The Santa Maria Pb-Zn-Cu-(Au, Ag) Deposit, Camaquã Basin, Brazil: Geology, Geochemistry and Geothermometry

Lucas F. Brito, Caetano Juliani
University of São Paulo, São Paulo, SP, Brazil

The Santa Maria Pb-Zn-Cu-(Au, Ag) deposit is hosted in the sedimentary clastic sequences of the Ediacaran Santa Bárbara Group, composed mainly of siltstones and arcosean sandstones crosscut by amygdaloidal andesites dikes. The mineralization is predominantly stratabound down to a depth of 200 m. The main ore is composed of sphalerite and galena with minor silver, chalcopyrite, bornite, and chalcocite in veins, veinlets, and lateral dissemination in sedimentary rocks. The Pb-Zn-(Ag) orebodies are enveloped by zones of intense pervasive leaching and bleaching of the sedimentary rocks with illite/sericite alteration, few pyrites, and local silicification. Below these zones, chalcopyrite and bornite occur associated with low-grade gold mineralization controlled by faults. Chalcocite prevails at the shallower levels. These copper ore minerals compose veinlet fracture infill and brecciated veins with quartz and carbonate. Sulfide-rich veins sometimes have platy calcite, indicating ore precipitation likely related to the boiling process. This deeper mineralization zone is associated with chlorite and sericite alteration halos. The sericitic alteration in this zone is more intense and has subordinated hydrothermal light green biotite. Electron microprobe analyses (EMPA) were conducted in hydrothermal chlorite and micas. Chlorite revealed composition varying between chamosite-clinochlore with Aliv from 1.2 to 2.5 a.p.f.u. and Mg/(Mg+Fe) ratio between 0.32 to 0.69, resulting in calculated temperatures from 208 to 417ºC. Ripidolite commonly occurs closer to the ore. The white mica is usually fine-grained muscovite in all the samples, with Aliv between 2 and 3 and Si ranging from 3 to 4 a.p.f.u. The biotite has a siderophyllite to eastonite composition. The chlorite geothermometry indicates higher temperatures in the copper ore zones relative to the shallower sphalerite and galena mineralization zone. The deposit geometry, ore mineralogy, and hydrothermal zoning suggest a magmatic-hydrothermal genesis, with epithermal intermediate Zn-Pb-Ag mineralization grading to porphyry-like distal Cu-Au veinlets at depth.