

## **Inhibitory effects of organic matter and arsenic on the Fe(II)-catalyzed transformation of schwertmannite**

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Acid mine drainage (AMD) is a result of the microbially-mediated oxidation of iron sulphides which leads to high concentrations of sulphur and iron in the waters. Apart from high acidity, trace elements, e.g. copper or arsenic, leach out into the waters. Iron oxidizes from Fe(II) to Fe(III), favouring the formation of amorphous mineral phases and subsequently immobilizing trace elements through adsorption or co-precipitation processes. The main challenge is to predict when the amorphous mineral phases will transform to more crystalline phases. This transformation will lead to a re-mobilization of trace elements, increasing the risk to the environment.

Among these minerals, schwertmannite can act as scavenger of bioessential elements, as phosphate, and contaminants, as arsenate. Schwertmannite can remain stable for years under acidic conditions, although it tends to transform into crystalline phases depending on the environmental conditions. Interestingly, certain trace elements related to AMD, such as arsenic, have been observed to increase the stability of schwertmannite at variable pH conditions. In contrast, the presence of Fe(II) ions promotes the transformation to more stable phases such as goethite or lepidocrocite through an Ostwald ripening process. In the present study we evaluated the effect that the presence of arsenic or natural organic matter has on the stability of schwertmannite under variable pH and redox conditions. The transformation products obtained at different time periods were evaluated in terms of crystallinity, reactivity and mineral dissolution with organic acids, e.g. oxalic and ascorbic acid. The presence of increasing concentrations of Fe(II) ions enhances the reductive dissolution rate of schwertmannite at slightly acidic to neutral pH values, leading to the formation of crystalline phases. This process decreases the attenuation capacity to immobilize arsenate or chromate, thus increasing the environmental risk. However, the presence of increasing concentration of organic matter or arsenic decreases the transformation rate from schwertmannite to iron crystalline phases. Complexation of Fe(II) ions by natural organic matter or competition between Fe(II) and As(V) ions for surface binding sites are the main causes. The changes in mineral structure, as well as the oxyanion mobility upon transformation, were followed by wet chemistry, XRD, EXAFS and ATR-FTIR measurements.