

Metal isotopic release in a contaminated peatland: redox reactivity of organic matter and Fe phases

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Peatlands are natural sinks for atmospheric carbon dioxide and are major long-term carbon (C) stores. The influence of the human activities on peatland through metal atmospheric deposits may modify the biomass production rate, the vegetation diversity and raise the question about the impact of metal release on these environments. The redox properties of peatlands are (a)biotically driven by the organic matter (OM) and elementary Fe cycles. Therefore, the reactivity of OM may lead to (i) its dissolution or precipitation on solid phases acting as redox buffers and (ii) a large degree of crystallinity of Fe(III) oxyhydroxides with different (de)sorption properties with metals. Moreover, climate models predict that the frequency, intensity and number of short-term extreme precipitation events and flood variability will increase as the global climate changes. The hydrological cycle of peatland (high water/low water) favors the formation of chemical gradients and biogeochemical processes controlling the metal cycle. During extreme water levels and flows, the source-sink balance of metals in wetlands is then unbalanced, increasing the metals exported in very short periods of time (“flash pollution”) and in partially known physicochemical forms, possibly toxic and in quantities and concentrations that we have to estimate.

The isotopic approach makes it possible to follow the behavior of the metal during its transfer from one reservoir to another through the processes of sorption, dissolution, complexation, precipitation. The multi-tracer isotopic study (Cu and Zn), coupled with the characterization of the OM, the Fe cycle and the microbial compartment, will make it possible to better quantify metal fluxes in these complex systems during extreme flood episodes.

Observing the Fe concentration changes over the depth with the Cu and Zn concentration, we assume a main trend of typical

anthropogenic profile with metal redistribution as accumulated zone, especially for Cu (Fig. 1). Moreover, first isotopic results showed an interesting anticorrelation between the Zn and Cu isotopic fractionation. That highlight the geochemical processes involved in metal remobilization in such environment favorable to redox gradient.

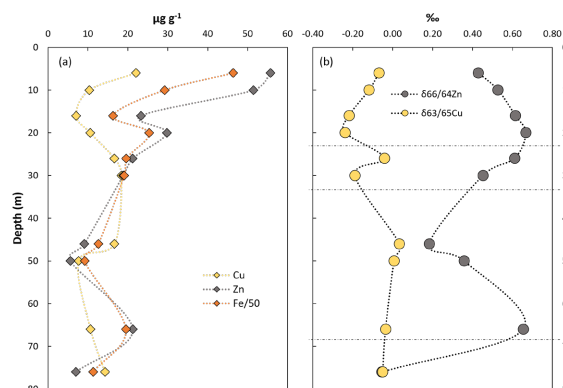


Figure 1: (a) Copper, Zn and Fe concentration in a peat core and (b) their Cu and Zn isotopic signature (Las Conchas peatbog).