# Stabiliy of schwertmannite sorbed by oxyanions

JIYEON KIM, JONG-A CHOI, CHAN-YOUNG PARK, YEONGKYOO KIM* AND INCHANG RYU

Department of Geology, Kyungpook National University, Daegu, 702-701, Korea
(*correspondence: ygkim@knu.ac.kr)

Schwertmannite, commonly found iron-oxyhydroxysulfate in acid mine drainage has high sorption capacity and can play an important role in removing heavy metals in acid mine drainage. Heavy metals existing as oxyanions are known to have high affinity to schwertmannite compared with other heavy metals due to substitution for sulfate in the schwertmannite structure. However, schwertmannite is thermodynamically unstable and eventually transformed to goethite. The oxyanions such as $AsO_4^{2-}$, however, has been known to decrease the transformation rate. We made oxyanion-sorbed schwertmannite samples and studied their rates of transformation to geothite based on XRD patterns and pH values.

Schwertmannite was synthesized and oxyanion-sorbed schwertmannite was prepared by $AsO_4^{2-}$, $SeO_3^{2-}$, $SeO_4^{2-}$, $MoO_4^{2-}$, and $CrO_4^{2-}$. Because of the different sorption isotherms, the amount of sorbed oxyanions were fixed at 0.5 mmol/g for the samples. 0.1g of each samples were mixed with 40 ml distilled water and pH was adjusted at pH 9 at 30 $^oC$ to increase the transformation rate. The pH was measured every week pH values were adjusted to pH 9 again. The experiment was conducted for 3 months and during that period, 3 samples of each schwertmannite were analysed by XRD and compared.

Our results show that all the samples sorbed by oxyanions have slower transformation rate than pure schwertmannite, indicated by higher pH values. However, the transformation rates among oxyanions are different. Based on the pH value changes, the transformation rates to goethite are in the order of pure schwertmannite > $SeO_4^{2-}$ > $SeO_3^{2-}$ > $CrO_4^{2-}$ > $MO_4^{2-}$ > $AsO_4^{2-}$. XRD pattern of each sample shows that pure schwertmanite transformed to goethite after 1 month. After 3 months, the schwertmannite sorbed by $SeO_4^{2-}$ almost transformed to goethite while other samples still have schwertmannite peaks. Therefore, the XRD patterns and pH values are quite closely matched. Our results show that sorption of oxyanions on schwertmannite decreases the transformation rate to goethite, and the rates of each samples are different.

# Relations of arsenic concentrations among groundwater, soil, and bedrock in Geumsan, Korea: Implication for As mobilization according to changes in As-hosting minerals and land use

KANGJOO KIM[1]*, SEOK-HWI KIM[1], GI-YOUNG JEONG[2] AND PRAFULLA KUMAR SAHOO[1]

[1]Department of Environmental Engineering, Kunsan National University, Kunsan, Jeonbuk 573-701, Korea
(*correspondence: kangjoo@kunsan.ac.kr)
[2]Department of Earth and Environmental Sciences, Andong National University, Andong, Kyeongbuk 760-747, Korea

Arsenic concentrations and As-bearing minerals in bedrock, and soil, and their relations with groundwater concentrations were investigated in a small agricultural area of Korea to understand the changes in arsenic mobility by pedogenetic processes and changes in geochemical conditions. The arsenic concentration in bedrock shows a wide variation (<1 to 3990 mg/kg) and is well correlated with that in contacting groundwaters. Soils, the weathering product of bedrock, show much mitigated and dispersed, but still very high As concentrations (8.8 to 387 mg/kg). Furthermore, As concentrations in the shallow groundwaters were very low (<20 $\mu$g/L) and independent on the soil concentrations due to the differences in As hosts and geochemical conditions. Arsenopyrite is the major As-bearing mineral in bedrock and its oxidation controls the As levels in deep groundwater. In contrast, the As mostly resides in soil as Fe-(hydr)oxide bound forms. Due to low pH and oxidizing redox condition, the release of As from Fe (hydr)oxides are largely suppressed and the shallow groundwater show low As concentrations. However, it is suggested that the disturbance of geochemical conditions in soils by land use changes mobilize As and would cause serious As contamination in shallow groundwaters.