



## **DOM induced iron and sulphate reduction promotes arsenic mobility in column experiments**

M. Raber, M. Bauer, S. Peiffer, C. Blodau

Limnological Research Station and Department of Hydrology, University of Bayreuth, Germany (markus.bauer1@uni-bayreuth / Fax: +49921552366)

A number of case studies emphasize a link between high organic matter content of aquifers and increased arsenic concentrations in aquifers (McArthur et al., 2004). Organic matter, as microbial substrate, leads to metal oxide dissolution and arsenic release under reducing condition (Islam et al., 2004). In the presence of sulphate and with enough organic carbon for sulphate reduction, arsenic is immobilized again in sulphide precipitates (O'Day et al., 2004). Quality and supply of organic compounds, therefore, determines whether arsenic mobility window between iron and sulphate reducing conditions is met.

We tested this hypothesis in column experiments (1,9 kg of solid phase, 85 % HCl washed quartz sand, 15 % quartz sand coated with amorphous iron oxide) receiving different organic matter influent concentrations. The column was sorbed with arsenic and spiked with peat containing iron/sulphate reducers. The mobile phase included leaf litter DOM in concentrations of 0, 20 and 100 ppm C. The column effluent was sampled for As(tot), Fe species, H<sub>2</sub>S and gases (CO<sub>2</sub>, CH<sub>4</sub>). After the experiment solid phase extractions (amorphous oxides, TRIS) were conducted.

In contrast to the DOM free reference column both DOM fed columns soon showed signs of microbial activity (increased in CO<sub>2</sub> from 0,5 to > 2 mmol/L) and iron reduction (Fe(II) formation) in the effluent. A maximum in mobile iron concentration was followed by a steady decrease, correlated with the appearance of H<sub>2</sub>S. This reaction sequence was similar for both carbon concentrations, but started earlier and had a higher intensity in the 100 ppm C column. The colour of the column material changed from orange/red to grey/black and bleaching on the inflow side could be observed. This is explained by solid phase extraction data, showing almost complete iron reduc-

tion/depletion especially on the inflow side of the column. The arsenic concentration in the effluent of the 100 ppmC column mainly follows the dynamics of iron. Concentration increases with the appearance of solute iron and drops when free iron values decline. The 20 ppm C column however showed almost no As in the outflow, even though iron depletion and H<sub>2</sub>S production occurred.

The results show, that iron and sulphate reduction in the high DOM system were decoupled in time, leading to fast oxide dissolution and high As export. In the low DOM system As export was low, which can be explained by slower release from the oxides and parallel fixation in sulphide form.

#### References:

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McArthur JM, Banerjee DM, et al.: Appl. Geochem. 2004; 19: 1255-1293.

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