

Linking Sn-Li-(W-Cu) Mineralization to Post-Collapse Caldera Evolution Through Cassiterite LA-ICP-MS U-Pb Geochronology

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The Sadisdorf Sn-Li-(W-Cu) prospect, eastern Erzgebirge/ Krušné hory, is one of several Sn-W vein- and greisen-style deposits that are associated to the Altenberg-Teplice Caldera (ATC) system. Cassiterite mineralization is hosted by greisen alteration and stockworks intimately related to the composite Sadisdorf leucogranitic porphyry as well as a NE-SW–striking vein system. The latter appears spatially—and possibly also genetically—unrelated to the Sadisdorf leucogranitic porphyry. Here, we applied LA-ICP-MS U-Pb geochronology to 16 cassiterite samples from the Sadisdorf prospect in order to constrain the timing of ore formation in the regional context of the evolution of the ATC.

All cassiterite ages range between 315.1 ± 3.3 and 311 ± 4.0 Ma and overlap within uncertainty across the Sadisdorf prospect—irrespective of the style of mineralization. The calculated weighted mean average ages for greisen/stockwork and vein-hosted mineralization are 313.07 ± 0.56 and 313.2 ± 1.6 Ma, respectively. This suggests that cassiterite mineralization at Sadisdorf is related to one single magmatic-hydrothermal event, albeit possibly associated to two spatially separated magmatic centers.

The cassiterite ages also coincide with the intrusion age of several microgranitic and rhyolitic dikes (314–313 Ma) that were emplaced late during the collapse of the ATC. This relates Sn mineralization to the late stages of the caldera evolution and suggests that Sn mineralization in the eastern Erzgebirge occurred 5–12 m.y. later than previously assumed. The occurrence of fertile intrusions during the late stages of a caldera evolution is documented elsewhere (e.g., Mt. Aetna, USA and Mt. Pleasant, Canada) and provides useful criteria for regional exploration targeting.