

Arsenic speciation and distribution in peat deposits of the Hetao Basin, China

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The shallow (< 100 m) groundwater in Hetao Basin (13,000 km²) located in the Yellow river catchment in China, is highly contaminated by As. Several peat layers were found to contain between ~40 and ~300 mg/kg As in deposits that formed concurrently during the paleolake deposition. An evaluation of As partitioning and distribution in these peat layers is helpful for understanding the patchy distribution of groundwater contaminated with high As concentrations.

In this study, three peat layers from different depths from two boreholes (~80 m) were analysed. Moessbauer analysis combined with Fe K-edge X-Ray spectroscopy (XAS) showed Fe-bearing phases to be mainly silicates and Fe sulfides including greigite and pyrite, while iron oxides are only minor phases under the strong reducing conditions of the peat formation. Speciation and reactivities of As were examined by As K-edge XAS analysis and sequential extractions. Results suggested that large proportions of As are incorporated and adsorbed onto Fe-sulfides and organic matter. Furthermore, field emission scanning electron microscopy (FE-SEM) and electron probe microanalysis (EPMA) were used to examine the distribution and concentrations of As in framboidal and massive pyrite and greigite. Results showed that As substitutes S in pyrite independently of grain size and shape with contents varying from < 90 mg/kg (detection limit of EPMA) up to around 1.2 wt % with an average value of 3100 mg/kg. Compared with pyrite, the average As concentration in greigite (900 mg/kg) is clearly less. This study provides a new insight for the As sequestration process in lacustrine peat horizons.