EAST KEMPTVILLE TIN DEPOSIT, NOVA SCOTIA: LITHOPHILE-ELEMENT MINERALIZATION ASSOCIATED WITH A TOPAZ GRANITE

Daniel J. Kontak
Nova Scotia Department of Mines and Energy
Halifax, Nova Scotia, B3J 2X1

The East Kemptville Sn(-Cu-Zn) deposit (56 million tonnes/ 0.165% Sn), located in Yarmouth Co., N. S., is North America's first primary producer of tin. Greisen-style mineralization (qtz.-topaz-cassiterite) is developed within a leucocratic monzogranite intrusion at the SW termination of the 370 Ma old, peraluminous South Mountain Batholith (SMB). The northern part of the deposit has recently been mapped (1:200 scale), revealing for the first time the nature of the host granitoid and mineralization in outcrop.

The mapped area (600 m x 250 m) is underlain (≈ 40%) by relatively pristine, leucocratic, muscovite-bearing monzogranite (Q=42%, P=33%, A=25%); the remaining surface exposure (≈ 60%) is comprised of variably altered and mineralized granite. The freshest granite samples have a fine- to medium grained, hypidiomorphic granular texture and consist of quartz, oligoclase, orthoclase microperthite, muscovite, topaz and apatite - all are considered to represent magmatic phases. Major element chemistry (N=13 wt. %) is very uniform: SiO_2 (≈74.5), Al_2O_3 (14.5-15), K_2O (3.5-4.0), Na_2O (3.5-3.9), CaO (0.4-0.7) $Fe_2O_{3(T)}$ (1.1-1.4), P_2O_5 (0.45-0.6), TiO_2 (<0.08), and MgO (0.03-0.07). Trace element (ppm) chemistry is also uniform: U (16-34), Th (5-6), Rb (900-1150), Sr (35-80), Ga (32-42), Ba (<10), Nb (26-37) and Y (25-50). Despite the relatively fresh appearance of the leucogranite, the contents of Sn (80-450 ppm), F (0.45-1.3 wt.%), Li (170-700 ppm) and W (11-44 ppm) are anomalously high, contrasting with lower values for B (<10 ppm). Much of the trace element chemistry differs from that found in evolved rocks of the SMB and, instead, is more comparable to that found in topaz rhyolites/granites and ongonites.

Mineralization occurs in the form of NE-trending greisen zones (10 cm to 10 m wide) or quartz veins as part of three paragenetically distinct stages: (i) qtz.-topaz-cassiterite±sulphide (Fe-Cu-Zn) greisens; (ii) qtz.-sulphide (Fe-Cu-Zn)±cassiterite veins; and (iii) qtz.-phosphate±sulphide (Fe-Zn±Cu) veins. Late-stage clay alteration occurs as coatings on earlier mineralized quartz veins and in altered granite.

$\delta^{34}S$ (N = 16) for all stages of mineralization is very uniform (pyrite = 5.1 °/oo; sphalerite = 5.3 °/oo; galena = 3.6 °/oo; chalcopyrite = 5.3 °/oo) and indicates a dominantly magmatic source for sulphur during all stages of mineralization. Similarly, a magmatic origin for oxygen is also indicated during the entire episode of mineralization.

Post-dating both the intrusive and mineralizing events was a shear-related deformation. The granite bears a heterogenously developed spaced cleavage, C-S fabrics and proto- to ultramylonitic textures. These fabrics all trend NE-SW, essentially parallelling the trend of mineralized structures.

It is suggested that the East Kemptville granite represents a discrete, specialized, F-rich intrusive (i.e., topaz granite) generated within a shear-related regime post-dating emplacement of the SMB. The same structure localized the intrusion and the ambient stress was responsible for the preferred orientation of mineralized veins. Later reactivation of this structure resulted in the subparallel orientation of veins and deformational fabrics.