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The mineralizing fluids of the Santa Helena Breccia- a unique W deposit in the Iberian Peninsula

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The Santa Helena Breccia (SHB) is a unique case of a collapse breccia with a late injection breccia in the Iberian Peninsula. The SHB is located in the NE Portugal in the contact between the Central Iberian Zone and the Galiza Trás os Montes Zone. This type of W deposit is a very uncommon example in the European Variscan Belt with only another similar deposit known, the Puy le Vignes in French Central Massif. The SHB is a sub-vertical structure, with an ellipsoidal shape with N-S major axis revealing at least 575 m in length, over 150 m in width, and at least 200 m in depth. This structural body occurs in the contact between synorogenic Variscan granites and metasedimentary rocks (Silurian in age). The lithological composition of the fragments is identical to the surrounding rocks cemented by quartz and lately cut by an injection breccia cemented by a leucocratic matrix. In the 60s of last century, a small exploitation of the SHB was performed in outcrops near two N-S subvertical quartz veins that limit SHB at east and west. The main goal of this study was to characterize and understand the behaviour of the mineralizing fluids in the breccia body.

The study of fluid inclusions in different types of quartz revealed the presence of four distinct types of fluids. The fluid 1 occurs in two phase aqueous fluid inclusions (FI) with an average salinity of 3.91 wt% Eq. NaCl, an average bulk density of 1.03 g/cc and an homogenization temperature (Th) between 250 to 300° C. Fluid 2 occurs in in three phase aqueous-carbonic FI with an average salinity of 5.93 wt% Eq. NaCl and an average bulk density of 1.07 g/cc. The lower entrapment temperature for fluid 2 was 250° C. Later in the SBH occur a fluid 3 which characterized by a lowest average salinity. The fluid 3 show an average salinity of 3.03 wt% Eq. NaCl and an average bulk density of 1.02 g/cc. The lowest Th of this fluid is 190°C. A last fluid 4 shows an average salinity of 4.00 wt% Eq. NaCl and an average bulk density of 1.03 g/cc. This fluid was entrapped at the lowest temperatures (Th between 90° and 190°C).

The FI results together with ore petrography showed that although the presence of four distinct fluids, two main ore stages occurred at SHB genetic model. The first one is characterized by the presence of the oxide minerals associated with fluids 1 and 2) and characterize the collapsing and the injection of the leucocratic rock into the SHB at higher temperature and pressure that were responsible for the W mineralization. After, a late stage where fluids 3 and 4 were responsible by a scarce sulfidic mineralization at lower pressure and temperature.

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