The Mechanism of the Reaction between Pyrite and Cu(I)-Chloride under Mesothermal to Low Temperature Hydrothermal Conditions

YUANFENG CAI[1] AND YANG ZHANG[2]

[1] State Key Laboratory of Metal Deposits Research, School of Earth Scieneces and Engineering, 163 Xianlin Dadao, Nanjing 210046, P.R. China. (caiyf@nju.edu.cn.)

[2] School of Earth Scieneces and Engineering, 163 Xianlin Dadao, Nanjing 210046, P.R. China. (Zhangyangmineral@163.com).

In some ore deposits, such as Sediment-hosted Stratiform Copper deposits, Epithermal Copper deposits and Volcanic associated massive sulfide deposits, the assemblage of pyrite, copper (iron) sulfides and iron oxides often occurs. Aims to understand the mechanism and its geological significance of of outcropping this assemblage, we use pyrite and Cu(I)-Cl solution to study the products as well as the reaction mechanism at their interface.

We conducted the reaction in a 10 mL PTFE tube. Every tube contains 6mL pH buffer solutions and one cubic-cut pyrite. The cube provides one reference shape during the leaching process. The reaction is kept under anaerobic conditions with different Cu(I) concentrations, at different temperature and different pH, and lasts different reaction time. We used X-ray Diffraction (XRD), Electron Probe Microanalysis (EPMA), Scanning Electron Microscope (SEM) and Laser Raman Microprobe (LRMP) to study the chemical composition and structure change of products.

The results show that the species of the product vary with different temperature, pH and reaction time. The main mineral compositions are chalcopyrite, bornite, digenite, anilite, hematite and magnetite etc. At low temperature (about $100^{O}C$) the pyrite mainly converts to hematite. The hematite formed in different pH solutions and much of them was found to nucleate on the bottom and wall of the PTFE tube. Chalcopyrite and bornite form in mild acid conditions while digenite forms in mild basic conditions at higher temperatures. The bornite could be the final product with the hematite and chalcopyrite as the intermidiates in mild acid solutions. However, the diginite was the final product with the hematite as the intermidiate in basic solutions. The study shows that mineral-fluid interaction involves dissolution-reprecipitation process, giving rise to migration and/or precipitation of some ore-formation elements and the processes are pseudomorphic reactions.

The project is supported by the National Natural Science Foundation of China (Grant No.41272055).