Trace Element analysis and ^{147}Sm-^{143}Nd age dating of Scheelite at Timmins West Mine, Timmins, Ontario.

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Gold bearing quartz-carbonate-pyrite-scheelite veins cross-cut syenitic-monzonitic intrusions at the Thunder Creek and 144 Gap deposits at the Timmins West Mine (TWM). Scheelite ($CaWO_4$) is a common hydrothermal accessory mineral at TWM, as well as other gold deposits in Archean greenstone belts globally. The geochemical information collected from scheelites can be used to characterize the origin of the ore-forming fluids, and possibly provide an age for gold mineralization. Major elements and trace elements were measured in 16 scheelite grains from auriferous scheelite-bearing veins at the Thunder Creek and 144-Gap deposits using wavelength dispersive and electron dispersive spectroscopy on an electron microprobe analyzer at Western University. Trace elements were determined by point analyses and transects using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) at the University of Toronto. The LA-ICPMS transects across scheelite grains revealed most scheelites were homogenous. The concentrations of Sr range from ~1000-2000ppm, while Mo concentrations range from ~100-300ppm, which is consistent with crystallization from metamorphic fluids. Chondrite normalized rare-earth element (REE) patterns are bell shaped with no Eu anomalies ($Eu/Eu^* = 1.0 \pm 0.1$, 2SD). This suggests that Eu was transported in its oxidized state (Eu^{3+}) in the ore-forming fluid. The Scheelites are enrichmed in intermediate REE, with average Gd_N of 1053±493 (2SD), and $[La/Gd]_N = 0.05 \pm 0.02$ (2SD). The ^{147}Sm-^{143}Nd isotopic systematics were measured for the scheelites and corresponding host veins. Whole-rock analyses were done using Multi-Collector ICP-MS at the Trent University Water Quality Center. A linear regression of the scheelite Sm-Nd isotopic compositions ($^{147}Sm/^{144}Nd = 0.2770$ to 0.4232) produced an isochron age of 2603 ± 43 Ma (MSDW = 1.4). Although this age is younger than possible related magmatic and metamorphic activity, it agrees well with U-Pb ages of gold related hydrothermal minerals in Val D'or. The average initial εNd (deviation from the Chondritic Uniform Reservoir in parts per 10^4) of 15 measured scheelites at 2.6 Ga is 1.4 ± 2.1 (2SD), indicating a depleted mantle source for the fluids. This is comparable with other measurements on Archean scheelite which typically show a depleted mantle signature. The geochemistry and age of mineralization suggests that scheelite, and possibly gold, was related to oxidized late-stage metamorphic fluids.