Riverbank as major control of trace metal flux between river and wetland: Role of ferric deposits

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Wetlands are buffer zones that control many chemical elements environmental flux, through the high scavenging capacity of their large amount of organic matter and Fe oxyhydroxides. Under reducing conditions, waters enriched in Fe(II) and chemical elements reach riverbed and oxidized water through riverbank. In such redox interface, Fe(II) is oxidized and precipitates as solid Fe(III) in the riverbank porosity. Iron(III) precipitates are known to be strong scavenger of a large variety of elements (nutrients and trace metals) by sorption and co-precipitation. Therefore, riverbank ferric deposits may act as a "geochemical filter" between wetland and river and could be a major mechanism in chemical trapping and flux regulation. However, few are known on their structure and the subsequent impact on their capacity to immobilize chemicals.

This study aims at determining (1) the Fe speciation at this redox interface between wetland and river, (2) the associated components and the linkage processes and (3) the role of ferric deposits on the overall metal flux between river and wetland.

Riverbank sediments have been sampled in the Mercy riparian wetland of Kervidy-Naizin (Brittany, France). Their chemical and mineralogical compositions have been determined. Micro-XANES and μXRF analysis have been performed at LUCIA beamline at SOLEIL to determine the Fe speciation and the associated elements.

Micro-XRF analysis showed that S, P, Cr and Rare earth elements (REE) are correlated with Fe in riverbank sediment samples. These firt results evidence that ferric deposits influence the chemical trapping and flux regulation at the redox interface. Moreover, μXANES allowed to identify two Fe-oxides: goethite (Gt) and ferrihydrite (Fh), which exhibit strongly different reactivities regards trace metals sorption. Goethite occurs mainly as large areas in the first surface layerof the riverbank, while Fh is mixed with clays. After one centimeter Fh dominates. The presence of Gt was unexpected in such wetland area and determining the Fe oxides location in riverbank will give keys to refine the filtration processes occuring in the riverbank.