

Dehydration and rehydration of melanterite with significant copper content

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Melanterite (Fe,Cu)SO₄·7H₂O with more than a few atomic % copper dehydrates to siderotil (Fe,Cu)SO₄·5H₂O while melanterite with no copper dehydrates to rozenite FeSO₄·4H₂O. The field of stability of non-substituted melanterite is known (Chou *et al.* 2002). The present study investigates the humidity and temperatures where copper-substituted melanterite is in equilibrium with siderotil.

The dehydration and hydration of a copper-bearing melanterite was studied under controlled temperature and relative humidity in a chamber constructed to fit on a Philips X'pert Pro diffractometer. The boundary between the field of stability of the 7-hydrate(melanterite) and the 5-hydrate(siderotil) was explored by adjusting the relative humidity and temperature in the chamber during the diffraction experiment.

It was discovered that the relative humidity and temperature conditions where Cu-containing melanterite is in equilibrium with siderotil are the same, within experimental error, as the conditions where Cu-free melanterite coexists with rozenite.

Investigation of the factors which control the rate of dehydration shows the rate to be strongly dependent on temperature. It was also observed that at a given temperature, the rate of dehydration depends on the difference of the relative humidity of the atmosphere from the relative humidity where the two hydration states are in equilibrium.

The formation of a sulfate with the rozenite structure from copper-containing melanterite occurred when the melanterite sample was dried very quickly at high temperature. Rozenite was also observed to form from copper-containing melanterite during intense grinding. If this copper-containing rozenite is exposed to high humidity conditions, siderotil is the first higher hydrate to form followed soon after by melanterite.

Theories regarding the mechanisms of dehydration and hydration of these sulfates are discussed based on these observations

Reference

Chou, I.M., Seal, R.R., II and Hemingway, B.S. (2002) Determination of melanterite-rozenite and chalcantite-bonattite equilibria by humidity measurements at 0.1 MPa. *American Mineralogist*, 87, 108-114.

Arsenic distribution in the Sansu Tailings Dam, AngloGold Ashanti gold mine, Obuasi, Ghana

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Gold recovery from ores containing arsenopyrite releases significant amounts of arsenic into the environment. The AngloGold Ashanti gold mine at Obuasi in Ghana is the second largest in Africa and the largest in Ghana. The tailings from processing of ore that contains up to 1% As at this mine is stored in the Sansu tailings dam.

Arsenic distribution in the tailings dam and downstream waters are studied by means of laboratory and field experiments. Total, soluble and labile arsenic measurements in pore waters and sediments were determined. Arsenic speciation of pore waters was carried out in the field using an acetate form of analytical grade AG1-X8 anion exchange resin. Arsenic (III) concentrations are between 48 to 84% of the total arsenic. Pond water arsenic measures between 2 ppm and 33 ppm. Labile arsenic concentration in the sediment samples are between 56 to 270 ppm. Seepage pond arsenic values were between 4-25 ppm.

The arsenic concentrations with depth in the dam vary with dissolved oxygen content, pH and Eh of the pore waters. The dam has different chemical conditions. Where pyrite oxidation generates relatively low pH pore waters As concentration is high and sediment As is low. The carbonates and secondary minerals (illite and kaolinite) in the dam consume the acid and increase the pH to near neutral. Arsenic is mobilized under these conditions.

In case of spill from this tailings enough As will be released that can kill fishes in the downstream waters and wildlife