Paper Number: 2329

Evolution of greisen-type Sn-W-Li-mineralization (Zinnwald/Cínovec, Erzgebirge) - a microstructural and microthermometric approach

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Zinnwald Mine near the village of Zinnwald/Cínovec in the eastern Erzgebirge is world-famous for its Sn-W-Li-mineralization, bound to the roof of a granitic intrusion. The granitic body shows a vertical zonation, with transition from lithium-poor, porphyritic granite in the deeper parts to lithium-enriched albite-granite at shallow levels. In its upper part, the cupola is transected by several subhorizontal quartz veins, in many places surrounded by greisen.

The objective of this study is to gain new insights into the genesis of the deposit, the late stage processes taking place in the uppermost levels of a cooling granitic body, and the nature of fluids involved in these processes. One major question is whether the greisen formed by direct crystallization from residual hydrous melts or by metasomatic replacement of solidified granite at subsolidus conditions, referred to as greisenization.

Microfabrics, phase relations, and bulk chemical compositions in confined domains are used to identify possible solid-solid replacement reactions. In fact, direct crystallization from a hydrous melt or fluid phase is indicated in cases where miarolitic, intercrystalline cavities are coated by mineral assemblages with a variety of compositional zoning features and systematic overgrowth relations. For instance, at low confining pressure in a shallow granite cupola, the stability of muscovite plus quartz is typically taken to indicate crystallization at sub-solidus conditions. On the other hand, the high F- and Li-content of the melt inferred for the Zinnwald granite can shift the solidus of the system towards considerably lower temperatures, possibly allowing crystallization of muscovite plus quartz from low temperature hydrous melt.

Information on the fluids involved is provided by fluid inclusions in quartz, topaz and cassiterite which, in combination with characteristic microstructures of solid phase assemblages, promise new insights into the processes of greisen formation in a shallow granitic cupola.