

Assessment of the long term behaviour of waste rock piles and performance of dry cover structure

The long lasting processes of the waste rock piles has been studied at the active Kevitsa Ni-Cu-PGE sulphide ore mine in Finnish Lapland, 140 km north of the Arctic Circle. The Kevitsa is an open-pit mine which went into operation in 2012. The main objective is the assessment of the geochemical properties of the low sulphide waste rock and performance of potential cover materials. The usability of NAF (non-acid forming) tailings in the mine closure activities has also been studied.

Methods

Six different covers are tested in experimental wasterockfilled lysimeters at the active Kevitsa mine (Fig 1.) by monitoring stability and permeability of the structures, and quality of the effluent waters year-round. Lysimeters will be monitored at least until autumn 2018 and based on the results, the geochemical properties, efficiency and comparison between different potential cover structures will be demonstrated.

Lysimeter #4 (in Fig 2.) was left empty for background water quality analysis, including rainwater analysis and possible material contamination by lysimeter material and dust. Seven lysimeters were filled with potentially acid forming (PAF) waste rock. In this study ore was used for enhanced acid forming and drainage of elements. Six of the lysimeters were covered with potential cover structures.

From the cover materials were characterized particle size distribution, water conductivity, whole rock analysis by XRF, Aqua Regia extraction, oxalate extraction, acetate extraction, total S, C, carbonate C and mineralogy by FE-SEM-EDS. Shaking tests, ABA and NAG-tests also were done.

For sampling, the drainage waters are conducted to canisters below the lysimeters (Fig 3.) Sampling is depending on the amount of water, around once / 1-2 months. Field measurements include pH, EC and alkalinity. Analyses include dissolved elements by ICP-MS/OES and anions.

Results will be used in the planning of the best recommendable cover structure and environmental practices for mine waste facility closure.



Fig 1. Eight waste rock lysimeters and the data logger unit at the Kevitsa mine, Finland. Lysimeters are 1 m diameter and 2 m high plastic cylinders with sensors for moisture, temperature, electric conductivity and oxygen.

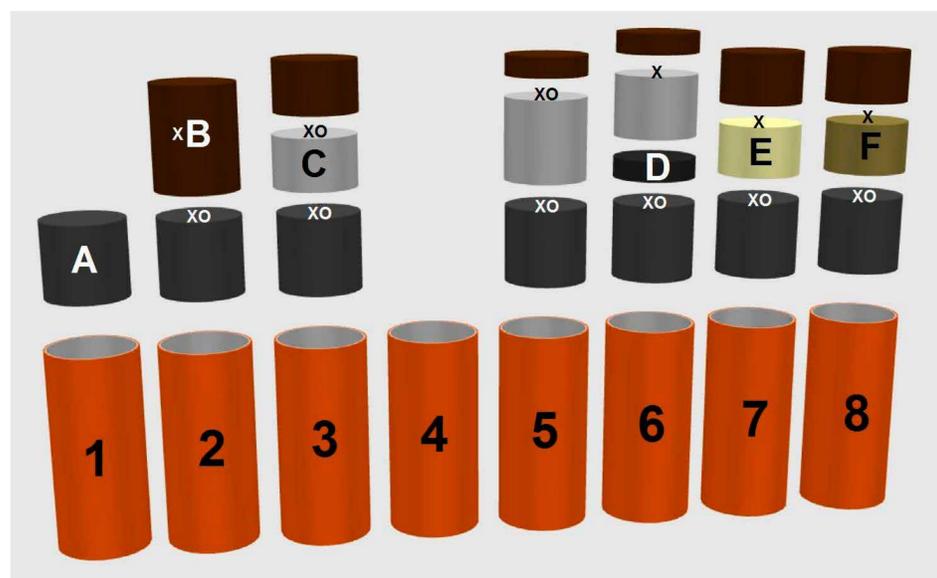


Fig 2. Lysimeter fillings: A = Ore, B = till, C = NAF tailings, D = NAF tailings + biochar, E = high NP tailings, F = low permeable, solidified slag with natural aggregate layer, X = EC-moisture-T sensor, O = oxygen sensor.



Fig 3. Drainage waters are conducted to canisters below the lysimeters.

Interreg Nord

European Regional Development Fund



EUROPEAN UNION

Geological Survey of Finland

Raija Pietilä, Geological Survey of Finland, Environmental Geology Unit, P.O. Box 77, 96101 Rovaniemi, Finland, raija.pietila@gtk.fi

Teemu Karlsson, Geological Survey of Finland, Industrial Environments and Recycling, P.O. Box 1237, 70211 Kuopio, Finland, teemu.karlsson@gtk.fi



GTK
gtk.fi