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Constraining the time-span of magmatic-hydrothermal activity in the Variscan Orogenic Belt – U-Pb geochronology of skarn-related garnet from the Schwarzenberg district, Erzgebirge, Germany

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Europe's major Sn and W resources are hosted by magmatic-hydrothermal ore deposits of the Variscan Belt: e.g. in Cornwall, the Erzgebirge, the Iberian Massif, and the French Massif Central. In the Erzgebirge, several major skarn bodies are located in the Schwarzenberg district (12 x 15 km). Although recent geochronological data relates (skarn) ore-formation to late- and post-orogenic magmatic-hydrothermal activity, details on the nature and duration of mineralization events remain insufficiently understood.

In this study we present innovative in-situ LA-ICP-MS U-Pb geochronology of garnet from several skarn prospects in the Schwarzenberg district, which is complemented with available geochronological data on intrusions and mineralization in order to constrain the timing of skarn formation within the Variscan orogenic cycle.

Eighteen garnet dates range from 338.2 ± 2.5 to 294 ± 8.3 Ma. Associated errors are in the range of 2.5 to 8.4 Ma, but generally tend to be <7 Ma. The oldest ages (338-331 Ma, stage I) are related to metasomatic garnets of the Globenstein skarn (n=5) – a skarn that is exceptionally enriched in W compared to the other skarn prospects in the same district. Conversely, the other skarns (Antonsthal, Breitenbrunn, Hämmerlein) are younger and range from 327 to 313 Ma (stage II) and 304 to 294 Ma (stage III), respectively. Stage I and II garnets lie within the range of available zircon ages of major intrusive bodies in this area (Aue-Schwarzenberg granite suite: 334-322 Ma; Eibenstock granite: 326-311 Ma). The third stage, in contrast, does not overlap with the age of any known granite intrusions in the Schwarzenberg district. However, it coincides with widespread early Permian volcanic rocks, which presumably have intrusive roots that are not yet exposed in the Erzgebirge region.

The distribution of garnet ages implies that skarn formation occurred episodically during the ~45 Ma life-time of the Variscan orogen, with the onset of magmatic-hydrothermal activity occurring significantly earlier than previously assumed – at 338 Ma, immediately after the peak of regional

metamorphism. Tin and W deposits (skarn, greisen and vein-type) seem to have formed episodically over the entire 45 Ma orogenic cycle of the Erzgebirge – this is consistent with the age range of available geochronological data related to magmatic-hydrothermal ore deposits from other internal parts of the European Variscan Belt.