



## **Nanosized Iron(hydroxy)oxide Particles are readily reduced by iron-reducing Microorganisms**

**J. Bosch** (1), A. Fritzsche (2), R.U. Meckenstock (1)

(1) Institute of Groundwater Ecology, GSF-National Research Center for Environment and Health (julian.bosch@gsf.de), (2) Lehrstuhl für Bodenkunde, Technische Universität Muenchen

Anaerobic degradation of contaminants in association with microbial Fe(III)-reduction is nowadays considered to be a significant subsurface process. However, the rate-limiting bioavailability of the insoluble, electron accepting iron(hydroxy)oxides is still a topic of debate. Their specific surface area and mineral structure are recognized as decisive parameters for microbial reduction rates. Furthermore, recent literature reported that a significant fraction of iron minerals in the subsurface is frequently present as nano-sized colloids rather than bulk aggregates. We therefore studied the role of nano-crystalline iron forms in microbial iron reduction. In a series of batch growth experiments with *Geobacter sulfurreducens*, colloidal crystals of different ferric iron minerals were added as electron acceptors. This led to strongly increased rates of Fe(III) reduction as compared with bulk iron phases. The smaller the particle size, the more the reduction rates approached the reduction rates of chelated, soluble Fe(III) which are usually the highest observed. This was especially found with stable colloidal suspensions as compared to coagulating colloids. Apart from the high surface areas of the minerals in colloidal form we suggest that the higher reactivity of nanocrystals stems from their electron shuttling properties in suspension. This was tentatively confirmed by column experiments. Microbial reduction rates of a goethite-coated quartz sand under flow conditions were significantly elevated after adding colloidal ferrihydrite. We speculate that nano-crystalline, colloidal iron(hydroxy)oxides might have electron shuttling properties similar to humic acids and enhance the reactivity of bulk iron phases in the environment.