Petrogenesis of scheelite at Timmins West Mine, Timmins, Ontario.

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Scheelite ($CaWO_4$) is a hydrothermal mineral commonly found in gold deposits. It can be very useful as many major and trace elements, particularly REE, substitute into the Ca^{2+} site in its crystal lattice. This geochemical information can be used to characterize the origin of the oreforming fluids, mechanisms of mineral growth and even the genetic type of deposit. Such data can be applied to gold exploration, increasing the efficiency of finding new deposits. The current study examines the Timmins West Mine (TWM) in Timmins, Ontario, where gold mineralization occurs as quartz-carbonate veins that cross-cut “syenitic” intrusions (possibly monzonite). Gold is also thought to be associated with a main zone of deformation and shearing known as the Rusk Zone. Thus, two main hypotheses regarding the relationship between gold occurrences and the syenite arise. Firstly, gold mineralization is of a magmatic-hydrothermal origin and genetically related to the syenite, whereas the alternative is that the deformation that produced the Rusk Zone also resulted in brittle fracturing of the syenite and deposition of gold in these fractures from metamorphic fluids. Determining which event is associated with the mineralization is critical to guide future exploration. The petrogenesis of scheelite from several quartz veins at the TWM were investigated. The major and trace element concentrations, distribution, and growth zoning were established in grains using electron microprobe analysis (EMPA), cathodoluminescence (CL), and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). EMPA. CL revealed zoning only in one scheelite grain and minimal inclusions in all grains. Four scheelite grains were measured for major and trace element composition using LA-ICP-MS. These measurements were then evaluated and compared to values from literature for magmatic, hydrothermal, and metamorphic scheelites to determine what style of mineralization it most closely resembles. The low Mo and high Sr concentrations suggest a strong correlation with metamorphic fluids. This may indicate that gold mineralization is very closely associated with the Rusk Shear zone, and that tectonic activity causing metamorphism produced fractures in the brittle syenite creating a conduit for the ore forming fluid. The gold would have then had to have been deposited after the syenitic intrusion and later regional deformation events, which agrees with observed crosscutting relationships.