Tungsten (W) mobility in historical sulfidic-oxidic tailings

L. HALLSTROM[1*], L. ALAKANGAS[1], O. MARTINSSON[1]

[1]Division of Geoscience and Environmental Engineering, Lulea University of Technology, 97187 Lulea, Sweden (*lina.hallstrom@ltu.se)

The worldwide usage of tungsten (W) has increased substantially during the last decade and it is predicted to continue. The European Commission listed W as one of the top 20 EU-critical elements in 2013, but still more than 85% of the primary supply comes from China. In Europe, one valuable source of W could be historical tailings from W mining since former inefficient extraction techniques have left elevated concentrations in the tailings. These tailings might also be a source of pollution. W has previously been considered as an inert element but is now classified as an emerging contaminant of concern. The knowledge of W mobility in mine waste and its drainage is poor and needs to be investigated further.

This project studies geochemical weathering of the primary W-minerals scheelite and wolframite in historical tailings (1887-1963) from Yxsjöberg, Sweden. The study will form the basis for evaluating if reprocessing tailings could be beneficial from an economical, technical and environmental perspective.

The Yxsjöberg tailings (2.8 million tons) are derived from Scandinavias largest W deposit, and contains an average of 0.1 wt% W, 1.5 wt% S and 2 wt% F. Mineralogical and chemical studies with optical- and transmitted microscope, SEM-EDS & Laser-ICP-MS, ICP-MS and 7-step sequential extraction were carried out on subsamples from a intact 6.5 m long core representing a vertical profile through the tailings.

The upper part of the tailings has been exposed to atmospheric oxygen, which has caused sulfide oxidation down to 1.5 m depth. The sulfide oxidation has reduced pH with subsequent weathering of other minerals resulting in a release of sulfates, fluoride and metal(loid)s. W is accumulated at the interphase between oxidiced and unoxidiced tailings (0.5 wt%). Water-soluble fractions of the subsamples show that almost no W is released in the oxidised acidic part while elevated concentrations are released in the unoxidised near-neutral part of the tailings, with a maximum release 2.5 m below the surface (380 µg/kg).

This study indicates that the chemical conditions in the tailings affect tungsten minerals, causing a transport of tungsten in the tailings profile.