The mineralogical evolution of bioleached copper ore traced by SEM-MLA

S. DIERS[1], T. W. HÖFIG[1*], S. HASER[12], R. A. BOBADILLA-FAZZINI[3] AND J. GUTZMER[12]

[1]TU Bergakademie Freiberg, Freiberg, Germany (*correspondence: tobias.hoefig@mineral.tu-freiberg.de)
[2]Helmholtz Institute Freiberg for Resource Technology, Freiberg, Germany
[3]BioSigma, Parque Industrial Los Libertadores, lote 106, Colina, Santiago, Chile

Understanding the complex mechanisms of microbially-assisted leaching of copper sulfide ore is critical to develop adequate processing facilities. Most studies commonly address dissolution of mono- or bimineralic ores or concentrates. In contrast, the present study aims at revealing compositional changes in a mineralogically complex low-grade porphyry copper ore during a bioleaching operation.

We have investigated Chilean copper ore that was subject to mesophilic microbes in a leaching column over a total period of 61 days. Feed and associated bioleached samples, taken at different treatment times, have been analyzed by polarization microscopy and scanning electron microscopy (SEM)-based mineral liberation analysis (MLA).

Unlike the felsic composition of rock-forming minerals, the sulfide assemblage, primarily made up of chalcopyrite, bornite, covellite, and pyrite, was overall significantly affected by microbial leaching. This process governed the deportment of Cu, since it was predominantly hosted by bornite and chalcopyrite and subordinate covellite. Pyrite largely dissolved during the initial leaching period of 12 days. Bornite and covellite essentially disappeared between day 19 and 36, whereas the chalcopyrite content remained relatively invariable over the entire leaching period. This may have resulted from the progressive formation of an identified jarosite-like phase over time. Such newly formed sulfate species are known to profoundly impede dissolution of spatially closely related chalcopyrite (reviewed by [1]). Thus, the Cu concentration was relatively stagnant as from day 12. However, 50 % of the total Cu was eventually recovered after 61 days. The other half remained in chalcopyrite. This suggests formation of new chalcopyrite during the leaching process, since only ~35 % of the total amount of Cu was hosted by chalcopyrite in the feed ore.

[1] Li *et al*. (2013) *Adv. Colloid Interface Sci*. **197–198**, 1–32.