

A Study of Synchrotron-based X-ray Microscopy: Activity and Diversity of Sulphate-reducing Bacteria in Alluvial Aquifers of Taiwan and Bangladesh

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Aquifer sediments were collected from northwestern part of Bangladesh, southwestern part and northwestern part of Taiwan for X-ray microscopy analysis. Arsenic -bearing mineral phases ranged from amorphous to more crystalline forms as well as their morphology in sediments were distinguished by using X-ray microscope. Morphology of sulphate-reducing bacteria was distinguished by using X-ray microscope but the sulphate- reducing bacteria was limited so it was difficult to identify. Experiments will have to be conducted on 01B1 beam line at National Synchrotron Radiation Research Center (NSRRC), Hsinchu. X-ray microscope allowed unique characterization of iron oxide mineral and sulphate-reducing bacteria in sediments of different part of plains at the 0.5 nm scales and high spectral resolution spectroscopy.

Fe-oxides occur in different forms in these sediments. A typical grain of iron oxide in sandy sediments is shown in Figs. 1-3. Small spheres of Fe-oxyhydroxide are present in the sandy sediments at different depths. Small grains of goethite were found in the sandy sediments (Figs. 1- 3). The As-bearing Fe-oxides are not uniformly distributed, even in the shallow sandy sediments. Figures. 1-3 show goethite-coating quartz grains in the sandy sediments which collected at different depths from three different plains.

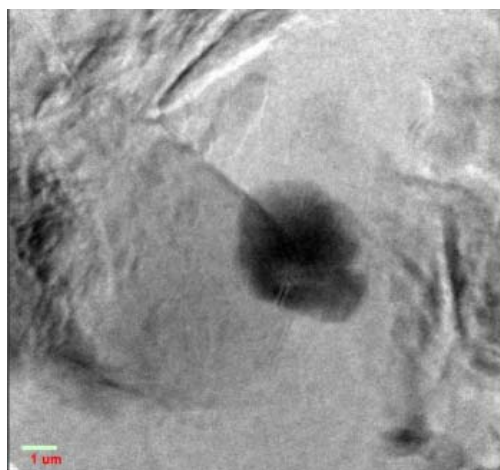


Fig. 1: X-ray microscopy image of Fe-oxyhydroxide mineral (goethite) grain found in sandy sediments layer or coating on quartz grain in sands at depth of 4m of Jorgachi core sediments from Bangladesh.

FeOOH is very important mineral in sediment because it acts like a scavenger to grab arsenic and finally due to microbial (sulphate-reducing bacteria) reductive dissolution of iron oxyhydroxide, arsenic releases into the groundwater from the sediments of different plains.

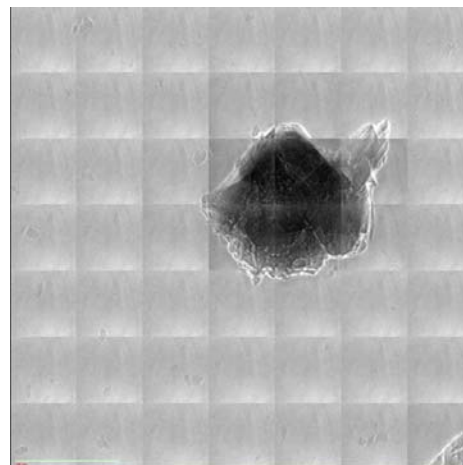


Fig. 2: X-ray microscopy image of Fe-oxyhydroxide mineral (goethite) grain found in sandy sediments layer or coating on quartz grain in sands of core sediments from 25 m depth of Jorgachi core.

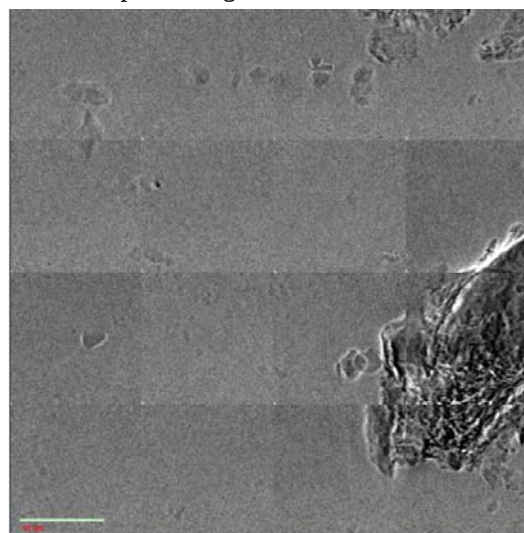


Fig. 3: X-ray microscopy image of Fe-oxyhydroxide mineral (goethite) grain found in sandy sediments layer or coating on quartz grain in sands at depth of 145m of core sediments from southwestern part of Taiwan.