

The influence of chalcopyrite on the acid generating behaviour of pyrite

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Pyrite (FeS_2), chalcopyrite (CuFeS_2) and mixtures thereof, with and without quartz, were subjected to wet and dry leaching cycles to mimic natural weathering. The equilibrium stoichiometry and concentration of the resultant solution effluent species were calculated from the measured effluent pH, Eh and concentrations. To ascertain whether the end-products of the leach reactions were as anticipated the effluent pH was estimated from stoichiometric leach reactions leading to the predicted solution species.

The pH of the effluent from the samples containing sulfide only as FeS_2 rapidly decreased and after 12 weeks of leaching remained under pH 3.5. There is good agreement between the pH predicted and that measured. Negligible secondary mineralisation is observed. Reaction of the leach effluents with H_2O_2 solution led to decreases in pH commensurate with the complete oxidation/hydrolysis of Fe solution species.

The pH of the effluents from the experiments containing CuFeS_2 (both with and without FeS_2) generally remained above pH 5 for the duration of the leach. Prediction of the effluent pH for the experiments containing sulfide only as CuFeS_2 resulted in a value significantly lower than that observed. Considerable formation of the hydroxylated precipitants of Fe and Cu was observed suggesting an even greater discrepancy between the measured and anticipated pH. Reaction of the leach effluent with H_2O_2 led to a significant drop in pH that cannot be explained by metal cation hydrolysis.

The high solution pH measured for all the CuFeS_2 containing experiments, both with and without FeS_2 , may result from non-equilibrium of S aqueous species. The high pH, relatively low Eh and low solution Fe content suggests an extremely slow oxidation rate of S^{2-} containing aqueous species to SO_4^{2-} . The formation of S^{2-} species results in reduced H^+ production as compared to the formation of SO_4^{2-} . The drop in pH on H_2O_2 induced oxidation of the effluent from the CuFeS_2 containing experiments is in agreement with that predicted by oxidation of solution S content from H_2S to SO_4^{2-} .