

## **Copper sequestration in mofettes – how geogenic carbon dioxide affects binding to organic matter and mineral precipitation**

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Increased soil CO<sub>2</sub> contents can significantly alter soil conditions [1] and the mobility of metal(loid)s [2]. Mofettes (natural CO<sub>2</sub> degassing sites) represent excellent sites to study CO<sub>2</sub> influence with conditions changing from permanently anoxic in the degassing centers to non-CO<sub>2</sub>-influenced, oxic soils within only some meters distance.

We investigated the influence of CO<sub>2</sub>-induced changes in soil conditions on the mobility of metal(loid)s by determining the spatial distribution of several trace elements over a mofette site. Especially Cu showed a complex behavior with lowest soil contents in zones of moderate CO<sub>2</sub> influence and strong accumulation in degassing centers. Cu sorption isotherms determined in experiments with natural organic matter (NOM)-rich topsoil from a transect over a mofette and X-ray absorption spectroscopy analyses of natural and Cu-spiked soil samples revealed two main processes of Cu sequestration: At low to moderate CO<sub>2</sub>, Cu(II) was mainly adsorbed to NOM, with Cu mobility increasing towards the mofette center due to an increase in the dissolved to solid ratio of NOM. However, at >90% CO<sub>2</sub> in soil air, reduction and precipitation as Cu sulfide minerals again limited Cu mobility and led to accumulation in the solid phase.

Representative for other soils influenced by anoxic gasses, our results show exemplary that increased Cu mobility due to high dissolved NOM concentrations can become problematic, e.g. at contaminated sites, while Cu mineral precipitation might negatively influence plants and microbes due to limited bioavailability of this essential trace element.

[1] Rennert and Pfan (2016) *Geoderma* **280**, 73-81.

[2] Mehlhorn *et al.* (2014) *Chem. Geol.* **382**, 54-66.