Contaminant attenuation by biogenic Mn and Fe oxide minerals: Lessons from their abiotic counterparts

JASQUELIN PENA[1], CASE VAN GENUCHTEN[1], ANNA SIMANOVA[1]

[1] Institute of Earth Surface Dynamics, University of Lausanne, CH-1015 Lausanne, Switzerland, jasquelin.pena@unil.ch

In soils and sediments, contaminant dynamics are coupled closely to their interactions with iron and manganese oxides. These solid phases typically occur as nanoparticles that bear significant structural disorder and are admixed with microbial biomass. Layer-type MnO_2 produced by bacteria and fungi display high sorption capacities for trace and contaminant metals and contribute to oxidative transformation of organic and inorganic pollutants. The precipitation of iron oxides under circumneutral pH environments in hyporheic and riparian zones can also be induced through bacterial activity, leading to the formation of highly disordered nanaoparticles that are embedded in an organic matrix and have large sorption capacities for trace metals and metalloids. Given their high reactivity, along with the ease and low-cost of synthesis, these biogenic minerals have the potential to be implemented as adsorbents in engineered systems and water treatment.

In this talk, we present our recent work on contaminant uptake by biogenic and Fe and Mn oxides, highlighting aspects of their surface chemistry that can be assessed through the study of chemically generated abiotic minerals alone or in composite biomass-mineral assemblages. We exploit synchrotron-based X-ray absorption and X-ray scattering methods to analyse samples under steady-state and dynamic conditions, providing basic knowledge of these mineral systems that can be harnessed for technological applications.