

# Development of low-impact exploration methods promoting the Green Mining concept in Finland

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In the **NovTecEx** project (Novel technologies for greenfield exploration; funded by Tekes Green mining program; 2012-2014) new mineral exploration methods are developed. Mineral exploration within thick glacial overburden, peat lands and different conservation programs is very demanding, sensitive and expensive. Essential exploration techniques include concurrent use of geological, geochemical and geophysical surveys. These techniques allow us to locate and thoroughly investigate geological processes responsible for mineral deposits and the indications of ore forming processes. The aim in this project is to find cost- and eco-effective best practices for mineral techniques and concepts. Research partners of the project are the Geological Survey of Finland and the University of Oulu.

Advanced ways to do mineral mapping and exploration are studied and developed in the eight tasks of the **NovTecEx** project:

- Task 1: Developing sampling techniques for till geochemistry
- Task 2: Indicator minerals, automated mineralogy
- Task 3: On-site field assay techniques
- Task 4: Spatial data mining and modeling
- Task 5: Object based recognition of bedrock fractures
- Task 6: AMT as a mineral exploration tool
- Task 7: Development of the 2D interpretation of airborne TEM measurements
- Task 8: Airborne gravity gradient surveys

The **UltraLIM** project (Ultra-low impact exploration methods in the subarctic; funded by Tekes Green mining program; 2013-2015) compares several ultra light geochemical methods and sampling techniques and aims to find the best practices for sampling and assaying samples from very sensitive subarctic regions. There is an increasing demand to develop effective methods for exploration in poorly exposed and deep-seated mineralized bedrock sources, under thick sediment cover which are often characterized by complex glacial dispersal patterns. Sample media used in this project are the sediments of the upper parts of soils, organic layers, plants and snow. The research will be conducted on known mineral deposit targets given by GTK and the industry partners of the project. Research partners of the project are the Geological Survey of Finland and the University of Oulu.

The study is divided into three tasks:

- Task 1: Weak leach techniques
- Task 2: Biogeochemistry
- Task 3: Snow geochemistry

The sampling and assaying is repeated twice in subsequent years in order to evaluate the repeatability, accuracy and precision of the methods. Also a number of quality control samples will be used.



## Novel technologies for greenfield exploration NovTecEx

- User need
  - New mineral discoveries
  - Mineral exploration is challenged by thick glacial formations, peat bogs and weathered bedrock
  - Arctic areas typically exhibit a vulnerable environment
- Approach
  - Improve exploration concepts
  - New sampling techniques
  - Deep penetrating exploration geophysics
- Benefits
  - Mineral exploration with minimum impact on environment
- Users
  - Mining and exploration companies
  - Drilling companies



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## Results

Novel technologies for greenfield exploration project generates and develops mineral exploration concepts utilizing methods and best available practices to assess mineral potential or directly locate especially deep seated mineral deposits within northern vulnerable terrains. More effective processing, interpretation

and modeling techniques of mineral exploration data enable even larger amounts of data being processed fast. This goal serves especially the companies and organizations conducting grass root mineral exploration on regional scale. Techniques are also adoptable into target scale exploration.

## UltraLIM - Ultra low-impact exploration methods in the subarctic

- Needs
  - New mineral discoveries
  - Mineral exploration in the subarctic areas covered by thick glacial deposits, peat bogs and weathered bedrock
  - Practical knowledge and experimental results of exploration methods for environmentally sensitive areas
- Approach
  - Use of upper parts of the mineral soils, organic layers, plants and snow as the sample media for exploration
  - Comparison of sampling and assay techniques
  - Find the best practices for sampling and assaying samples in very sensitive subarctic regions
- Benefits
  - New applications and knowledge for the mineral exploration with minimum impact on environment
- Users
  - Mining and exploration companies
  - Scientific community



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## Results

UltraLIM project produces research information of several low impact geochemical techniques for mineral exploration within previously glaciated terrains. This research gives reliable and practically tested benchmarks for the use different geochemical sampling and assay techniques in mineral exploration

within the subarctic. The project aims to find the best geochemical practices for locating mineral deposits under thick soil cover. The project also aims to promote the use of methods and results in exploration in Finland.