



Kinetics of Fe release from organic ligand complexes: implications for abiotic and biotic control of iron cycling in subsurface environments

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Although iron is the fourth most abundant element in the earth surface its bioavailability is limited by its natural tendency to form insoluble iron (oxyhydr)oxides in terrestrial and marine environments. In order to use iron as a nutrient, some organisms express iron-specific chelators, called siderophores. These molecules play an important role in nutrient uptake for organisms, but they are also involved in iron translocation in marine and terrestrial environments. In our study we are focusing on different biotic and pathways of iron displacement from siderophores and the subsequent iron oxide formation.

The transformation of insoluble crystal-bound iron to organic ligand-bound iron via ligand promoted dissolution is studied in detail. The reverse process whereby ferric iron is released from siderophores resulting in the precipitation of iron minerals is an important but not well studied process in soils. In such soils, siderophores and other iron chelators are translocated from near surface to deeper soil horizons. During this transport, iron is released and subsequently precipitated as iron (oxyhydr)oxides. The mechanism of this iron release process is unknown.

In a first approach to understand this mechanism, we mimic and compare the kinetics of enzymatic degradation of different ligands and the subsequent displacement of ferric iron with a reductive mechanism resulting in the displacement of ferrous iron from different ligands.