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Early ore-forming fluids at the world-class Panasqueira W-Sn-Cu deposit (Portugal). Insights from in-situ micro-analytical techniques

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Hydrothermal fluids flowing through the upper crust formed most of the earth's ore deposits. Thus, developing methods that help to trace the fluid origin and evolution is essential to understand ore formation and to improve exploration strategies. Isotopic and trace-element compositions of minerals and fluid inclusions can be used as fingerprints of these processes and advances in *in-situ* micro-analytical methods such as SIMS and LA-ICP-MS now allow the detection of geochemical variations at the micron scale.

The Panasqueira vein-type W-Sn-Cu deposit is hosted by pelitic-psammitic metasediments of Cambrian age and related to a partially greisenized two-mica S-type granite emplaced during the late stages of the Variscan Orogeny (Kelly and Rye, 1979). White mica is one of the most abundant hydrothermal minerals in the deposit, including the greisen and wall-rock alteration zones, which predate the main ore stages. White mica is also an abundant mineral in the ore veins, from the pre-ore to the main ore stage. In contrast, tourmaline is the main phase forming the wall-rock alteration, but it is scarce in the mineralized veins, forming only locally at the edges of the veins and also in late-stage fractures.

We present results of a comprehensive set of *in-situ* microprobe (major elements), LA-ICP-MS (trace elements) and SIMS (B-isotopes) measurements of coexisting tourmaline and white mica from different settings within the Panasqueira mine. The data show that W and Sn preferentially partition into mica over tourmaline. Tungsten is almost absent in tourmaline and Sn concentration is $<$30 ppm. Interestingly, Cu is commonly below the detection limit ($<$0.1 ppm) in both phases whereas Zn has relatively high concentrations and partitions preferentially into tourmaline, reaching up to 600 ppm. Other elements such as Li and Rb have high concentrations in white mica (up to 2000 ppm).

Boron isotope variations in tourmaline from vein proximal to distal alteration zones (δ^{11}B = -4 to -13‰ Codeço et al., 2017) reflect a combination of cooling and a change from fluid-dominated to rock-dominated conditions in the transition between the early and main ore stages. The data support a magmatic fluid source, and a repetition of zoning patterns in early *vs.* late-stage tourmaline suggests multiple pulses of magmatic-dominated fluids, possibly related to periodic faulting (Foxford et al., 2000).

This study highlights the potential of combining tourmaline and white mica geochemistry to trace the hydrothermal fluid composition and source in W-Sn deposits.

References:

Codeço et al. (2017). Chemical and boron isotopic composition of hydrothermal tourmaline from the Panasqueira W-Sn-Cu deposit, Portugal. Chem. Geol. 468, 1-16.

Kelly, W.C. and Rye, R.O. (1979). Geologic, fluid inclusion, and stable isotopic studies of the tin-tungsten deposits of Panasqueira, Portugal. Econ. Geol. 74, 1721-1822.

Foxford et al. (2000). Extensional failure and hydraulic valving at Minas da Panasqueira, Portugal: evidence from vein spatial distributions, displacements and geometries. J. Struct. Geol. 22:1065-1086.