# Substitutive cover materials for waste rock piles – a lysimeter study

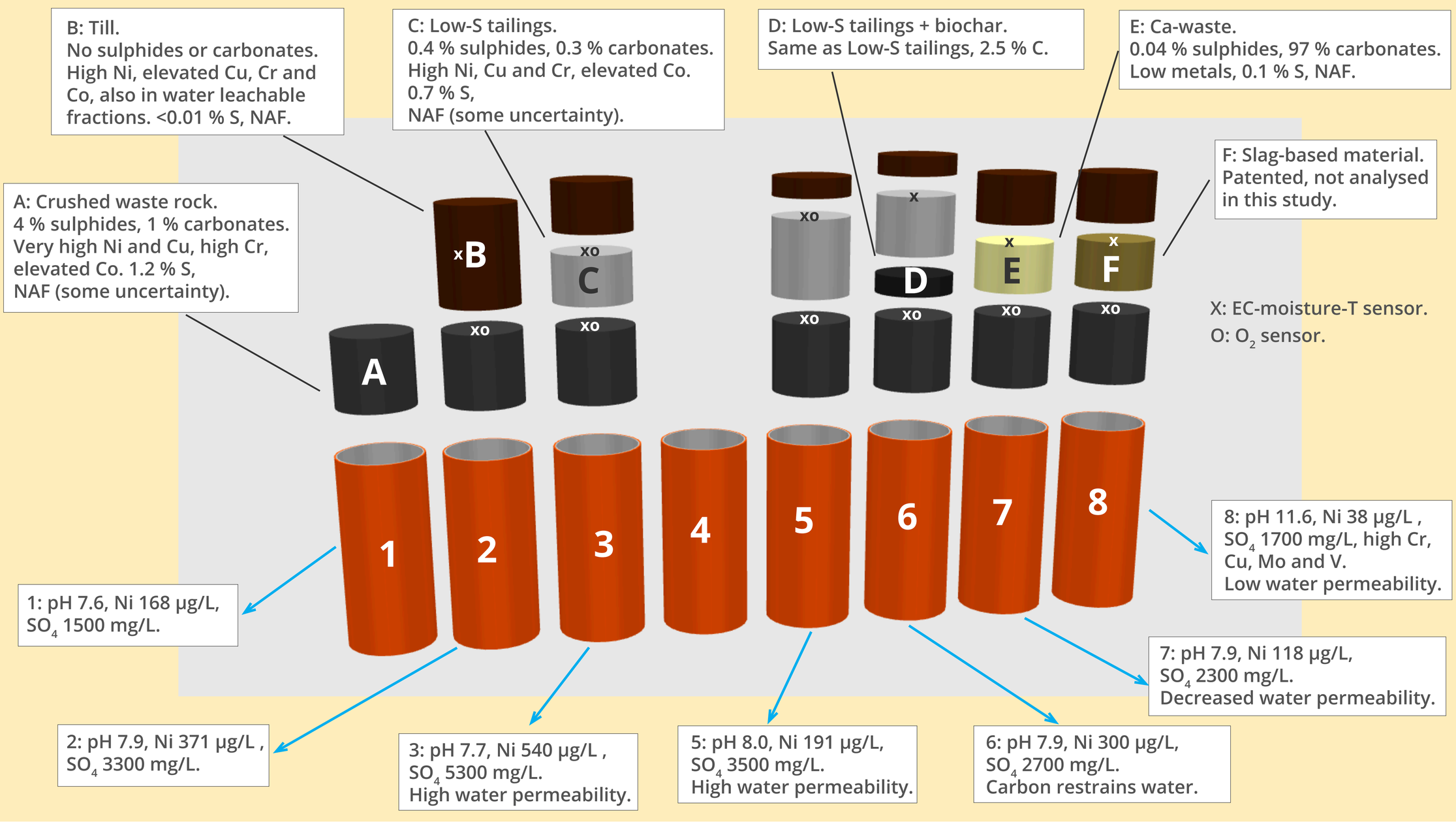
MIN-NORTH (Development, Evaluation and Optimization of Measures to Reduce the Impact on the Environment from Mining Activities in Northern Regions) is a EU Interreg Nord program funded cooperation project between Geological Survey of Finland (GTK), University of Oulu (UO), The Arctic University of Norway (UiT) and Luleå University of Technology (LTU, coordinator) to study and reduce the environmental impacts of mining in the northern regions. The main objective of the project is to study the management of waste rocks of the mining areas in Nordic region.

Acid rock drainage (ARD) is a major problem related to the management of mining wastes. ARD is generated when $O_2$ and water infiltrate the waste rock pile, oxidizing sulphide minerals e.g., pyrite and pyrrhotite. Different cover systems have been developed to prevent weathering processes. Material availability is one of the key challenges related to cover system design.

For instance, good quality till might be scarce in the mine area. Therefore, substitutive materials for cover systems are needed, while promoting the use of secondary resources.

In this study, functionality of various potential cover materials for waste rock has been compared, utilizing lysimeter tests at Kevitsa mine site. The 1 m diameter and 2 m tall lysimeters were installed in July 2017 and have been monitored since.

## Tested cover structures and materials (A-F), and the drainage qualities after 1 year of monitoring




## Conclusions after 1 year of monitoring

**Till (B):** low water conductivity (7.4 x 10-9 m/s), short term release of weakly bound elements, inefficient $O_2$ barrier. **Low-S tailings (C):** higher water conductivity (3.3 x 10-6 m/s), lower water retention, release of sulphide bound elements, inefficient $O_2$ barrier. **Low-S tailing + carbon (D):** same as above, carbon increases slightly water retention capacity. **Ca-Waste (E):** decreased water conductivity (3.5 x 10-8 m/s), decreased element release. **Slag-based material (F):** Low water permeability, decrease of Ni, high release of Cr, Cu, Mo and V (short term?), high pH, more efficient $O_2$ barrier.

Several years of monitoring is needed for lysimeter studies, results presented here represent short term observation. No significant differences regarding $O_2$ permeability could be observed between till, tailings or Ca-waste based cover systems. Slag-based material seems to be more efficient $O_2$ barrier. Due to issues related to lysimeter structure, reliable $O_2$ results are hard to obtain.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