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Skarn-, greisen- and vein-hosted Sn mineralization at Geyer, Erzgebirge (Germany)

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The Geyer tin prospect is located in the western Erzgebirge (Germany) and hosts skarn-, greisen-, and vein-style alterations. Petrographic observations, mineral chemistry, microthermometry and in-situ U-Pb geochronology (garnet and cassiterite) delineate two distinct magmatic-hydrothermal events. The main tin mineralization, hosted by skarn (former marble), greisen (former granite) and fluorite-quartz veins is related to the second hydrothermal event.

The first stage of skarn alteration is characterized by skarnoid textures consisting of clinopyroxene, garnet, vesuvianite and wollastonite with only low tin concentrations (<1000 µg/g), whereas discrete Sn minerals are absent. U-Pb ages (~322 Ma) relate this skarn stage to the contact metamorphism during the emplacement of the voluminous Ehrenfriedersdorf granite. Fluid inclusions of this stage hosted in fluorite and clinopyroxene have high homogenization temperatures (460 – 480 °C) and intermediate salinities (7-11% eq. w(NaCl)), which is interpreted as the initial fluid exolved from the granite. The early phase of the second stage of skarn alteration has distinctly higher Sn concentrations (up to 50000 µg/g)) in garnet, vesuvianite, epidote, and amphibole, which are accompanied by malayaite ($CaSn[SiO_4]O$). Garnet of this stage have U-Pb ages of 307 to 301 Ma. In the late phase of skarn stage II, early skarn minerals are replaced by chlorite, amphibole and cassiterite, which presents the main Sn mineralization. Greisen- and vein-hosted cassiterite provides U-Pb ages of 308 to 305 Ma, which relate greisen, skarn and vein formation to the same magmatic-hydrothermal event. This event postdates the intrusion of the Ehrenfriedersdorf granite which was previously assumed to have caused Sn-mineralization at Geyer. Rather, the tin mineralization is related to a younger magmatic-hydrothermal event associated with a yet undiscovered intrusion. Fluid inclusions related to the second skarn, greisen and vein stages show salinities between 1.0 to 31.5% eq. w($NaCl \pm CaCl_2$) and homogenization temperatures between 255 and 340 °C. Fluid inclusions in tin-rich assemblages indicate heterogeneous entrapment, dilution of hydrothermal fluids with meteoric fluids, and an overall cooling of the system, which thus seem to have favored cassiterite precipitation.