Reactivity of nanoparticulate FeS_{1-x} (mackinawite) in suboxic and oxic conditions

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Nanoparticulate iron sulfide ($Fe_{1-x}S$ as mackinawite) forms in soils and sediments by microbial reduction of sulfate to sulfide followed by reaction of the dissolved sulfide with solid or soluble forms of ferrous iron. Similarly, $Fe_{1-x}S$ may be produced abiotically under anoxic conditions in the laboratory by reaction of equimolar quantities of sulfide and ferrous iron salts at alkaline pH. Once formed mackinawite can be metastable under sulfate reducing conditions, but may eventually form other iron sulfides phases such as greigite or pyrite in reaction with polysulfides or form mixed Fe(II)/Fe(III) or Fe(III) oxyhydroxides solid phases upon oxidation by oxygen or other suitable oxidants. The reactivity of metastable nanoparticulate iron sulfide changes with aging time and conditions through surface passivation or particle aggregation. In this presentation, reactivity of nanoparticulate $Fe_{1-x}S$, formed biogenically or abiotically, will be discussed in the context of its reaction with a variety of surface or redox active compounds such as chlorinated organic compounds, metal ions, and radionuclides, and solution conditions including pH, redox conditions, and partial pressure of CO_2 and O_2.