Characterizing the mineral domains of Li-(Rb-Cs) enrichment at the East Kemptville Sn-(Cu-Zn-Ag) deposit, southwestern Nova Scotia, Canada

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The ca. 380 Ma composite South Mountain Batholith contains 11 plutonic centers, including the Davis Lake Pluton that hosts the East Kemptville Sn-Cu-Zn-Ag deposit. Whereas this deposit was previously mined (1985–1992) primarily for Sn and this remains the main commodity of interest in current resource evaluations, other elements of interest and having prospective by-product credits, in addition to formerly extracted Cu-Zn-Ag, include the group I alkalis Li, Rb and Cs. However, where these latter elements reside in terms of their mineralogical sites, lithological controls (i.e., host rocks of residence), distribution, and relationship to Sn mineralization are not constrained. This study describes the nature of this Li-Rb-Cs mineralization as determined using a combination of optical petrography, Raman spectroscopy, scanning electron microscopy, and laser ablation ICP-MS.

The host metasedimentary rocks, contact zone, and topaz-muscovite leucogranite intrusion all contain Li-rich minerals which include zinnwaldite, phlogopite, muscovitetrilithionite, and tourmaline. A bulk rock control of mica chemistry is reflected by ternary element plots and a Rb-Sn-Li diagram is the best discriminate among different Li domains by rock type when used for mafic micas, but less so for muscovite-type micas. In comparison, a ternary plot of Nb-Li-Ta distinguishes among rock types for both mafic micas and muscovite-type micas. In terms of mica chemistry, phlogopite grains >600 µm typically contain >6000 ppm Li and are found within the granite, whereas grains in the metasedimentary rocks are smaller but more abundant. Overall granite-hosted phlogopite appears to be the main Li-Rb-Cs carrier in contrast to the metasedimentary rocks where muscovite-trilithionite contributes the largest portion of Li-Rb-Cs. Enrichment in Li at the contact zone may related to infiltration of wall-rock derived fluids from the host metasedimentary rocks which facilitated the growth of new mica in this zone. Overall there is a correlation among Rb-Cs-Li, whereas there is a lack of correlation of Sn with Li-Rb-Cs. Instead, Sn concentrations are higher for granite-hosted mica with Li-Rb-Cs mainly higher in the metasedimentary rock-hosted mica.

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