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ABSTRACT BOOK

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THE CROWN JEWELS: UNDERSTANDING ORE-FORMING PROCESSES AT THE WORLD-CLASS PANASQUEIRA AND NEVES CORVO DEPOSITS, PORTUGAL

Codeço Marta S.¹, Weis Philipp¹, Trumbull Robert¹, Relvas Jorge², Veksler Ilya¹, Gleeson Sarah A.¹

¹Geochemistry, GFZ German Research Centre for Geosciences, Germany, ²Department of Geology, University of Lisbon, Portugal

The Panasqueira and Neves Corvo deposits in Portugal are leading producers of tungsten and copper-zinc concentrates in the European Union. Both are situated in the Iberian Massif but formed in very distinct geological and temporal contexts. They have in common that in both cases, the influence of tectonic and magmatic processes, the origin and composition of the mineralizing fluids, and the hydrothermal processes involved in ore deposition are topics of much debate.

The Panasqueira deposit is situated in the Central Iberian Zone and consists of subhorizontal W-Sn-Cu-bearing quartz veins hosted by metasediments. The deposit is genetically and spatially related to a late-Variscan, peraluminous, S-type granite (ca. 300 Ma). Hydrothermal alteration of the wall rocks around the veins produced concentric zones consisting of a proximal tourmaline-quartz-muscovite zone, and a distal muscovite-quartz zone, with minor tourmaline. We addressed the question of fluid source, composition, and evolution from the results of in-situ microprobe, LA-ICP-MS, and SIMS measurements of coexisting tourmaline and white mica. Boron isotopic and trace element compositions of tourmaline, and white mica support a magmatic source for the early hydrothermal fluids. Furthermore, the fractionation of B-isotopes between tourmaline and mica provides an estimate for the temperature of vein formation (ca. 460°C) and of a later fluid pulse recorded in cross-cutting, mineralized fault zones (ca. 260°C). The in-situ LA-ICP-MS data show that Rb, Cs, Ba, Li, Nb, Ta, W, and Sn preferentially partition into white mica over tourmaline while Zn, V, and Sr do the opposite. Thus, white mica better reflects the hydrothermal fluid and its evolution, whereas tourmaline compositions reflect the composition of the host rocks.

The Neves Corvo deposit is located in the Iberian Pyrite Belt and is one of the most important volcanogenic massive sulfides (VMS) provinces globally. The Cu-Zn-(Sn) mineralization is either hosted by black shales or by felsic-volcanic rocks and formed between 366 to 358 Ma. Ongoing work aims to determine the origin and evolution of the ore-forming fluids and mineralization mechanisms by combining melt inclusions in the volcanic host rocks and fluid inclusions in quartz and ore minerals. Preliminary results show that the footwall volcanic rocks have abundant silicate melt inclusions in quartz, which is the only primary mineral that survived the hydrothermal alteration associated with the mineralizing event. The primary and pseudo-secondary melt inclusions vary in shape and size and are typically from a few microns to 100 microns in diameter. They are typically randomly distributed and are predominantly crystalline. In addition, many secondary melt inclusions form along fluid inclusion trails and fractures. Fluid inclusions around melt inclusions and along trails are in general tiny (<10 microns) and display a small bubble suggesting either low temperature or high pressures during entrapment.