

## Senior Geomechanical Engineer

<b>Expertise</b>	Rock Mechanics
<b>Education</b>	M.Sc. Civil Engineering (Rock Mechanics), 2019 Luleå University of Technology, Luleå, Sweden
<b>Honors</b>	Recipient of the Best Master Thesis Scholarship from the Bergforsk foundation (2020).

### Professional Experience

2020 – Present	Itasca Consultants AB, Luleå, Sweden Geomechanical Engineer
2017 – 2018	Ramböll Sverige AB, Geoteknik, Stockholm, Sweden Geotechnical Engineer

### Project Experience

**Open pit mining:** Two-dimensional study (*FLAC*) of large-scale slope stability for Boliden Aitik mine with respect to additional load placed near the slope crest of the hanging wall. Using strength reduction technique, large-scale failure surfaces and safety factors were studied. The analysis was conducted for several different scenarios based on varying (i) groundwater table, (ii) height and width of added load and (iii) depth of mine.

Two-dimensional study (*FLAC*) of rock mass behavior and evaluation of slope stability at the Boliden Aitik mine. Analysis of slope stability during water storage in Salmijärvi pit after closure of mining operations using safety factors.

Analysis of stress distribution around two raise shafts located close to Salmijärvi open pit at Boliden Aitik mine. Three-dimensional numerical calculations (*FLAC3D*) were performed utilizing a global numerical-local analytical approach to account for the secondary stresses from the large-scale mining.

Large-scale stability analysis of future mining in LKAB Leveäniemi open pit. Analysis included a discontinuum numerical study (*FLAC3D*) with large shear zones integrated in the model.

Project support for three-dimensional numerical analysis (*FLAC3D*) of large-scale slope stability for the Kuusilampi open pit for Terrafame mine in Finland. The project included modelling of large-scale structures as well as modelling of discontinuities using four ubiquitous joints in bench and inter-ramp scale slope stability.

**Underground mining:** Geomechanical study as part of rock mechanics feasibility study for a sublevel-stopping mine. Conducted work included: (i) creating a geomechanical model for the new mine site based on previous core logging and information from mine geologists, (ii) analysis of suitable room dimensions, both with and without reinforcement, using Modified Stability Graph Method, (iii) estimation of overbreak, (iv) calculation of appropriate fill strength, as well as (v) providing recommendations for reinforcement of stopes and drifts.

Developing analysis-tool for calculating Modified Stability Number for stopes in sublevel stopping mines based on statistically varied input data and estimations using multiple Monte-Carlo simulations. The analysis-tool was implemented at Copperstone Resources underground mine, outside Kiruna.

Numerical modelling of underground Creighton mine, Sudbury Canada. Creation of rock mechanical models for analysis and comparison between different production schedules.

Three-dimensional continuum analysis of mining of the 91 m level at Rana Gruber (sublevel caving) to evaluate stability of mining infrastructure when opening a deeper mining level. This also included detailed analysis of different mining sequences for the N91 m level and their impact on the stability of drifts and other infrastructure.

Analysis of alternative resumption options for the LKAB Kiirunavaara mine after a significant mining induced seismic event including determination of safe dimensions for the Kiruna mine barrier pillar.

Literature and case study of different factors influencing ore pass stability e.g., dimension, inclination, stress state, load from material etc. for LKAB. The study also included compilation of previously performed analyses of ore pass stability for Kiirunavaara and Malmberget mines. The theoretical work was combined with analytical calculations studying (i) the optimal distance between ore pass and ore body and (ii) the maximum distance the ore pass diameter can be allowed to expand in an ore pass group at the Kiirunavaara mine. Additional numerical calculations were performed, at a later stage, as a continuation of the ore pass stability investigation at the Kiirunavaara mine, utilizing a global-local numerical approach to account for the secondary stresses from the large-scale mining.

Numerical modelling for stability assessment of a jointed rock mass: Developed a numerical model in FLAC3D with discrete joint elements for simulation of fractured rock. The purpose was to assess the response of the rock mass adjacent to an existing surface shaft from a nearby dam raise. Modelling of the discrete joint surfaces allowed for identification of possible rock wedges and assessment of their stability.

**Infrastructure (Tunneling):** Three dimensional numerical analyses performed for stability analysis of a civil tunnel in Gothenburg, details of work are confidential.

Master Thesis project in which three-dimensional numerical modelling was used to study deformations at the tunnel boundary during an excavation process. Simulation of several tunnels with varying tunnel geometry, rock properties, stresses and at different depths. Modelling was conducted using *FLAC3D*. Cases both with and without reinforcement were studied.

**Energy:** Rock mechanics analysis of a pilot storage for hydrogen gas, in the form of an underground lined cavern. Analysis have been conducted using three-dimensional continuum modelling, with applied pressures and with lining simulated explicitly.

**Field work:** Assistant at geotechnical surveys investigating project specific soil properties and soil depth. Amongst the techniques used were Soil-/Rock probing, Ram sounding, Weight sounding and Soil sampling. Assessment of groundwater level in groundwater tubes.

Core logging for Kaunis Iron, including rock mechanics core logging of oriented core.

Conducting joint mapping at site (as subcontractor to Norconsult) for NCC during excavation of rock masses when installing a second turbine at the hydropower plant Rengård, outside Skellefteå. Field mapping was performed as part of a team from Itasca Consultants AB and findings was regularly reported to the client. One of the team members were always on site mapping the rock slope as the excavation proceeded. Additional tasks included regular control of the surveillance system, i.e., results from total station measurements, vibration measurements and water level measurements, as well as surveying the outlet canal for erosion.

**Research:** Ongoing research work, performed together with researchers at KTH (Royal institute of Technology). Swedish Mining Innovation (SMI) funded (VINNOVA) study entitled: "Framework for risk-based pillar design in underground mines" with start in December 2023.

Research work in the Swedish Mining Innovation funded (VINNOVA) prestudy "Probabilistic design for underground and open pit mines" during 2022 together with researcher at KTH.

Internal review work during 2022 in the BeFo financed project entitled "Spiling in tunnels and portals".

**Soil Engineering:** Planning of geotechnical surveys including field investigations and laboratory tests. Assessment of field and laboratory results and documentation in geotechnical reports (MUR) and drawings. Evaluating soil properties and conducting analyses of expected settlements. Investigating pros and cons of different foundation methods suited for project specific conditions. Authoring of technical documents.