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Master's project – Mine reclamation and mining geotechnique in cold regions

Use of crushed-rock bentonite mixtures as mine reclamation cover materials in arctic regions

Duration and location

2 years – Université du Québec en Abitibi-Témiscamingue (UQAT), Rouyn-Noranda, Québec

Project start

As soon as possible

Research fields

Mine reclamation, mining geotechnique, geotechnical engineering in cold regions, mining environment

Research supervision

Vincent Boulanger-Martel and Bruno Bussière, assisted by a team of specialized professors and professionals.

General project description

The environmental reclamation of tailings and waste rock storage facilities located in arctic environments is a growing area of research. Presently, only a few cover options are available for these climates, and alternative cover systems, robust in the face of progressive climate change, must be developed. In this context, cover systems that aim to control more than one key driver of acid mine drainage generation (i.e. temperature and oxygen flux or water infiltration) should be favoured. These new cover concepts often require the construction of a fine-grained cover layer (i.e. low permeability layer, moisture-retaining layer, flow control layer). However, in arctic climates, such natural fine-grained materials are usually not available close to the construction site or their mining can become onerous. Therefore, alternative materials with low saturated hydraulic conductivities and high water retention capacities, such as soil- and crushed rock-bentonite mixtures, could be used to construct fine-grained cover layers. Currently, the use of soil- and crushed rock-bentonite mixtures as cover materials in arctic conditions is not well documented, and the effectiveness of such materials must be demonstrated under field conditions.

Specific objectives

The main objective of this project is to assess the in-situ behaviour of a crushed rock-bentonite mixture used as cover materials in the arctic.

Specifically, this project will involve:

1. Performing a literature review on the thermal and hydraulic behaviour of soil- and crushed rock-bentonite mixtures;
2. Sampling the moisture-retaining layer of a field experimental cell made with a crushed rock-bentonite mixture;
3. Characterizing the hydraulic properties of crushed rock-bentonite mixtures using laboratory and field tests;
4. Performing computed tomography scans to assess the microstructure of crushed rock-bentonite mixtures;
5. Assessing the performance of the tested cover system to limit oxygen diffusion and water infiltration.

Financial support

\$18 500\$/year.

Candidate profile

Degree in mining, geological, or civil engineering, or any other relevant field.

Demonstrate autonomy and have good teamwork skills.

Documents required

Curriculum vitae, motivation letter, and university transcripts.

Only candidates selected for an interview will be contacted.

For more information or to apply:

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