# The Role of Microbial Fe Metabolism in the Biogeochemical Cycle of Cd

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Microbial iron (Fe) cycling in soils precipitates, transforms and dissolves Fe minerals that usually have a high sorption capacity and is therefore intimately linked to trace metal cycling. These processes can drastically influence the mobility of potentially toxic trace metals such as cadmium (Cd), which is toxic to microorganisms, plants, and humans, causing a variety of diseases. As global supplies of phosphate fertilizers decrease, phosphate ores which are often laden with Cd, are being increasingly used as alternatives to meet demands. It is therefore essential to study the effect of microbial Fe(II) oxidation and Fe(III) reduction on the fate of Cd in order to understand the mobility and bioavailability of this metal into the environment.

We examined Cd biogeochemistry during microbial Fe-cycling. Biogenic Fe(III) minerals were formed in the presence and absence of Cd under anoxic conditions by either nitrate-reducing Fe(II)-oxidizing bacteria *Acidovorax* sp. BoFeN1 or phototrophic Fe(II)-oxidizing bacteria *Rhodobacter ferrooxidans* sp. SW2. We observed that the formation of biogenic Cd-Fe phases increases the tolerance of these microbial species towards Cd.

The mobility and toxicity of Cd was also examined during microbial Fe(III) mineral reduction. Abiogenic ferrihydrite and goethite were either sorbed or co-precipitated with Cd and introduced to the Fe(III)-reducer *Geobacter sulfurreducens.* Fluorescence microscopy revealed that Cd is potentially more toxic to these bacteria when sorbed vs. co-precipitated to goethite and overall less toxic when associated with ferrihydrite. X-ray absorption spectroscopy (XAS) showed Fe mineral transformation during microbial Fe cycling varies based on initial solid phase Cd. These results help to better understand the environmental behaviour of Cd under dynamic geochemical conditions.