Biogenic iron oxides are efficient contaminant sorbents

D. FORTIN[1] AND E.J. ASHBY[1]

[1]Department of Earth and Environmental Sciences, University of Ottawa, 25 Templeton St., Ottawa, Ontario, Canada, K1N 6N5, dfortin@uottawa.ca

Biogenic iron oxides (BIOS) form when Fe(II)-rich anoxic waters encounter sub-oxic conditions which are ideal conditions for neutrophilic iron oxidizing bacteria. The end result of their metabolic activity is the formation of occasionally large accumulations of poorly ordered iron oxides mixed with bacterial exopolysaccharides (in the form of sheaths and stalks). XRD analysis indicates that BIOS are mainly composed of poorly ordered ferrihydrite but small amounts of lepidocrocite and goethite are also present. BIOS present in pH-neutral mining-impacted areas have been shown to immobilize large quantities of toxic metals, including Cu and Zn and metalloids, such as As. Microbial reduction experiments have revealed that both Zn and As are likely bound to the iron oxide fraction of BIOS whereas Cu appears to be associated with the organic fraction. More recently, iron-rich biofilms collected from acid mine and acid rock draiange areas were analyzed for their REE content. Results indicate that REE sequestration is strongly pH dependent. Lower pH values are associated with greater aqueous REE concentrations whereas, higher pH values are associated with greater biofilm REE concentrations. The total REE content of dried biofilms measured two to five orders of magnitudes higher than the REE content of co-existing waters. Ongoing experiments have been designed to assess which component of BIOS immobilizes REEs, i.e., the organic fraction or the mineral fraction. In summary, natural BIOS play a key role in various contaminants' fate and have the potential to be used to clean-up contaminated areas as long as oxic conditions are maintained within BIOS in order to prevent reduction and contaminant release.