

# **TEM observations of interaction products between microbes and As-rich muddy sediments in Bangladesh**

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Arsenic contamination of groundwater in Bangladesh has become a serious health problem recently. We examined mineralogically all the pertinent mineral species: pyrite, its precursors, several types of Fe oxides (or hydroxides) and possibly organic matters contain arsenic. We examined interaction effects between microbes and muddy sediments in Bangladesh which contain more arsenic than sandy sediments.

Culture experiments were carried out for a week, using Sakurai medium (polypepton, yeast extract, glucose) in anaerobic environment of nitrogen gas. Arsenic was released from sediments into water in the bacteria-rich environments. The bacteria themselves were coated with amorphous Ca-P-(Fe) minerals. On the other hand, culture products of only sediments + distilled water did not show release of arsenic. Interaction between microbes and the sediments in aerobic conditions was also examined. In the experiments with glucose, thin film formed on the water surface. The film contained many iron bacteria and was clarified to be nanocrystalline iron hydroxides,  $\text{Fe}(\text{OH})_3$  with arsenic. In the tube well water in Bangladesh, some yellowish brown precipitates soon formed. They were *Gallionella Ferruginea* and precipitates of nanocrystalline iron hydroxides with arsenic.

The precipitates formed in these bacteria-rich environments were found by HRTEM to be randomly oriented nanocrystals. We also discuss possible dissolution mechanisms of arsenic into groundwater and bacterial effects to arsenic behavior.