Mineralogical Characterization and an Insight on Silver Distribution in Sulfides at the Las Luces Volcanic Hosted Cu-Ag Deposit, Chile

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Las Luces deposit is a stratabound Jurassic Volcanic Hosted Cu-Ag deposit; Geographically located in the western area of the coastal cordillera at 50 Km of the Taltal town, Antofagasta region, Chile and metallogenetically, in the south corner of the Tocopilla-Taltal belt (S. Kojima, 2007), Mineralization is mainly hosted in basaltic andesite to andesite Jurassic volcanic-sedimentary piles (Camaraca, Ofícina Viz and La Negra formations). The characteristic mineralization styles are, vesicle infill that predominates over other styles, network of veinlets (up to ~20 um thickness) that interconnect the major open spaces and inside some breccias as late cement component, sealing remaining open space. Creation and enhancement of open space could be explained by a mixture of the following processes: at lithospheric scale, tectonic inversion in a back-arc basin, at a regional scale, hydraulic fracturing driven by circulating fluids either related or not with the mineralizing fluids and finally, molar volume reduction driven by the effects of hydrothermal alteration. The main hydrothermal alterations can be listed as follows, sodic alteration (albite-hematite-~chlorite), chlorite-calcite alteration (accompanied by specular hematite) and a late destructive alteration (white phyllosilicate-clays). The petrographic study identified as the main mineralogy, specular-hematite, pyrite, chalcocite, bornite, digenite and chalcopyrite, covellite as distal-minor phases and based on their textural relationships a paragenesis of the order of the events have been developed (see attached Image). The sequence of events starts with the Sodic Alteration characterized by albite, hematite, staining host rocks, and chlorite from the ferromagnesian phases of the host rocks; interpreted to represent an early low temperature fluid passing through the permeable areas. The second event, Chlorite-Calcite Alteration characterized by quartz, chlorite, calcite, infilling vesicles along with the saturation of specular hematite and a first generation of chalcocite (chalcocite I); it is interpreted to portray fluids of at least higher temperature than the previous event, >~190 ºC to be specular hematite stable (Dr. William Chavez Jr. verbal communication). The third event, Mineralization Stage I is characterized by, porous specular hematite, a highly porous bornite (bornite I), digenite and an interpreted undifferentiated chalcocite event. Finally, the fourth event, Mineralization Stage II is characterized by chalcocite (chalcocite II), bornite (bornite II), digenite, fringing hematite and minor chalcopyrite and covellite. Everything considered; There were at least three different mineralization cycles overprinting previously formed mineralization based on the available mineralogical and textural relationships. it can be interpreted that the fluids responsible for each cycle of mineralization were chemically similar, yielding a history of alike mineral assemblages overprinting previously formed phases that ended showing a simple set of mineral associations, even though, with complex paragenetical relationships. Finally; Electron probe microanalysis data has shown that the main mineral phases holding silver on their structure are chalcocite (average 0.10 wt% Ag) and bornite (average 0.37 wt% Ag), being the bornite the most important phase for silver, contrary of what it is expected for this set of co-precipitating minerals (Nigel J. Cook, 2011), supported by myrmekitic textures with bismuth concentrations b.l.d..

Keywords:

Las Luces, Chile; Volcanic Hosted Cu-Ag deposits; Petrographic study; Paragenesis; Ag distribution in sulfides.