

## Kinetics of arsenic sorption on aquifer sediment from Bangladesh imaged by XRF microprobe in flowing columns

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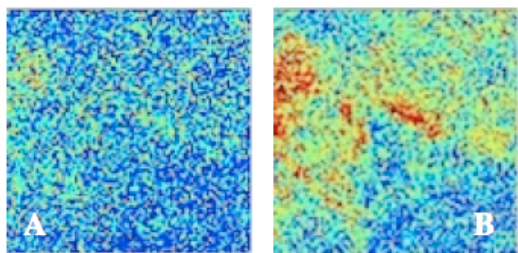
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To avoid groundwater arsenic (As) contamination, much of the population of Bangladesh depends on deeper wells that are low in As. Pumping these wells could draw high-As groundwater into currently As-safe aquifers. This research examines the mechanisms of As adsorption on natural aquifer sediments that can help retard the migration of As.

Freshly collected sediment from a low-As aquifer in Bangladesh was used for sorption kinetics studies in low-O<sub>2</sub> batch reactors set up in the field with *in situ* (unoxidized) groundwater, as well as in two small columns run under a synchrotron beam for ~20 hrs. Sorption of As onto column sediments was monitored by continuous X-ray fluorescence (XRF) imagery at 2 or 3 μm resolution, and Fe mineralogy was assessed by XANES at several representative points.



**Figure 1:** Same-scale and co-located XRF images of As on column sediment at time 0 (A) and after 16 hrs of continuous flow (B). Warmer colors indicate higher concentrations.

Results from both batch and beam column experiments consistently indicated that As adsorption proceeded at a high initial rate ( $k \sim 0.5 \text{ hr}^{-1}$ ) over the first 1-3 hrs, after which it progressively slowed down by 1-2 orders of magnitude. Sites responsible for rapid initial adsorption varied widely in mineralogy and reactivity, while later adsorption rate was more uniform and focused on sites correlated to Fe concentrations. Microscale measurements supplement the macroscopic data and indicate that As transport is kinetically limited by diffusive processes on the grain scale or smaller.

## Copper and lead isotope ratios as tracers of soils pollution from the Kombat mining area, Namibia

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Copper (Cu) and lead (Pb) concentration, isotopic composition (<sup>65</sup>Cu/<sup>63</sup>Cu, <sup>206</sup>Pb/<sup>207</sup>Pb) were studied in contaminated and non contaminated luvisols and mollisols from the Kombat mining area, Namibia. The Cu and Pb concentrations in the studied soils ranged between 21 mg/kg – 757 mg/kg, and 19 mg/kg – 815 mg/kg respectively. Concentration of both metals increased with increasing soil depth. The Pb isotopic signatures (<sup>206</sup>Pb/<sup>207</sup>Pb) in soils ranged between 1.15 – 1.21. In most of soil samples, surface horizons exhibited lower <sup>206</sup>Pb/<sup>207</sup>Pb ratio, which originates from the slime dust pollution (<sup>206</sup>Pb/<sup>207</sup>Pb ~ 1.15) compared to deeper soil horizons, with lithogenic Pb signatures. Isotopic composition of Cu differs on contaminated and uncontaminated sites and cultivated and non-cultivated sites. The  $\delta^{65}\text{Cu}$  in the studied soil horizon ranged between -0.373 ‰ and 0.561 ‰. The most pronounced variations occurred in contaminated non cultivated soils (0.529 ‰). The contaminated surface horizons are enriched in isotopically heavier Cu (tailing materials), and  $\delta^{65}\text{Cu}$  decreased with depth. Fractionation of Cu isotopes in soils is attributed to mobilization of lighter isotope, and preferential binding of heavy isotopes on secondary soil components. This study was supported by the Czech Science Foundation (project P210/12/1413) and IGCP project no. 594.