Effects of co-precipitated phosphate on the bioreducibility of ferrihydrite by *Shewanella putrefaciens* CN32

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Naturally occurring ferrihydrite is often associated with impurities such as phosphate and organic matter, which can considerably influence its reactivity particularly with respect to microbially induced reductive dissolution. However, past studies of the effects of phosphate on the bioreducibility of ferrihydrite have mainly focused on the impact of solution phase or mineral-sorbed phosphate, and therefore knowledge about the effects of incorporated phosphate is lacking. Therefore, we investigated the bioreduction of ferrihydrite coprecipitated with phosphate (0, 0.005, 0.01, or 0.1 P/Fe mol/mol), as well as alginate (0 or 1.00 C/Fe mol/mol), an analogue to microbial exopolysaccharides, by a model iron reducing bacterium *Shewanella putrefaciens* CN32.

At the highest phosphate loading, ferrihydrite was rapidly reduced in the presence and absence of alginate. In contrast, no significant difference in the rates of Fe reduction was observed in the absence and lower loadings of phosphate with and without alginate. However, alginate was found to significantly enhance the rate of Fe reduction across all treatments when compared to their counterparts. Phosphate also influenced the formation of the secondary iron minerals whereby a transient ferrihydrite-goethite mineral was the dominant phase observed at the highest phosphate loading. In contrast, a mixture of magnetite and goethite formed at the lower phosphate loadings. Alginate was also found to inhibit the formation of magnetite in favour for goethite. Results from this research add to the body of literature on the phosphate and iron biogeochemistry under conditions representative of the environment.