Microstructural features and trace element content of the chalcopyrite generations in the Hadal Awatib East Cu-Au(±Zn-Ag) VMS deposit (Red Sea Hills, NE Sudan)

J Perret[1,*], AS André-Mayer[1], L Ciancaleoni[2], R Bosc[2], C Peiffert[1], CT Barrie[3]

[1]GeoRessources, Université de Lorraine, Vandœuvre-lès-Nancy, France; [2]Arethuse Geology Sarl., Domaine du petit Arbois, France; [3]CTBA Geoconsultants, Ottawa, Ontario;

The Hadal Awatib East Cu-Au(±Zn-Ag) VMS deposit (Red Sea Hills, NE Sudan) is located in the 850-550 Ma Arabian-Nubian Shield (ANS), one of the most promising region concerning polymetallic deposit exploration worldwide. It hosts several types of deposits (VMS, orogenic gold, porphyry-type deposits) and underwent deformation stages that have affected both the geometry and the metal stock of the mineralized orebodies. The Hadal Awatib East Cu-Au(±Zn-Ag) VMS deposit is part of the Ariab mining district (Red Sea Hills, NE Sudan) that hosts numerous occurrences that have been explored and mined since 1991. This part of the East African orogeny and underwent numerous deformation stages related to ANS amalgamation that have affected both the geometry and the metal stock of the mineralized orebodies. Different generations of ore-bearing sulfide minerals, notably chalcopyrite (Ccp), have been microstructurally and texturally recognized at the Hadal Awatib East Cu-Au(±Zn-Ag) VMS deposit. Besides primary syn-volcanic Ccp_1 generation, later chalcopyrite generations occurred from syn-orogenic $D_{1/2}$ deformation stage (Ccp_2) to late orogenic D_3 deformation stage (Ccp_3), thus suggesting ore-bearing sulfide hydrothermal-metamorphic remobilization of the mineralized orebody. Furthermore, in spite of textural and microtextural evidence for reworking of the Hadal Awatib East ore, chalcopyrite trace element patterns illustrate the typical primary zoning of VMS deposits, Sb, Sn, In, As-enriched, and sphalerite-rich-massive sulfide lenses with minor Sn, As, Sb-enriched chalcopyrite to Se, Bi, Co-enriched, chalcopyrite-rich stringer zone without distinction between the distinct chalcopyrite generations. Additionally, most of the disseminated and stringer ore zones are overprinted by D_3-related late Cu-rich fluid injection resulting in a massive Se, Bi-rich chalcopyrite matrix. This suggests that younger mineralization was remobilized from preexisting mineralization with no new metal income during successive hydrothermal-metamorphic reworking events that have affected the Hadal Awatib East VMS orebody.