

## Release of trace metals in soil suspensions as affected by redox potential and temperature

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The redox potential is a master variable for the behavior of trace (semi)metals in the soils and sediments environment. In this study we investigated the influence of redox potential and temperature on the solubility of trace metals. A humic topsoil of a floodplain soil at the river Wupper in Northrhine Westphalia, Germany, was chosen. The total amounts (aqua regia) were for Zn 903, Cu 551, Pb 354, Ni 93.5, As 35.7, Co 22.4, Sb 20.5, Cd 8.3, and Mo 6.5 mg kg<sup>-1</sup>. Microcosm experiments were performed under controlled redox and temperature conditions at 500, 300 and 100 mV and at 7, 15 and 25 °C, respectively. Soil suspensions were obtained at different intervals and analyzed by ICP-MS for trace metals.

Most of the metals demonstrate an increase of concentration with lowering the redox potential. Especially Co and Mo showed a strong increase that is expressed by a high correlation between metal activity and pe+pH. Increasing the temperature resulted in a quicker decrease of the redox potential that can be explained by a higher activity of microorganisms. Only Sb revealed after a first increase a continuous decrease in its concentration. Responsible for this feature are presumably gaseous losses due to biological methylation.

Metal behavior depends among other things on the amounts of adsorbents. The most important adsorbents for Mo and Co are iron and manganese oxides. Under reducing conditions these oxides are dissolved and metals are liberated. However, for Pb, Cd, Cu, Zn, Ni and Cr other processes like complexation or pH-depending sorption are also important.

## Calcium isotope fractionation in alpine plants

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The presence of vegetation has a major impact on the biogeochemical cycles of many elements, through uptake, recycling and the acceleration of weathering rates. As one of the essential plant macronutrients, the biogeochemical cycle of calcium is particularly affected. Calcium uptake by plants is one of the few processes known to fractionate stable calcium isotopes, but the mechanisms of this process and the impact of vegetation on the Ca isotope ratios in runoff are poorly understood. This study aims to increase understanding of the fractionation processes during uptake and translocation within plants by analysing the calcium isotopic composition of alpine plants taken directly from a granitic, glacier forefield (BigLink CZO, Damma glacier, Switzerland).

Stable calcium isotope fractionation was measured (double-spike TIMS) in various species of alpine plants, including woody species, grasses and herbs. Analysis of plant parts (root, stem, leaf and flower samples) provided information on Ca isotope fractionation within plants. Additional seasonal sampling of leaves revealed temporal variation in leaf Ca isotopic composition.

There was significant Ca isotope fractionation between bulk soil and both root tissue ( $\Delta^{44/42}\text{Ca}_{\text{root-soil}} \approx -0.40\text{‰}$ ) and whole plant Ca isotopic compositions. Ca isotope fractionation between roots and leaves was species dependent, with negligible fractionation between leaves and roots in some species and isotopically heavier leaves compared to roots in others. Ca isotope ratios increased with leaf age in woody species but remained constant in herbs and grasses. The large Ca isotopic difference between root tissue and bulk soil is considered to be caused by the preferential binding of isotopically-light Ca to root adsorption sites. Several factors such as presence of a woody stem, root cation exchange capacity, presence of Ca oxalate and levels of mycorrhizal infection are likely to contribute to the observed differences in whole plant Ca isotopic compositions both between and within species.