

GSA DATA REPOSITORY ITEM 2009148

Experimental methods:

Synthesis products were characterized with X-ray diffraction (Figure 1s) and BET (Brunauer-Emmet-Teller) surface area analysis. Dilute batch experiments were conducted in ultrapure water (18.2 M Ω , Barnstead Nanopure). One g of either K-jarosite or Na-jarosite was made to 1 L volume with water within 1 L Pyrex Erlenmeyer flasks and mixed thoroughly with magnetic Teflon stir bars at 295K. 10 mL samples were removed at predetermined intervals, usually every 15 min for the first hour, every 30 min for the following two hours, and 2–6 additional samples collected hourly. Each sample was either filtered using 0.2 micron syringe filters or centrifuged at 5000 rpm for 5 min to remove remaining jarosite and reaction products from solution. The pH of the solution was measured at each sampling step using a standard KCl combination electrode. The remaining solution was refrigerated and analyzed within days using flame Atomic Absorption Spectroscopy (AAS) to measure the concentration of K or Na and Fe in solution. Sulfate concentrations were also analyzed in a subset of the samples using a barite turbidity measurement (Rossum, 1961). Jarosite dissolution in NaCl saturated brine was determined by reacting 0.5 g of K-jarosite with 500 mL of water saturated with NaCl (NaCl crystals were visible within the reactor throughout the experiment). 2 mL samples were removed from the reactors at predetermined intervals, filtered using 0.2 mL syringe filters, diluted in 18 mL ultrapure water prior to AAS analysis of K concentrations and barite turbidity analysis of sulfate and compared to NaCl- saturated standards which followed an identical dilution procedure.

Dissolution data were analyzed using the initial rate method by fitting the concentration of Na or K released versus time data to a second order polynomial, differentiating, and calculating the initial rate at $t = 0$ (Rimstidt and Newcomb 1993). Rates were normalized for surface area/molar mass to calculate the reaction rate for a standard system with 1 m² surface area per 1 kg solution (Fig. 2s)

Rimstidt, J.D. and Newcomb, W.D., 1993, Measurement and analysis of rate data- the rate of reaction of ferric iron with pyrite: *Geochimica et Cosmochimica Acta*, v. 57. P. 1919-1934.

Rossum, J.R. and Villarruz, P., 1961, Suggested methods for turbidimetric determination of sulfate in water: *J. American Water Works Assoc.* ,v.53, p. 893.

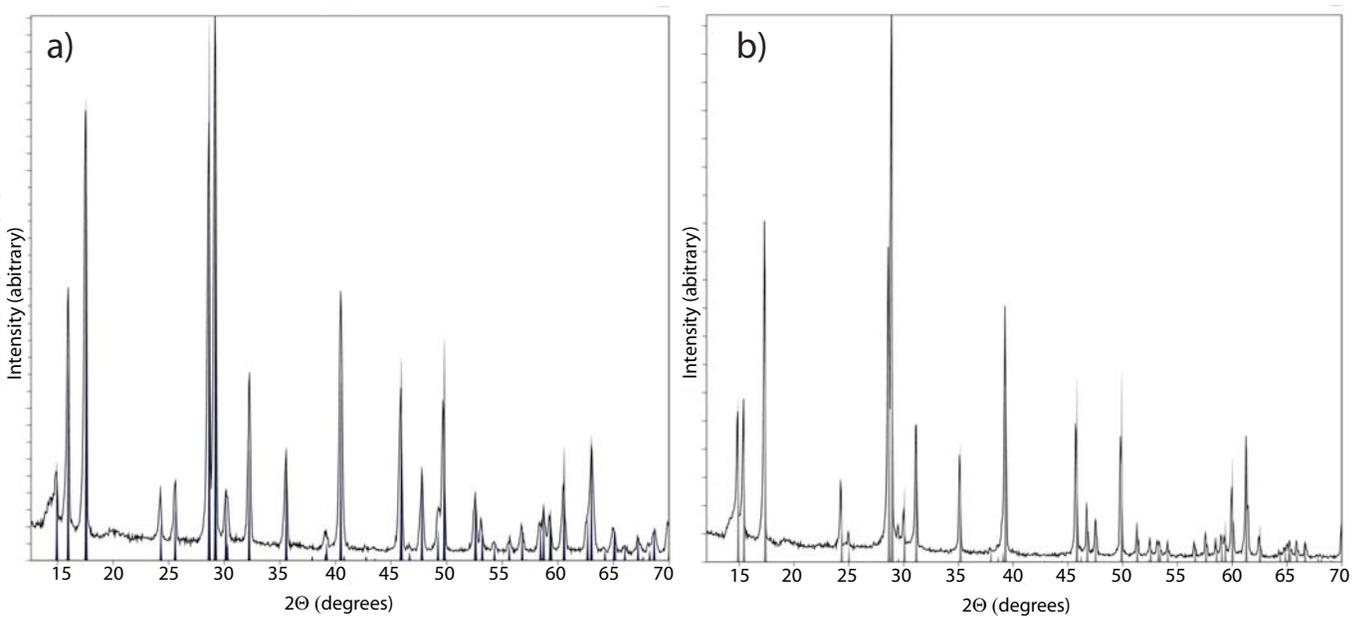


Figure 1S. Characterization of synthetic Na- and K-jarosite. The mineralogy of the synthesis products was verified using powder X-ray diffraction with a Cu source. The patterns match (a) Na- or (b) K-endmember jarosite. All peaks are attributed to jarosite.

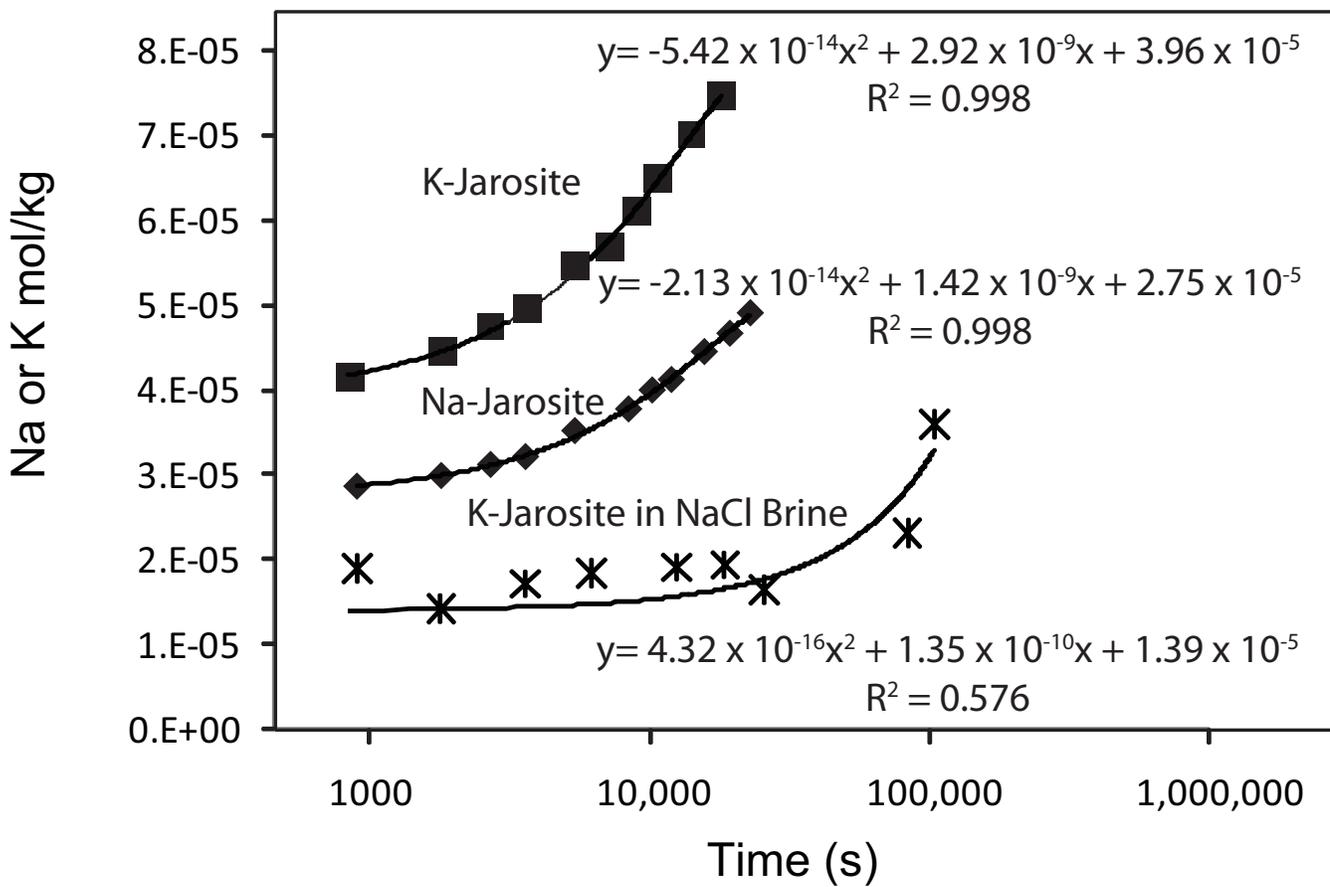


Figure 2s. Rate data and initial rate fits for three representative dissolution experiments. K-jarosite dissolution in ultrapure water (squares), Na-jarosite dissolution in ultrapure water (diamonds) and K-jarosite dissolution in Na-Cl saturated brine (asterisks). Concentration versus time data were fit with a second order polynomial and differentiated to determine the initial rate at $t = 0$.