

### **Spectral and Compositional Characterization of Lithium-Bearing Zinnwaldite Mineralization in Eastern Tasmania**

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Lithium has many industrial applications, but as approximately 75% of its demand is for rechargeable batteries, it has become a major exploration target over the past decade. Large Paleozoic granite batholiths in eastern Tasmania intruded into a north-trending magmatic arc parallel to the active continental margin of eastern Australia. Some of the highly fractionated post-collisional granitoids potentially host critical mineral resources, including tin, tungsten, lead, zinc, silver, indium, and/or bismuth. Recently, high grade Li ores (up to 1.2 wt.% Li<sub>2</sub>O) have been discovered to associate with greisen alteration in eastern Tasmania. These mica-rich greisens are related to leucogranitic intrusions (~375 Ma) emplaced in a post-collisional extensional setting and the mineral potential of such greisens is yet to be constrained. We have characterized the spectral and chemical compositions of Li-rich minerals from altered granites at the Dead Pig prospect, to determine the genesis of greisen-hosted Li mineralization and support the exploration for this new type of Li resource. Petrographic, SEM and microprobe analyses reveal that Li-bearing mineral in the greisens is mainly zinnwaldite, intergrown with an alteration assemblage of topaz + albite + K-feldspar + quartz overprinted by fluorite ± kaolinite ± dickite. LA-ICP-MS analyses show that the zinnwaldite has an average of 1.32 wt.% Li, 12.1 wt.% Fe, 7,400 ppm Mn, 6,900 ppm Rb, 280 ppm Cs, 100 ppm Nb, and 80 ppm Sn. The zinnwaldite is characterized by extremely high Rb/Sr and low Nb/Ta ratios, with F averaged at 7.6 wt.%. Although easily misrecognized as biotite due to its black color and other similar properties, zinnwaldite shows distinctive spectral (short-wave and thermal infrared) reflectance positions that distinguish it from other micas. Our results provide insights into the origin of greisen-hosted Li mineralization and contribute to the development of a new spectral tool to aid Li exploration.