Assessment of Wolframite-Scheelite Replacement as a Vectoring Tool In Sn-W Lode Deposits – a Case Study of the Argozelo Mine (NE Portugal)

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The tin-tungsten ore deposit of Argozelo is a lode mineralization located in the NE sector of the Central Iberian Zone (CIZ) and included in the “Iberian Sn-W metallogenetic province”. The Sn-W quartz veins are hosted in upper Devonian CIZ metasedimentary rocks. Due to the existence of several productive granitic intrusions at a regional scale, the lode mineralization is believed to be related with a deep, hidden granitic body. Systematic core sampling, petrographic studies, and extensive microprobe analysis helped define the main ore vein phase, mineral assemblages, paragenetic sequence and a preliminary hypothesis for the chemical evolution of the magmatic-hydrothermal system. Common features of Argozelo’s ore veins include wolframite-scheelite replacement textures and the presence of euhedral fluorapatite selvages. The electron microprobe study of wolframite, scheelite and co-precipitated fluorapatite within the ore veins showed that: wolframite precipitates dominantly as hübnerite ($Mn^{2+}WO_4$); scheelite replaces wolframite by partial to total dissolution followed by reprecipitation; an early fluorapatite generation rich in Mn and Fe, and poor in Ca (Ap1) occurs with the wolframite stage, and a late Ca-rich and poor in Mn and Fe fluorapatite (Ap2) precipitates with the scheelite stage. Thus, mineral chemistry documents a progressive increase in the Ca/(Fe+Mn) ratio during the magmatic-hydrothermal fluid evolution. Since regional calc-silicate units are considered the primary Ca source, the increase in the Ca/(Fe+Mn) ratio should reflect the input of an external fluid component resulting from a progressive higher fluid-wallrock interaction. Intense wolframite-scheelite replacements, with predominance of hübnerite and Ca-rich fluorapatite (Ap2), also reflect distal deposit features, whereas fewer and less extensive wolframite-scheelite replacements, with prevailing ferberite ($Fe^{2+}WO_4$) over hübnerite and fluorapatite (Ap1) higher in Mn and Fe, suggest proximity to a causative granitic intrusion.