Arsenic contamination in an anoxic aquifer in southwest Germany: Assessment and process studies

M. ISENBECK-SCHRÖTER*, M. MAIER, S. AL NAJEM, N. SALM AND C. SCHOLZ

Institute of Earth Sciences, Heidelberg University, INF 236, 69120 Heidelberg, Germany (*correspondence: Margot.Isenbeck@geow.uni-heidelberg.de)

Arsenic groundwater contamination due to the infiltration of arsenic bearing sewage has been assessed analysing groundwater and aquifer material on an abandoned industrial site in the quaternary aquifer in the Upper Rhine Rift, southwest Germany. The contamination plume is about 800 m long, 200 m wide and 20-30 m deep. Detailed studies were performed in order to investigate the redox state and the binding forms of arsenic in the water and in the aquifer material, respectively.

A cross section of four liner boreholes along the plume was drilled and analysed in detail as well as 20 direct push soundings in the center of the contamination. Groundwater was sampled using filtered groundwater wells and the direct push boreholes. The analyses lead to a detailed assessment of the contamination extension and mass. This assessment could also be used to characterize the mobility of both arsenic redox species.

The transport processes in the aquifer were studied more in detail using column experiments with contaminated material under oxic and anoxic conditions. It could be shown that surface complexation and microbial redox processes dominately influence the arsenic mobility under anoxic conditions. The reduction of As (V) to As (III) following iron reduction seems to be the dominating process under the aquifer conditions.

Similar processes have also been observed during field studies with As (V) input into the Cape Cod Aquifer [1]. Both sites are characterized by an iron dominated redox system. They are anoxic due to contamination with sewage of organic contaminants. The sites differ in the geochemical milieu; whereas the contaminated site in the Upper Rhine Valley is a carbonate system, the Cape Cod aquifer is acidic.

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[1] Höhn *et al*.. (2006): *J. Cont. Hydrology* **88**, 36-54

U-Pb dating of Eoarchaean zircons using a NanoSIMS

AKIZUMI ISHIDA[1], NAOTO TAKAHATA[1], YUJI SANO[1], JEAN DAVID[2], AND DANIELE L. PINTI[2]

[1] Atmosphere and Ocean Research Institute, the University of Tokyo (e-mail:ishiaki@aori.u-tokyo.c.jp), [2] GEOTOP, Université du Québec à Montréal

Volatiles, such as hydrogen or sulphur, included in Eoarchaean igneous rocks, have crucial information to reveal about the evolution of the early Earth. Apatite and/or glass inclusions, found in zircon crystals, are expected to preserve primitive information of such volatile elements. NanoSIMS is one of the more powerful tools for micro-scale analyses including precise *in situ* U-Pb dating of zircon.

We performed ^{238}U-^{206}Pb and ^{207}Pb-^{206}Pb zircon dating using a NanoSIMS 50 ion microprobe at the University of Tokyo, with the method developed by our group [1]. The targeted zircons were separated from a tonalite of the Eoarchaean Nuvvuagittuq supracrustal belt, Superior Craton, Canada. The reported U-Pb age of this tonalite is 3661± 4 Ma [2]. Euhedral to subeuhedral zircon crystals were picked up. Some of them have a zoning structure. Glass or apatite inclusions, whose size were 10 to 30 micrometers in diameter, were found in the crystal.

After the correction of common lead, ^{238}U/^{206}Pb* and ^{207}Pb*/^{206}Pb* ratios of 20 crystals were plotted on Terra-Wasserburg Concordia diagram. They showed a Discordia suggesting recent Pb loss. The intersection of Concordia and Discordia indicates that the age of this rock is 3637 ± 19 Ma, which agrees well with previous study. Now we are trying to measure the volatile compositions of inclusions in theses zircons.

[1] Takahata *et al*, *Gondowana Res*., 14, 587-596, 2008. [2] David *et al*, *GSA Bulletin*,121, 150-163, 2008.

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