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Santa Helena breccia pipe a new type of W deposit in Iberian W-Sn Metallogenic province (Borralha, N Portugal)

Ana Gonçalves, Luís Lima, Violeta Ramos, and Fernando Noronha

Institute of Earth Sciences, Porto Pole, Department of Geosciences, Environment and Spatial Planning, University of Porto, Portugal (anagoncalves.geo@gmail.com)

In Iberia belt, the main of W and/or Sn deposits are distributed all through the Central Iberian Zone and Galicia Trás-os-Montes Zone forming the so-called "Iberian W-Sn Metallogenic Province". The distribution of W and Sn deposits shows an occurrence according to alignments parallel to Variscan structures occurring where Variscan granites intrude marine series (Precambrian to Silurian-Devonian, in age).
Borralha mine, until its closure in 1985, was the second largest tungsten mine in Portugal after Panasqueira, exploiting vertical and sub-horizontal quartz veins. The ore was composed by wolframite and scheelite associated with sulphides, native bismuth and Pb-Bi-Ag sulphosalts. The total production (1904-1985) of wolframite and scheelite concentrates (65% WO_3), was estimated at about 18,500t. Borralha deposit has the particularity to have, in addition to the vein structures, two mineralized breccia pipes: Santa Helena breccia (SHB) and Venise breccia, only the first one outcropping.
SHB corresponds to a sub-vertical N-S structure cutting the contact between synorogenic granitoids and metasediments. The fragments of the breccia are mainly angular, their sizes are variable and the composition is similar to the surrounding rocks (e.g., granite, tonalite, pegmatite and metasediments). A consistent hydrothermal alteration is observed, mainly near the contact cement-fragments and in late fractures. This alteration is characterized by the occurrence of 2 generations of muscovite, quartz and 4 generations of chlorite.
The aim of this work is to give a contribution for the knowledge of a Variscan breccia pipe – SHB, which the main mineralization is of W, but other oxides (Ti, Sn, Nb and Ta), native Bi and sulphides are also present.
A drilling exploration program carried out 9 drill-cores contributing to the study of SHB.
The petrographic observations led to the definition of 4 mineralization stages: I (Ti, Sn, W, REE), II (W, Nb-Ta), III (Fe, Cu, Zn, Mo, Sn) and IV (Bi, Pb-Ag).
The second stage is the most important and is characterised by the occurrence of wolframite I and II, scheelite II and mineral phases enriched in Nb-Ta. Wolframite I (<500μm) presents several modes of occurrence: dispersed in muscovite I and II $\pm$ quartz $\pm$ Fe chlorite matrix, suggesting a crystallization in the void spaces and including cassiterite I ($\approx$200μm); in very fine-grained crystals (<20μm) replacing ilmenite and in medium to coarse-grained crystals (>2mm) usually associated with scheelite II. It is possible to observe fine inclusions ($\approx$5-20μm) of niobium-tungstate oxides, columbo-tantalite, monazite and fluorite in wolframite I. Sporadically a second generation of wolframite II, slightly enriched in Mn, in small zoned euhedral crystals ($\approx$10μm) can occur filling late fractures and/or cavities in wolframite I.
The presence of disseminated tungsten mineralization with high grades and the large volume of SHB pipe (22.5Mt, above -60 level), allows the exploitation in open pit. This type of W deposit is uncommon, only one more example is known at Puy les Vignes (French Massif Central) which was already exploited. The exploitation of a “Critical Metal” in a destitute region of Portugal would be crucial to improve the economic and social development.