
Mineral Zoning in Greisen Systems: Temporal and Spatial Evolution of the Sadisdorf Greisen and Vein-style Sn-W-Li-Cu Prospect, Germany

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The Sadisdorf Sn-W-Li-Cu prospect, Germany, hosts magmatic-hydrothermal greisen and vein-style mineralization associated to a composite granite porphyry. Here, we present petrographic and fluid inclusion data from 14 drill core intercepts covering the proximal and distal portions of the deposit. Based on this data, we aim to understand the temporal and spatial evolution of the system in order to constrain critical factors that control ore formation.

Four main mineral associations have been identified from proximal to distal with respect to the intrusion: 1) oxide, 2) oxide-sulfide, 3) sulfide and 4) fluorite. The oxide association is characterized by wolframite-cassiterite-quartz-topaz-Li-mica veins and greisen. Quartz-mica veins hosting cassiterite and/or polymetallic sulfides constitute the oxide-sulfide and sulfide associations, respectively. The fluorite assemblage consists of late fluorite veinlets and cavity-infill post-dating all previous mineral associations.

Primary fluid inclusions in quartz, topaz, cassiterite and sphalerite indicate the presence of two fluid types: a) high salinity (15-27 wt% NaCl eq.) and high homogenization temperature (Th; 270-300°C) fluid restricted to the oxide mineral association, and b) low salinity (0-13 wt% NaCl eq.) aqueous to aquo-carbonic fluid with Th ranging between 202 and 420°C in the oxide, oxide-sulfide and sulfide association, whereas maximum Th is invariably lower for the fluorite assemblage (<269°C).

Despite the overall temporal cooling trend of the system, indicated by lower Th in late fluorite, the rather constant Th of proximal and distal equivalents of oxide and sulfide assemblages does not support significant cooling along the fluid flow path during the early stage of the system along the lateral profile studied. This observation implies that the lateral mineral zoning is not a direct consequence of cooling. Instead, compositional changes (e.g., pH or fO_2) along the fluid flow path, related to e.g., water-rock interaction and/or degassing, seem to be the underlying processes that cause the observed mineral zoning.