Boliden Exploration

Tobias Hermansson (PhD) – Manager Expert Group Exploration

- About Boliden and Boliden Exploration
- How we work
- Research & Development
- Student opportunities

About Boliden

- 5 mining units and 5 smelters
- Approx. 6,000 employees
- More than 90 years’ experience
- Producer of base metals and precious metals

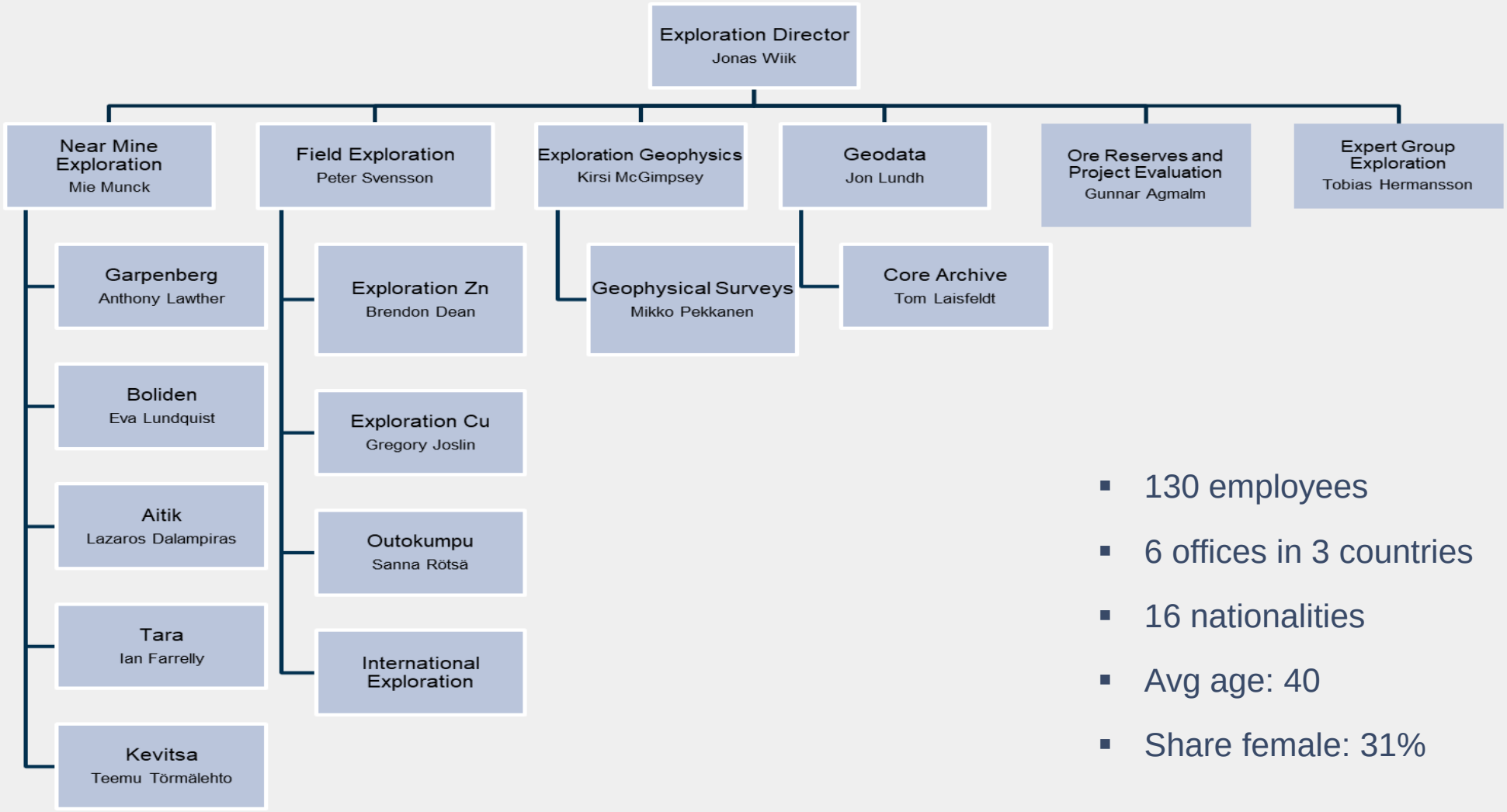
www.boliden.com

MINES

SMELTERS

HEAD OFFICE

Exploration Organisation

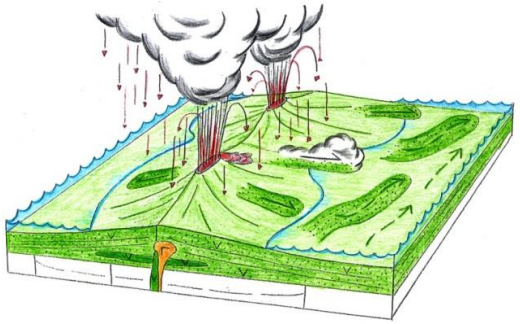


- 130 employees
- 6 offices in 3 countries
- 16 nationalities
- Avg age: 40
- Share female: 31%

How We Work

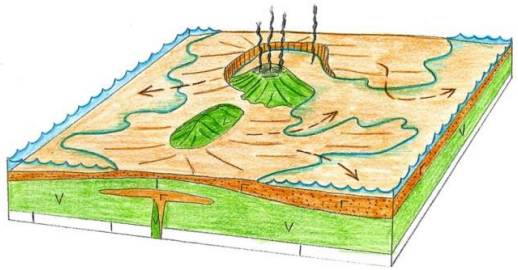
Understanding the ore forming process and selecting the right areas to explore

Geological model for volcanic evolution of Renström area



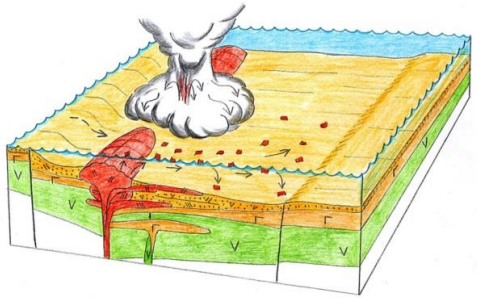
A

Lower footwall: subaerial + marine basalt



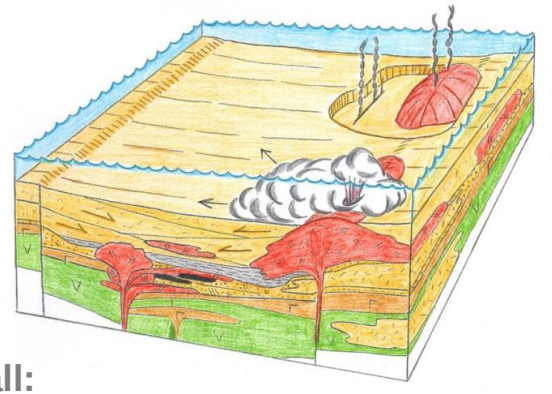
B

Upper footwall: subaerial + marine dacite



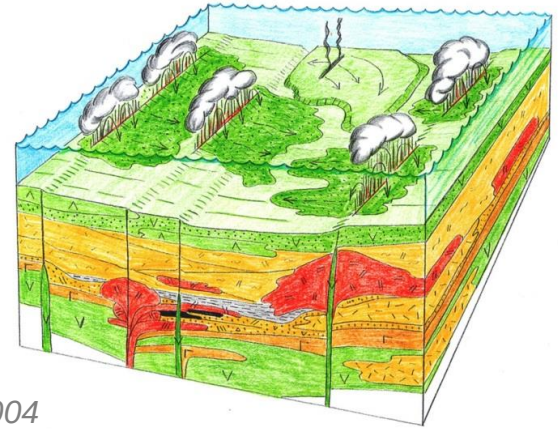
C

Ore horizon: deep water rhyolite



D

Hanging-wall: deep water rhyolite, basalt



E

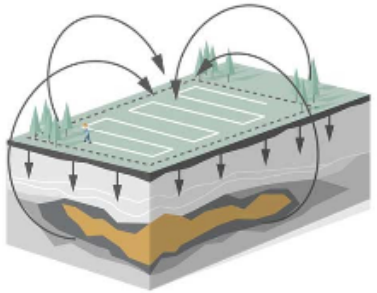
Allen and Svenson, 2004

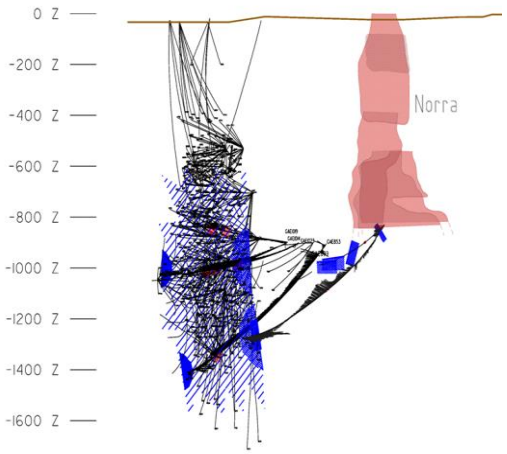
How We Work

GEOPHYSICAL SURVEYS

Investigates the bedrock's physical properties. Surveys can be performed from the air, manually on the ground or using probes lowered into bore holes.

The method has limited or no environmental impact.



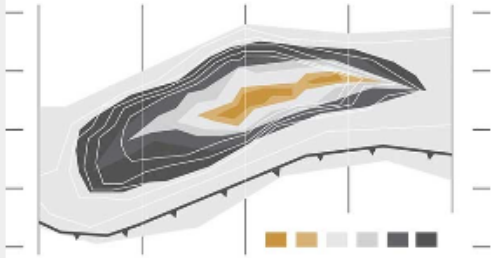


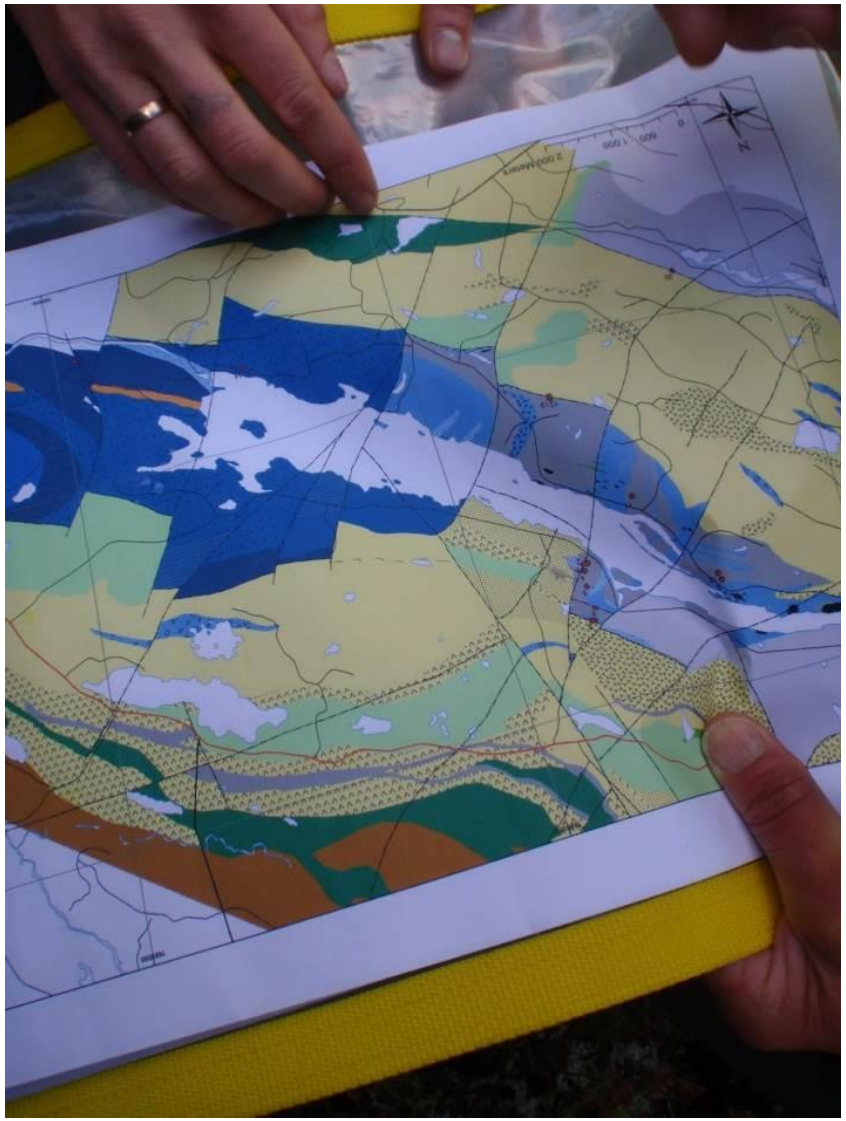
How We Work

BEDROCK MAPPING

Documents the geological properties of outcrops, including metallic minerals, and gathers the information in databases for interpretation and analysis.

The method has limited or no environmental impact.





How We Work

GEOCHEMICAL SAMPLING

Analyses till and drill cuttings to trace mineralisations

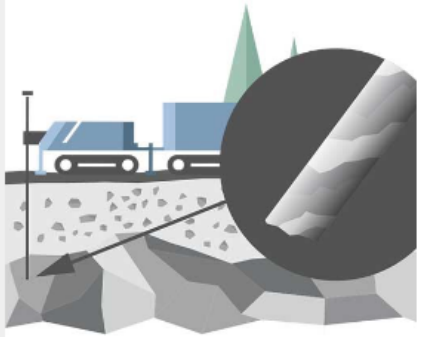
Limited impact on the environment in the form of minor ground damage may occur.

How We Work

DIAMOND DRILLING

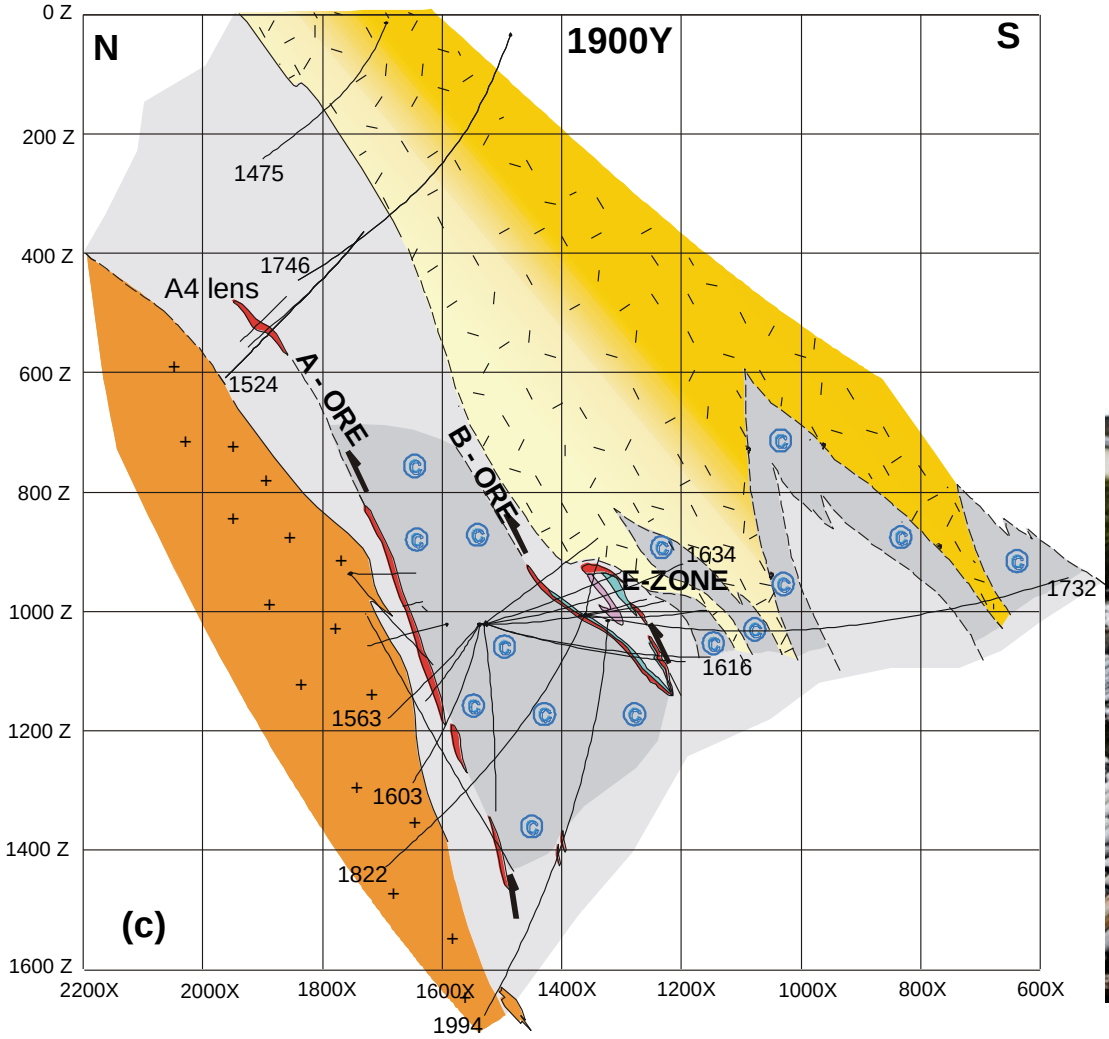
Enables the mapping of the bedrock at depth, its geology and possible mineralisation. Core drilling can take place to depths as great as 2,000 metres.

This method has some impact on the environment as the bore hole entails an intervention in the bedrock.



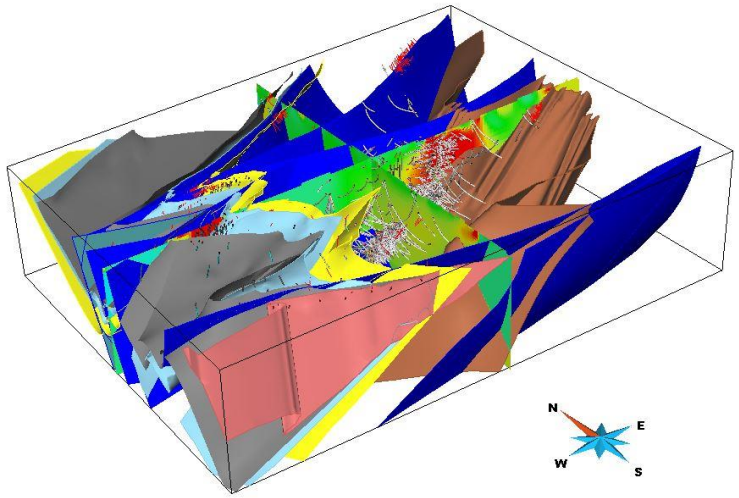
How We Work

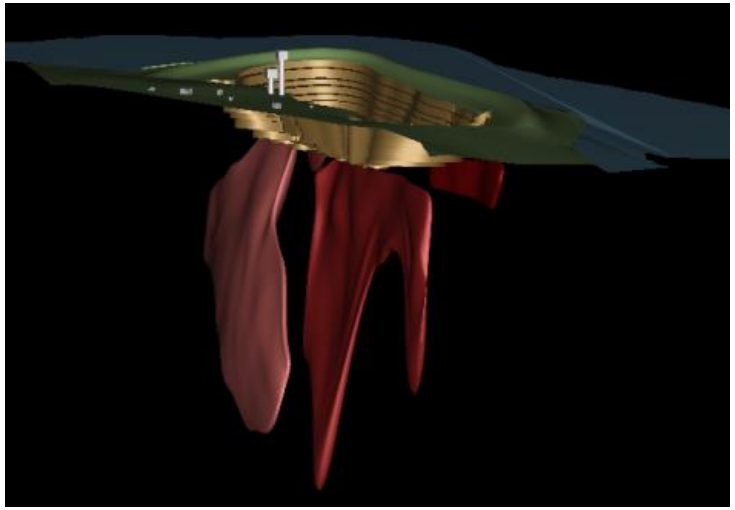
Core logging, sampling and Interpretation

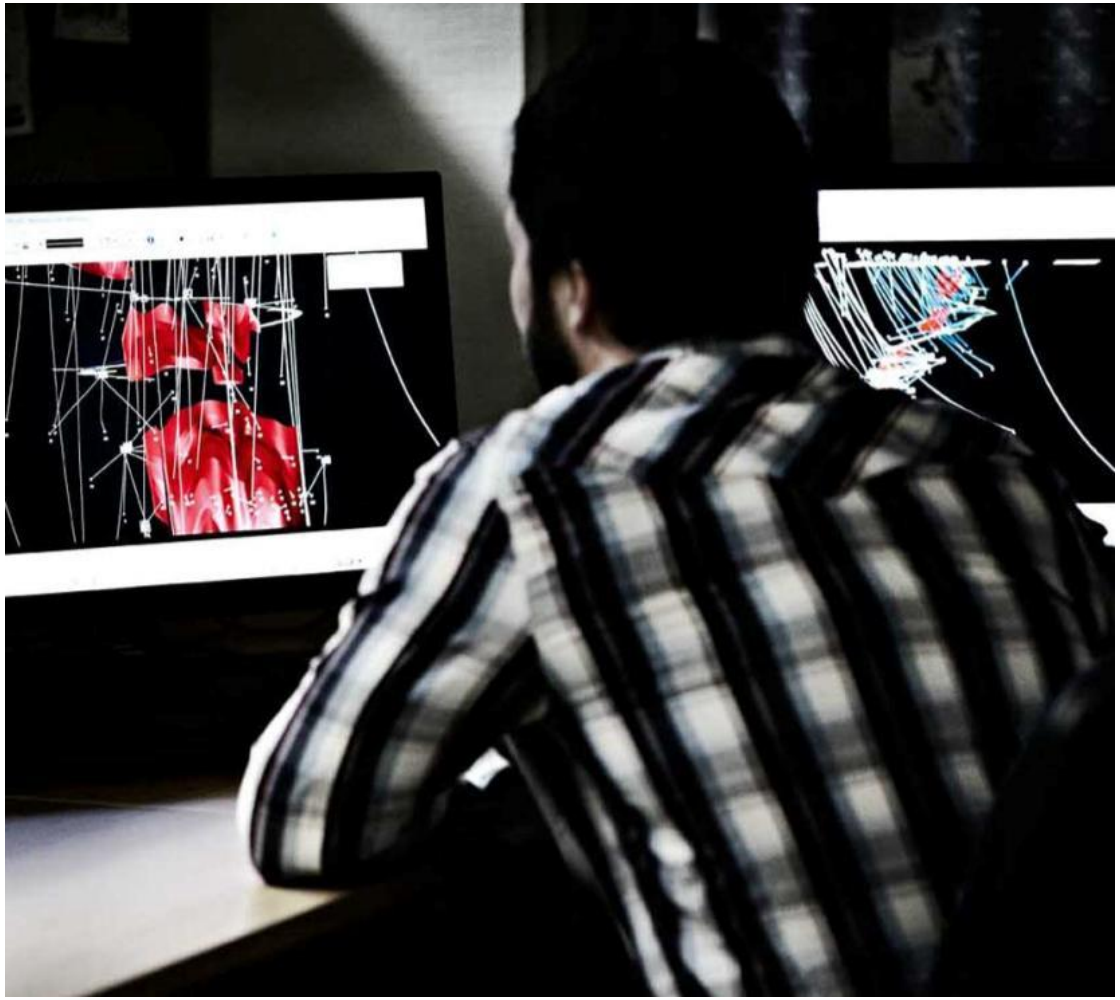


How We Work

3D modelling and mineral resource estimation







Boliden Exploration
R&D Challenges

Main challenges relate to:

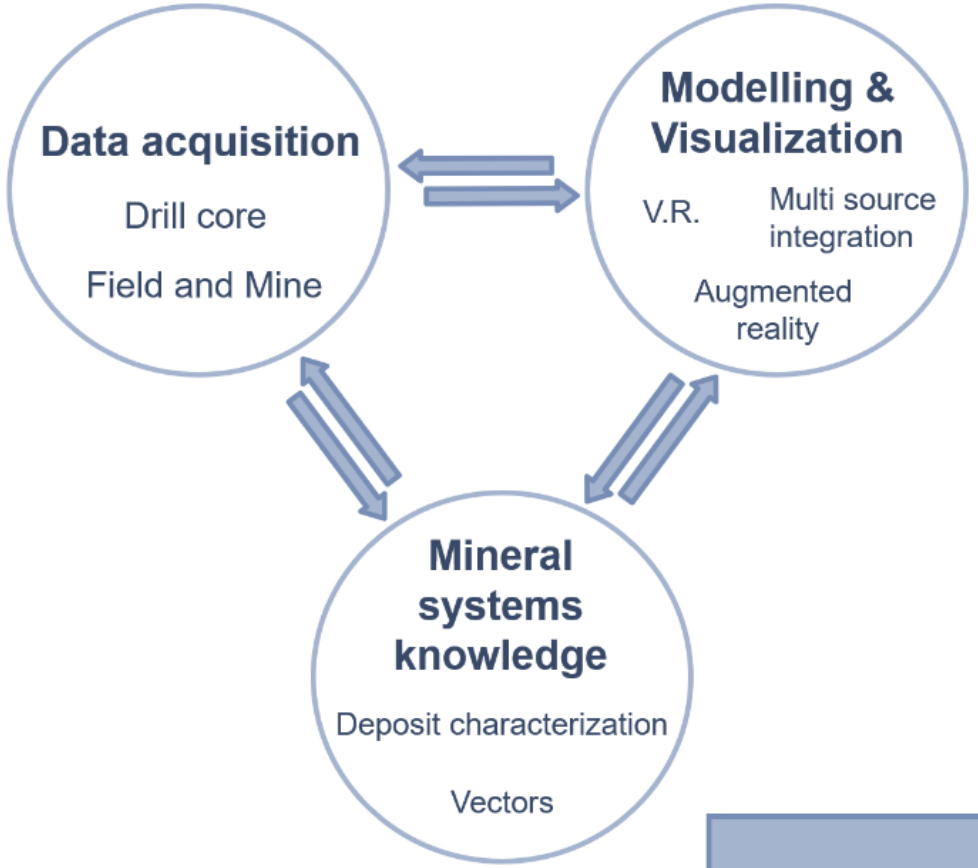
Making discoveries at increasing depths, with minimal environmental impact and maintained Social License to Operate

How do we do it?

- Collecting new types of data that can open up previously unknown search spaces
- Improved understanding for the geology and mineral systems in 3D
- Management and analysis of increasing volumes of data and information

Tobias Hermansson – Manager Expert Group Exploration, Boliden Mines

Research



Development

- Improving data quality
- Streamlining workflows
- Training and personnel development
- Testing and implimenting new methodologies
- Bridging the gap between departments
- Identifying new opportunities for improvements

Better geological understanding, reducing uncertainty, improving exploration success

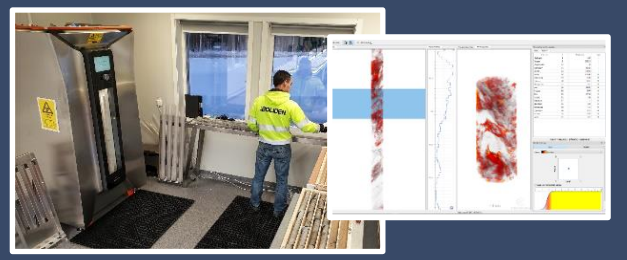
Future Logging Assistant R&D Program

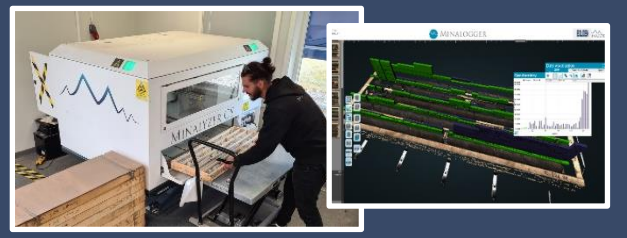
Pooling of the abilities of Geological and Artificial Intelligence research, with the vision to provide timely and objective outputs that can reduce the time needed for data collection and processing while providing time for deeper interpretation and knowledge creation

Investigating the possibility to utilise current and new drilling datasets to assist Geologists

Focused on continuous datasets:

- Core Scanning - non destructive systematic scanning
  - Measured Geochemistry (e.g XRF)
  - Core tomography (x-ray)
  - Hyperspectral data (e.g Infra red)
  - Calculated and measured rock properties
  - Digital core imagery
- Core Photography - capturing of core tray digital images





NEW BOLIDEN

From 2022, two fully Boliden funded cross-disciplinary industry PhDs at

Luleå University of Technology

Filip Simán
PhD student
Ore Geology (LTU)

Christian Günther
PhD student
Machine Learning (LTU)

LULEÅ UNIVERSITY OF TECHNOLOGY

PRODUCT

CLOUD-BASED GEOMODELING

LIQUIDEARTH

Bringing geological modeling to life.

BOLIDEN

WORK WITH 3D GEODATA AND MODELS – ANYWHERE, ANYTIME

Real-Time Collaboration

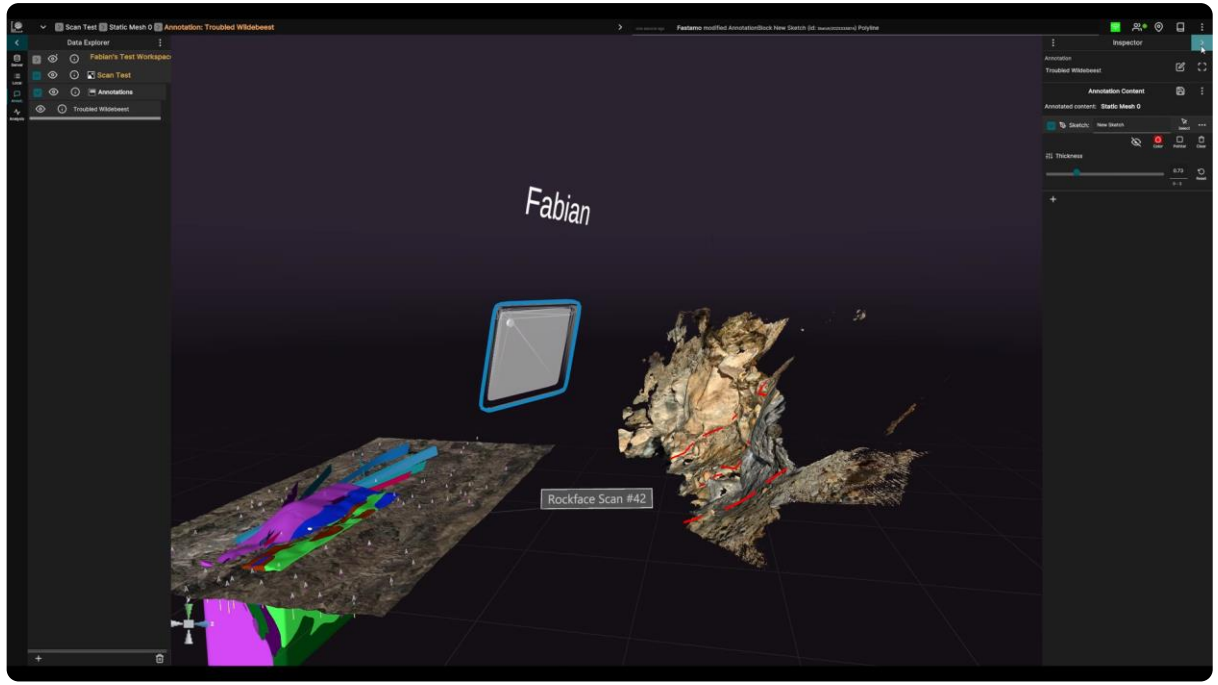
Improved **productivity and communication**

Multi-Device Compatibility

Work stationary, on the go, or in **mixed reality**

Connected Fieldwork

Real-time unification of field and office work

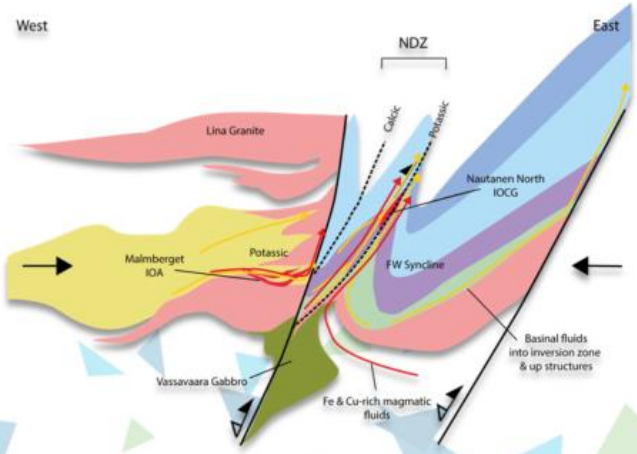


TERRANIGMA

https://www.terranigma-solutions.com/

Nautanen North PhD

- What are the deposits geological characteristics?
- How does it related to porphyry and iron-oxide apatite mineralization?
- How do we discover the next deposit?



HOST INSTITUTION
University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

PARTNER INSTITUTIONS
Trinity College Dublin · DIAS · NUI Galway OÉ Gaillimh · UCC · Maynooth University · Teagasc · DCU · Geological Survey

FUNDED BY:
European Union · Science Foundation Ireland

PhD student: David Drejing-Carroll

Student opportunities

- **Internships**
  Ad hoc when there is need or a team has possibility to host. (Rare)

- **MSc projects**
  - Suitable project and internal Boliden supervisor needs to exist, so timing and a bit of luck is important.

  CV + Personal letter to:
  tobias.hermansson@boliden.com

- **Summer geologist**
  - Paid job during the summer helping with mapping, sampling and other exploration related work.

  - Advertised and applied for on the Boliden Career site in February every year. Could be used as paid "internship".

  https://www.boliden.com/career

Thanks for listening!