The Replacement of Chalcopyrite by Covellite under Hydrothermal Conditions

ZHEN HE[1,2], GUJIE QIAN[3], ALLAN PRING[3] AND SARAH HARMER[1,2]

[1] Flinders Microscopy and Microanalysis, College of Science and Engineering, Flinders University, Bedford Park, SA 5042

[2]Flinders Institute for Nanoscale Science and Technology, College of Science and Engineering, Flinders University, Bedford Park, SA 5042

[3]College of Science and Engineering, Flinders University, Bedford Park, SA 5042

In the supergene layer, covellite (CuS) is commonly found and recognized as a secondary copper sulfide. Previous studies suggest that covellite is formed by the mineral replacement reaction of chalcopyrite ($CuFeS_2$) *in situ* [1]. Limited data available for the replacement of chalcopyrite by covellite, and therefore, the reaction mechanisms are still not well-understood. Currently, the copper extraction from chalcopyrite is not cost-effective because chalcopyrite is refractory compared to other copper sulfides. In this research we aim to understand the mechanisms and kinetics of the replacement reaction of chalcopyrite by covellite/chalcocite under hydrothermal conditions enabling an extrapolation of the reaction rate at low temperatures, typical of supergene environments. The preliminary results show that the transformation of chalcopyrite to covellite can be achieved at pH 1-3 in the temperature 180-210°C. The replacement reaction rate was found to increasing as the pH decreases. The outcome of this work is beneficial to the processing of copper sulfides in the mining industry by understanding the reaction mechanisms of the replacement of chalcopyrite by covellite.

[1] Reich, M. and Vasconcelos, P.M. (2015) Geological and economic significance of supergene metal deposits. *Elements* 11, 305-310.