

Critical metal signatures reveal complex paragenesis of chalcopyrite at the Avoca VMS deposit, Ireland

FOTEINI DRAKOU¹, SEAN H. MCCLENAGHAN²

¹School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland; drakouf@tcd.ie

²School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland; mclens@tcd.ie

Volcanic-sedimentary terranes along the Appalachian-Caledonian transect are host to numerous past producing volcanogenic massive sulfide (VMS) deposits, including 16 Mt of Cu resources at the Avoca Mine. The Avoca Cu-Zn-Pb-Ag deposit is hosted by an Ordovician volcano-sedimentary sequence within the SW-NE Caledonian trend in southeast Ireland. Massive sulfide mineralisation is distributed over six orebodies that are conformable with the host volcano-sedimentary stratigraphy, but likely represent a structurally dismembered exhalative horizon. Massive sulfides in the region have been affected by greenschist facies metamorphism and deformation associated with the Caledonian Orogeny, which controls the geometry and distribution of the ore bodies resulting in a strong penetrative fabric within both the sulfides and host stratigraphy.

Greenschist facies metamorphic conditions have resulted in the recrystallization of sulfides with porphyroblastic growth of pyrite and arsenopyrite and ductile remobilisation of chalcopyrite, sphalerite and galena. Nevertheless, primary textures including chalcopyrite diseased sphalerite and colloform pyrite are locally preserved.

Laser Ablation-ICP-MS analyses of chalcopyrite at Avoca show anomalous levels of In (120 ppm) and Sn (150 ppm) in the proximal vent facies of the deposit. Analyses also revealed two distinct geochemical populations, with a fine-grained fraction of chalcopyrite exhibiting elevated contents of Sn and In, whereas coarse-grained (5000 µm) forms display lower levels of these critical metals. The spatial dissociation and distinct chemical signatures would suggest that chalcopyrite within the Avoca VMS stockwork system, was emplaced in at least two distinct hydrothermal events. Although, chalcopyrite at Avoca has experienced variable degrees of metamorphic recrystallization and remobilization, these signatures could be indicative of varying Sn-In input from magmatic sources at depth.