Tailings oxidation and mineralogy of Haveri Au-Cu mine, SW Finland – Preliminary results

A. Parviainen¹ and M. Eklund²

¹Helsinki University of Technology, Geoenvironmental Technology Unit, P.O.Box 6200, FIN-02015 TKK, Finland (annika.parviainen@tkk.fi)
²Geological Survey of Finland, P.O.Box 96, FIN-02151 Espoo, Finland (mikael.eklund@gtk.fi)

The Haveri Au-Cu deposit, situated in SW Finland, composes mainly of pyrrhotite, chalcopyrite and pyrite with accessory Fe-Co-Ni sulfoarsenides, sphalerite, molybdenite, iron oxides and native gold (Mäkelä, 1980). The tailings were piled during the active mining period from 1942 to 1961 covering ca. 18.5 ha and having an average depth of 7 meters.

In May 2006, a total of 40 profiles were drilled. Three profiles, and 17 tailings samples at intervals of one meter, were selected for mineralogical feasibility study. They were studied by optical reflected-light microscopy and by scanning electron microscope (SEM-EDS). Furthermore, the samples will be examined by X-ray diffraction (XRD), and geochemical analyses from selective leachates are planned.

The tailings are exposed to air, rainwater and meltwater which oxidize the primary sulfides remaining from the ore processing. Consequently, the tailings present zoning with oxidized vadose layer closest to the surface and unoxidized water-saturated layer below 3 to 4 meters. In May 2006, a total of 40 profiles were drilled. Three profiles, and 17 tailings samples at intervals of one meter, were selected for mineralogical feasibility study. They were studied by optical reflected-light microscopy and by scanning electron microscope (SEM-EDS). Furthermore, the samples will be examined by X-ray diffraction (XRD), and geochemical analyses from selective leachates are planned.

The tailings are exposed to air, rainwater and meltwater which oxidize the primary sulfides remaining from the ore processing. Consequently, the tailings present zoning with oxidized vadose layer closest to the surface and unoxidized water-saturated layer below 3 to 4 meters. The uppermost vadose layer (from 0.9 to 2.0 m in thickness) contains primary iron oxides and scarce remnant sulfides, and abundant secondary Fe precipitates giving the characteristic ochreous color. Pyrrhotite and pyrite are the first sulfide minerals to oxidize and to dissolve. The geochemical processes within the surface layer of the impoundment produce acid mine drainage, in other words, acidic and heavy metal-rich waters. The secondary Fe precipitates (e.g. jarosite) form from the resulting solutions.

Deeper layers are under reducing and anoxic conditions presenting grayish black color. Here the major sulfides, pyrrhotite and pyrite, and minor chalcopyrite exhibit angular forms and no sign of alteration.

The oxidation process will continue for decades or even hundreds of years until reaching the groundwater surface.

The research is part of the EU LIFE Environment project “Risk Assessment and Risk Management procedure for Arsenic in the Tampere region” or RAMAS (www.gtk.fi/projects/ramas).

Reference