



Practical work/Master thesis

Period : 2012; 5-6 months (upon discussion)
Profile : Biogeochemistry, environmental sciences, hydrology
Topic : "Lab-scale wetland study for elucidating biogeochemical processes affecting copper mobility and isotope fractionation"
Laboratory : Laboratory of Hydrology and Geochemistry of Strasbourg (LHyGeS, CNRS-University of Strasbourg, http://lhyges.u-strasbg.fr/)
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Key-words : copper isotopes, reactive transfer, bioremediation, wetland systems, mesocosms

Framework

Copper is an essential micronutrient for living organisms, however, it can be a contaminant due its accumulation in soils and its transfer into aquatic ecosystems. Agriculture is one of the major sources of environmental copper contamination due to the intensive application of copper-based fungicides. **The mobilization and the transfer of copper by surface runoff** can pose a risk to downstream aquatic ecosystems due to copper toxicity for aquatic organisms. **Wetlands** can be active buffer zones between contaminated terrestrial and vulnerable aquatic ecosystems. These systems have the potential to **retain copper due to various biogeochemical processes**, such as sedimentation, sorption to organic matter or mineral phases, (co-)precipitation as minerals or plant uptake. However, the behavior of copper -and in general heavy metals- in a wetland is complex, since it is **affected by various hydrological, hydrochemical and biological processes and their interplay**. Therefore, studying of copper isotope compositions in the different wetland compartments (inlet, basin, outlet water, suspended matter, sediment and plant) represents a novel approach for evaluating biogeochemical processes **controlling its transfer in wetland systems**. A field study consisting of the monitoring of a constructed stormwater wetland receiving copper-contaminated runoff from a vineyard catchment (Rouffach, Alsace) during three months was carried out. However, simplified wetland systems are required to better understand key-processes of copper transfer. The use of lab-scale wetlands is a promising approach to better understand the behavior of copper in a well-controlled environment. In this framework, we are looking for a **highly motivated student to investigate processes controlling copper** in wetland systems. The study will be carried out within a dynamic and interdisciplinary team, in a well-equipped laboratory.

Objectives

This study aims at **understanding the transfer of copper in lab-scale wetland**: one series will be filled with wetland sediment from the stormwater wetland in Rouffach and another series with sand, under planted and unplanted conditions, with and without additional organic pesticides. The main objective is to **assess the fractionation of copper isotopes during its transfer** through the different wetlands based on both hydrochemical and copper isotope analyses of water samples regularly collected throughout the experiment.

Description

The study consists in sampling the lab-scale wetlands for further analytical and copper isotopic measurements, and interpretation of prevailing biogeochemical processes that affect copper. The study includes five steps:

- (i) Gathering the literature and background regarding copper (heavy metal) behavior in a wetland;
- (ii) Preparing and implementing the lab-scale wetlands;
- (iii) Organization of the sampling campaigns and regular sample collection;
- (iv) Hydrochemical and copper isotope analyses;
- (v) Analyzing and interpreting the obtained results (multivariate statistics and modeling);
- (vi) Wrapping up the results in a scientific report and an oral presentation (possibly in English).