Construction and Evaluation of Mine Cover Systems with Upgraded Soil

Experience gained from Laboratory and Pilot Tests

Project leader
Christian Maurice, Luleå tekniska universitet

Partners
Ltu , Boliden Mineral , Mitta , Ecoloop , NGI

Project duration
2024 - 2025

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SWEDISH MINING INNOVATION

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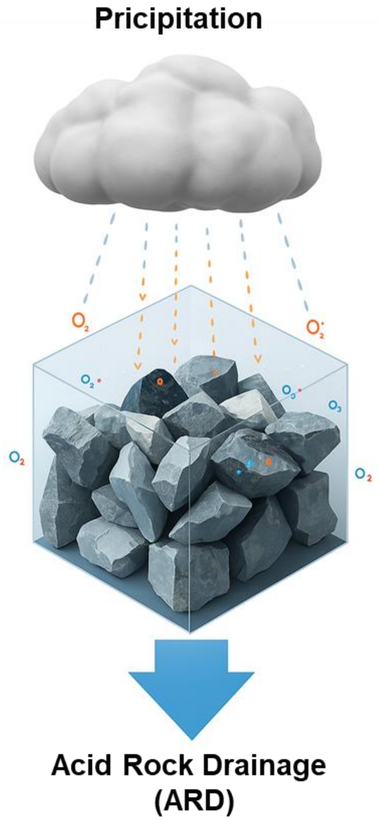
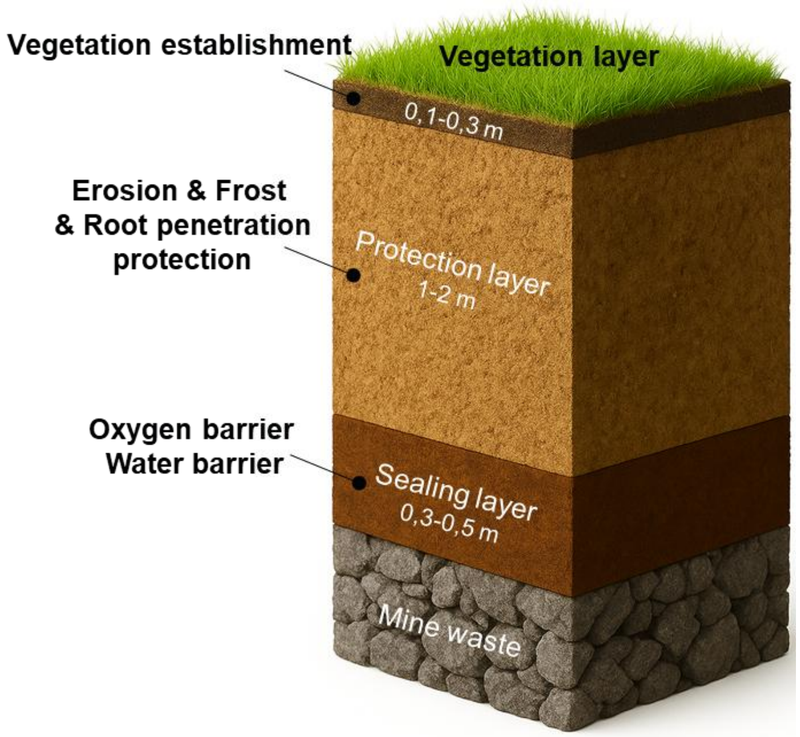
Description of the problem





70% of the mine waste in Sweden contains sulfide minerals

(SGU and Swedish EPA 2017)

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Objectives of the project

- Evaluate a stepwise, **(time- and cost-efficient)** method for mine cover design using lab experiments, field tests, and numerical simulations
- Facilitate the design of mine reclamation measures (guidance)
- Promote the use of alternative sealing materials.

What are the optimal cover geometries and properties?

- Each site is unique and needs a site-specific solution!

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Activities

- The construction of 2 instrumented field trials (400 m^2 each) was done by Boliden at Garpenberg mine, together with Maser Frakt, Sweco and Okane Consultants (instrumentation).

- Construction of three columns with the materials from the field trials.

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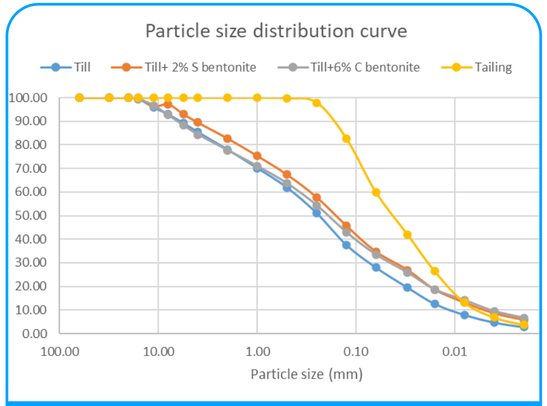
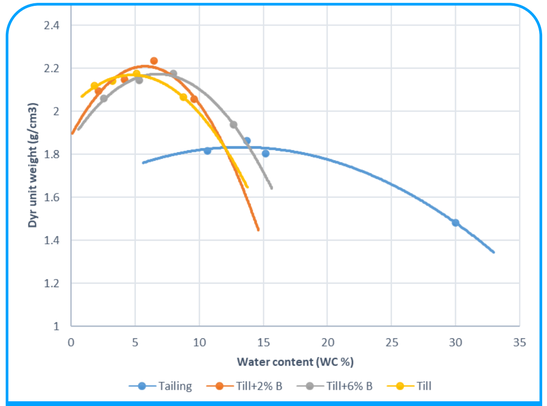
Activities

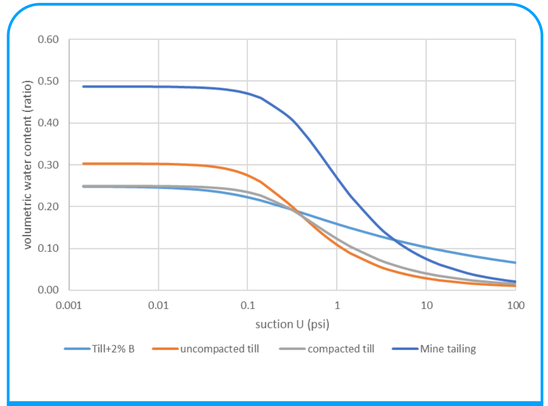
Laboratory Work for Soil Parameter Determination



Particle size distribution



Compaction test Proctor



Pressure plate apparatus test

Hydraulic conductivity test

Outcome:

Parameters: Saturated hydraulic conductivity, volumetric water content, air-entry value,and residual water content input into **SEEP/W** for cover system performance simulation.

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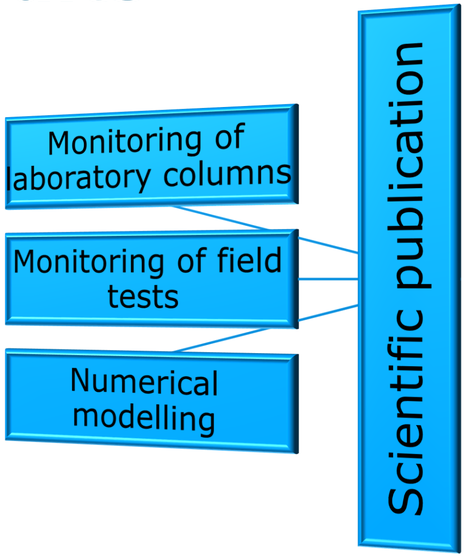
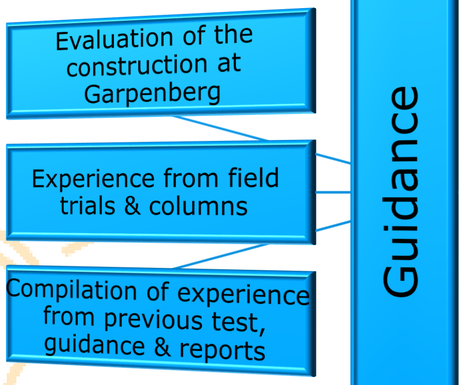
Results



Saafan, A., Toromanovic, J., Maurice, C. (2025). *Assessing the effect of snowmelt on mine covers in cold climates using numerical modelling and laboratory columns*. In **Mine Closure 2025**, ACG, Perth. https://doi.org/10.36487/ACG_repo/2515_92

Saafan, A., Toromanovic, J., Maurice, C. (2026). *Construction and evaluation of mine cover systems with upgraded soil: Experience from lab and pilot tests*. In **ICSMGE 2026**, Vienna, Austria.

Saafan, A., Toromanovic, J., Maurice, C. (Under Review). *Evaluating the impact of snow cover on mine cover performance using numerical modelling and field trial*.



Guidance report
Guidance describing the methodology (material Characterization, Column construction and modeling)- Target: mining companies and consultant design mine covers.

Workshop: Interview with contractors to discuss construction procedures and field challenges.

Plan a course (Mine Cover System Design)

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The research continues through …

Responsible mine restoration - Integrating local engagement, ecology, and engineered solutions in arctic environment

Project granted by NordForsk

Partners: Aarhus University, Copenhagen University, Greenland Institute of Natural Resources, Norwegian Geotechnical Institute, Norwegian Institute of Nature Research and Luleå University of Technology.

Funders: NordForsk, the Swedish Research Council, Swedish Research Council for Sustainable Development (Formas), Research Council of Norway, Independent Research Fund Denmark and Greenland Research Council.

We can use or improve locally available mine soils to build effective cover systems (sustainable, cost-effective, and practical).

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Mining innovation for a sustainable future

Thank You

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