

Tuesday 7th March 2023, 4.15 pm – 5.15 pm
Seminar room 208, Hochschulstrasse 4

Redox processes in soils: assessing the role of iron minerals

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ABSTRACT. Iron minerals are important reactants in a myriad of microbially and chemically mediated environmental redox reactions. As a result, the biogeochemical cycling of iron is tied to the cycling of other main elements, including carbon and sulfur, and has important consequences for the bioavailability, toxicity, and mobility of trace elements. The redox properties of iron minerals are difficult to assess because they depend on a large number of factors, including mineral type and particle size, solid phase Fe(III):Fe(II) ratio, and solution chemistry. Yet, information on these properties across different environmental conditions is crucial to predict biogeochemical processes involving iron in the environment.

Here, I present an approach to measure rates and extents of electron transfer to iron minerals and link the measured values to calculations of reaction thermodynamics in order to make findings generally applicable across environmental conditions. I highlight three projects in which I applied this approach: In the first project, I assessed how redox properties differ between various synthetic iron (oxyhydr)oxides and evolve during mineral transformations. The second project aimed at elucidating effects of mineral redox reactivity on rates of anaerobic microbial respiration in a floodplain soil. In the third project, I focused on microbial iron reduction and its effect on water quality in a heterogeneous aquifer system under groundwater flow. These three examples illustrate how we can characterize the redox reactivity of iron minerals and use the obtained information to address a broad range of research questions related to environmental biogeochemistry.

BIO. Meret Aeppli is an assistant professor and head of the soil biogeochemistry laboratory (SOIL) at EPFL. Before joining EPFL, Meret was a postdoctoral fellow at Stanford University in the department of Earth System Science from 2019 to 2022 where she studied biogeochemical controls on carbon turnover in soils and sediments. She holds a Bachelor's and a Master's degree in Environmental Sciences from ETH Zurich and obtained her PhD from ETH Zurich in 2018. She was awarded the ETH Medal for her dissertation work in which she developed novel approaches to quantify the redox properties and reactivities of iron minerals.