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168-1 Spectroscopic Evidence for Fe(II)-Layered Hydroxide Phase Formation on Pyrophyllite.

Poster Number 1361

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Iron (oxyhydr)oxides are important mineral phases in the natural environment, affecting many other elements in the system, especially those that are redox sensitive. Among these phases are layered hydroxides. An Fe(II)/Al(III)-layered double hydroxide (LDH) phase has recently been shown to form from reactions between Fe(II) and Al-bearing minerals in laboratory batch reactions; however, the implications of Si and Fe(III) presence on the phase formation has yet to be examined. Understanding the effects of Si and Fe(III) are important, because silicates have been shown to alter the structure and stability of LDHs through interlayer substitution, and Fe(III) introduces an oxidant component into the system. The research presented here examines the kinetics of layered hydroxide phase formation from sorption reactions of Fe(II) on pyrophyllite, an Al-bearing phyllosilicate with structural Fe(III) impurities, at near neutral pH under anoxic conditions. Batch reactions of 3mM Fe(II) (both natural and ⁵⁷Fe(II)) with 10 g/L pyrophyllite were conducted at pH 7.5 in a 4% H₂ – 96% N₂ atmosphere. Solid phase samples were collected at reaction times up to 12 weeks. Using two spectroscopic techniques, X-ray absorption spectroscopy (XAS) and ⁵⁷Fe Mössbauer spectroscopy, it was determined that two layered hydroxide phases, both an Fe(II)/Al(III) and an Fe(II)/Fe(III) phase, and an Fe(II)/Fe(III) phyllosilicate phase formed throughout the 12-week reaction time. This study presents evidence that multiple Fe phases, both layered hydroxide and phyllosilicate phases, can form from reactions of Fe(II) with Al-, Si-, and Fe-bearing minerals. Understanding the various Fe phases that could form in such complex systems will improve our ability to model natural redox systems.

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