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Effect of the relative humidity on the oxidation of arsenopyrite and löllingite

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Humidity is an important factor in sulfide oxidation as it has been shown that sulfide minerals weather differently depending on the humidity. Arsenopyrite (FeAsS) and löllingite ($FeAs_2$) concentrates were placed under six relative humidities (RH) between 75% and 100% for 40 months and then studied using XRD, EMPA, Raman microspectrometry, and chemical extractions. Results of our experiments showed that oxidative dissolution of arsenopyrite and löllingite concentrates led to formation of different mineral assemblages in different amounts. Oxidative dissolution of arsenopyrite concentrate led to formation of poorly crystalline ferric arsenate (PCFA) and minor elemental sulfur, while oxidation of löllingite concentrate resulted in formation of well crystalline scorodite ($FeAsO_4 \cdot 2H_2O$) and arsenolite (As_2O_3). Our data indicated that high levels of sulfate in arsenopyrite concentrate (released from sulfide oxidation) triggered fast precipitation of PCFA and retarded its transformation to scorodite. Effect of the RH on the mineralogy of oxidation products was negligible; however, quantity of newly formed oxidation products was function of RH. The data indicated that oxidation kinetics of arsenopyrite and löllingite concentrates were relatively similar and low (corresponding up to 3.5 % of the sulfide/arsenide) at RH≤94%, but löllingite concentrate oxidized much faster (up to 10×) at RH levels close to 100%.