lower contact of a volcanic quartz ± feldspar porphyry (the Moose Lake porphyry). A “mafic fragmental” unit (altered felsic fragmental rock) and a barite horizon are spatially closely associated with the ore zones. The protolith of the ore is mainly the fragmental rock and the barite. The stratigraphically lower contact of the Moose Lake porphyry and the fragmental rock at the contact probably served as mechanical traps and the barite horizon as a chemical trap.