
Properties of Goethite and Jarosite Precipitated from Acidic Groundwater, Dalarna, Sweden

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Abstract: This study characterizes various chemical and mineralogical properties of goethite and jarosite from a mine drainage environment using chemical extraction techniques, X-ray diffractometry (XRD), ^{57}Fe Mössbauer spectroscopy and scanning electron microscopy (SEM). Goethite and jarosite precipitates were collected from leachate-contaminated soils and from groundwater samples that were stored for up to 3 y. The results indicate that the soil goethites have primarily microcrystalline morphologies with moderately large mean crystallite dimensions ($\text{MCD}_{110} \sim 40 \text{ nm}$), and are superparamagnetic at room temperature and magnetically ordered at 77 K. The substitution of Al for Fe in the goethites is less than 0.03 mol/mol, and there is consequently no measured contraction in the goethite unit cell volume. The jarosite unit cell dimensions, Mössbauer parameters and chemical compositions indicate that the precipitates are primarily well-crystallized K-Na- H_3O solid solutions, although the presence of poorly crystalline H_3O -rich jarosite is also identified in one sample.

Key Words: Acid Mine Drainage • Goethite • Groundwater • Jarosite • Mössbauer Spectroscopy • X-ray Diffractometry

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