Kinetics of Fe-layered hydroxide formation from phyllosilicates using spectroscopy

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The effects of Al-bearing mineral structural Si and Fe(III) on Fe(II)-Al(III)-layered double hydroxide (LDH) phase formation were examined. Results of our study are shown in Figure 1.

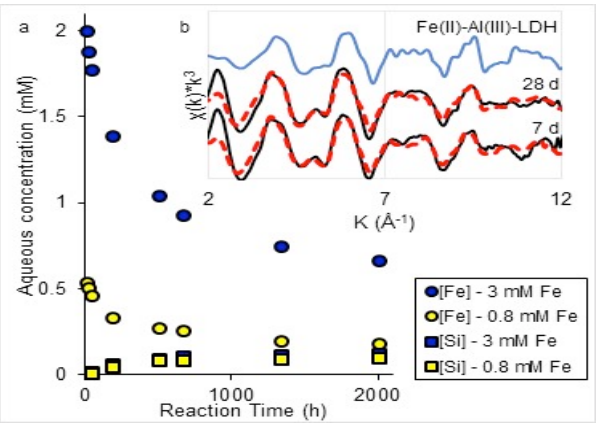

Figure 1: a) LDH formation kinetics during Fe(II) sorption reactions with pyrophyllite, an Al-bearing phyllosilicate, were examined through batch reactions of 3 mM and 0.8 mM Fe(II) with 10 g/L pyrophyllite at pH 7.5 in an inert atmosphere (4% H_2 – 96% N_2). b) EXAFS linear combination fits of sorption samples that were taken for up to 4 weeks of reaction time.

From X-ray absorption spectroscopy (XAS) and ^{57}Fe Mössbauer spectroscopy analyses, an Fe(II)-Al(III)-LDH phase formed during the 4-week reaction time. These results demonstrate the formation of Fe(II)-Al(III)-LDH phases from reactions of Fe(II) in model systems that contain Fe(III) and Si, and they suggest surface-sorption-induced electron-transfer oxidation as a source of oxidation in this system. By increasing the understanding on Fe(II)-Al(III)-LDH phase formation in laboratory model systems, we will be able to improve models of Fe redox geochemistry in natural systems.