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The chemical evolution from older (323–318 Ma) towards younger highly evolved tin granites (315–314 Ma)—sources and metal enrichment in Variscan granites of the Western Erzgebirge (Central European Variscides, Germany)

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The sources and critical enrichment processes for granite related tin ores are still not well understood. The Erzgebirge represents one of the classical regions for tin mineralization. We investigated the four largest plutons from the Western Erzgebirge (Germany) for the geochemistry of bulk rocks and autocrystic zircons and relate this information to their intrusion ages. The source rocks of the Variscan granites were identified as high-grade metamorphic rocks based on the comparison of Hf-O isotope data on zircons, the abundance of xenocrystic zircon ages as well as Nd and Hf model ages. Among these rocks, restite is the most likely candidate for later Variscan melts.

In contrast to previously published suggestions (Romer and Kroner, 2015; Wolf et al., 2018), we can exclude a substantial role of intense sedimentary weathering as an important control factor for later Sn and W enrichment in granite related ores of the Western Erzgebirge due to the remarkable homogeneous Hf and low O isotopes in granitic zircons that are extremely distinct to all pre-Devonian basement rocks of Saxothuringia. We document a source enrichment from meta-sedimentary rocks (575 Ma) towards metamorphic rocks (340 Ma) were restites from granulite-facies melts are enriched 6–7 times in Sn compared to UCC (upper continental crust). These rocks are also enriched in K, but depleted in Na and Ca, contain abundant muscovite, and are fertile for later melting. Further enrichment of Sn and W occurred during multiple melt production of the older igneous granites (323–318 Ma) leading finally to a general enrichment of Sn (15 times compared to UCC) in the tin granites (315–314 Ma). Multiple melt production did not lead to a very strong enrichment of ore metals in the granites but is probably very important for a general enrichment of Sn and W in the thick granite-rich crust of the Erzgebirge. Efficient leaching by hydrothermal fluids led to a very strong enrichment (up to several orders) of Sn and W in the greisen ore bodies.

References:

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