



Release of arsenic from a Haplic Gleysol under controlled redox conditions

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The redox potential (EH) governs the solubility of trace elements in soils, mainly by the reductive dissolution of iron (hydr)oxides, which are important adsorbents. Similarly the species distribution of some trace elements in soils strongly depends on EH. Species distribution in turn affects the solubility and toxicity of trace elements. Hence, the EH is a master variable for the behaviour of trace elements in soil. Arsenic is such a redox-sensitive trace element. In the lowlands of southern Münsterland, North Rhine-Westphalia (Germany), various Gleysols under grassland recently have been found to be naturally enriched with arsenic. Field measurements at such a site revealed high variations in soil EH during the course of the time with a range of 900 mV. We initiated a laboratory study to determine the effects of different redox regimes (oxidizing, moderately reducing and reducing soil conditions) both on the solubility and speciation of As.

The batch study was performed using the AhBg, Bg1 and Bg2 horizons from a Haplic Gleysol. Total arsenic contents increased with increasing soil depth from 121, 613 to 1.004 mg/kg As. Fixed redox potentials in stirred soil suspensions were achieved by flushing closed glass microcosms with either N₂ or air during 40 days. Redox potential and pH of the suspension were continuously recorded. In intervals of 48 hours, subsamples of 40 ml were taken from a sampling port by a tube connected to a vacuum filtration device (0.45 μm). The filtrates were analyzed for DOC, TIC, nitrate, sulfate, phosphate, and total Mn, Fe and total As. Also, Fe²⁺ and As(III) were determined.

First results indicate that lowering EH from 450 to -100 mV (pH 7) results in a significant increase of pH and concentrations of DOC, TIC, total Fe, Fe²⁺, Mn, and total As in solution. Significant concentrations of As(III) could be observed at EH values below 100 mV.