

Characterization of biogenic iron minerals formed in mine sediments

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Bacteria participate in the cycling of Fe in environments and produce biogenic Fe minerals. Biogenic Fe minerals are different from abiogenic Fe minerals because biological Fe mineral formation is relatively slow in comparison to the abiotic oxidation of Fe(II). Therefore, biogenic Fe minerals were characterized and compared with abiogenic Fe minerals. Biogenic and abiogenic Fe minerals were collected from stream sediments near coal mine and metal mine, respectively, and total elemental concentrations of collected samples were analyzed using ICP-OES. Most of collected samples were comprised of higher than 30% of Fe. Abiogenic Fe minerals contained 0.4-0.7% of As, which might be a limiting factor in the growth of Fe oxidizing bacteria. SEM-EDS results confirmed that they also contained sulfur, which is an indicative of the formation of schwertmannite. Biogenic Fe minerals have higher C content compared to abiogenic Fe minerals because of extracellular organic substances mainly composed of polysaccharides. Morphological analysis using SEM showed twisted stalks associated with Fe minerals, which is an evidence of the growth of *Gallionella* sp., although bacterial cells were not found. Mineralogical analysis using XRD did not show the presence of Fe minerals possibly due to the amorphous nature of Fe minerals formed. X-ray absorption fine structure spectrometry (XAFS) analysis indicated that Fe minerals formed were schwertmannite or ferrihydrite.

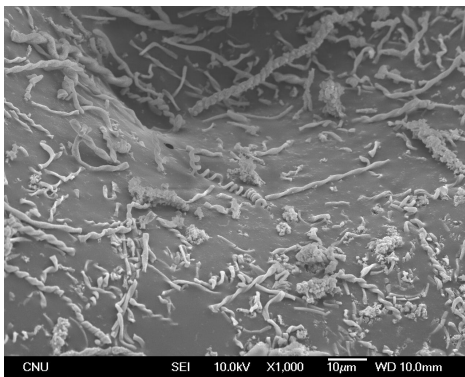


Figure 1. SEM image of biogenic Fe minerals (twisted stalks associated with schwertmannite)