Characterizing the Aijala copper mine tailings by diverse mineralogical methods

M.L. Lehtonen[1], P.M. Kauppila[2] and M. Tiljander[1]

[1] *Geological Survey of Finland, P.O. Box 96, Espoo FI-02150*

[2] *Geological Survey of Finland, P.O. Box 1237, Kuopio FI-70211*

A vertical sampling profile (0-80 cm) of the unremediated, weathered Aijala copper mine (1949-1974) tailings has been characterized by diverse mineralogical methods. The sample material was analysed by X-ray diffraction, traditional and field emission scanning electron microscopes, QEMSCAN and electron microprobe. The aim was to investigate the mineralogical evolution of the tailings profile, including compositional changes, elemental deportment, weathering processes and formation of secondary minerals and a hard pan deteced at the depth of 30-35 cm during the sampling. One important aspect was to study the alteration of sulphide minerals as a function of time, and to obtain information on the long-term behaviour of tailings.

The results obtained by different analytical methods demonstrate that the texture, modal mineralogy and the degree of alteration change dramatically throughout the tailings profile as a result of 35 years of tailings weathering. Acidity produced by the sulpide oxidation has depleted carbonates in the profile, and they are only found at the deepest, water-saturated level of the profile. Gypsum, formed as a secondary mineral, is abundant through the profile, expect for the deepest and the surface layers. Chlorite dominates the main mineralogy. The weathering degree of sulphides and the formation of their alteration products, Fe-hydroxide (goethite), Fe-sulphates and jarosite, increases gradually towards the surface. Above the hard pan layer the sulphide minerals are extremely rare, and, if present, heavily altered. The hard pan layer acts as a dividing range for several other minerals. Goethite and serpentine are present only below the hard pan, whereas jarosite is found at and above it.

The complementary setup of the mineralogical instruments used in this study proved to be efficient in characterizing the tailings. The methodology provides a good toolbox for future work dealing with environmental impact assessements and estimations of secondary raw material potential of tailings materials.