The East Kemptville Sn deposit, southwest Nova Scotia: a product of focusing saline, F-rich magmatic fluids into an active fault zone

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The East Kemptville Sn-(Cu-Zn-Ag) deposit (ca. 56 Mt, 0.18% Sn) occurs in a medium-grained topaz-muscovite leucogranite. The leucogranite formed due to extreme fractionation of the chemically zoned, F-rich Davis Lake Pluton (DLP) which occurs at the western end of the 380 Ma South Mountain Batholith, southern Nova Scotia. Significantly, the leucogranite outcrops as an elongate body localized to the northeast-trending contact between the DLP and competent metasandstone rocks of the Meguma Supergroup. At the top of the intrusion, which is chilled against the adjacent metasedimentary rocks, occur zoned pegmatites, layered aplite-pegmatites, UST textures, aphanitic dyke, and miarolitic cavities, which indicate pressure cycling and periodic fluid saturation during the terminal stages of crystallization that is constrained to P = 3.5 kbars, T = ≤500–600°C. Mineralization occurs as structurally controlled, subvertical dipping and northeast-trending, cm- to metre-scale, zoned topaz-sulphide-cassiterite greisens and

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related, but paragenetically later, quartz-sulphide veins. The mineralization formed due to infiltration of F- and Sn-rich, saline (30–40 wt. % equiv. NaCl) fluids of magmatic origin, as indicated from isotopic data ($\delta^{34}S_{H2S}$ = +5±0.5‰, $\delta^{18}O_{H2O}$ = +8±1‰); fluid inclusion data integrated with mineral and isotope geothermometry constrain greisen and vein formation to ≤400–450°C. The maximum concentration of greisens and, consequently, the widest ore zones, coincide with northeast-trending, brittle-ductile structures which traverse the deposit. Contouring of the Sn contents from blast-hole data also define the same structural features. In addition, the presence of quartz-sulphide-albite fibre veins coating faults, quartz-sulphide shear veins and mylonite zones suggest the mineralizing fluids infiltrated an active shear zone environment, the same structure which earlier localized the leucogranite. These data indicate that the East Kemptville deposit is an unusual type of granite-hosted Sn deposit in that it formed in a mesothermal setting (i.e., 10–12 km depth) rather than in a high-level, brittle environment which is more typical of vein and greisen Sn-W deposits. It is suggested that the unusual setting related to the localization of the DLP proximal to an active fault zone resulted in the breaching of an evolved, fluid-saturated melt causing the release of F- and metal- (Sn-Cu-Zn) rich fluids, which were subsequently focused into the structurally prepared host leucogranite.