

Advanced low-impact exploration methods promoting the Green Mining concept in Finland

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The Green Mining Programme of the Finnish Funding Agency for Technology and Innovation (Tekes) was launched in 2011 in Finland. A focus is to promote the development of low-impact and sustainable mineral industry and to increase the number of small and medium size enterprises in the mineral cluster in Finland. The Geological Survey of Finland (GTK) has several ongoing projects within this programme and two of these concern new methodologies for sampling, analysis and interpretation of multiple geological, geochemical and geophysical datasets in environmentally sensitive Arctic and Sub-Arctic areas.

The projects are Novel technologies for greenfield exploration (NovTecEx; 2012-2014) and Ultra low-impact exploration methods in the subarctic (UltraLIM; 2013-2015). These projects aim to minimize the environmental impact of mineral exploration, decrease analytical costs, and increase sampling and data interpretation efficiency.

NovTecEx

In the NovTecEx project, eight tasks focused on developing mineral exploration concepts utilizing the best available methods and practices to assess mineral potential or directly mineral deposits within vulnerable terrains. For example, advanced till and bedrock sampling and analysis techniques and indicator mineral identification methods were developed. Furthermore, more effective processing, interpretation and modelling techniques of geophysical and mineral exploration data enable even larger amounts of data being processed fast. The results and methodological advances especially serve companies and organizations conducting grass-root mineral exploration from the regional to target scale.

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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UltraLIM

In the UltraLIM project, the focus was in the best geochemical sampling and analysis methods of the upper mineral sediments, plant organs and snow for locating an underlying mineralization. For testing and comparing different sampling media

and leaching methods several known mineralizations in northern Finland were chosen as study sites. Results include practical recommendations of the use of tested methods in glaciated terrains.



Sampling of plant, snow and upper mineral Podsol soil profile for the selective/weak leach analyses. Photos by P. Sarala and J. Valkama.

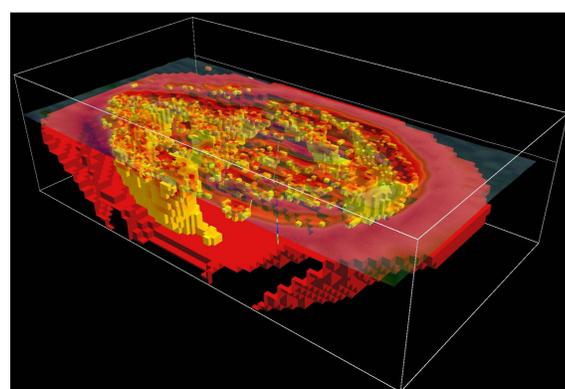
Both projects included a strong development component for the geochemical sampling and analyse methods for greenfield exploration. The ultimate goal was to give recommendations to low-impact sampling techniques coincident with multiple sample material collection, on-site field analysis methods, data processing and advanced spatial analysis methods.

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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3D model of deep mineral potential structure based on audiomagnetotelluric methods from Sotkavaara, Rovaniemi. Model by I. Lahti.



Photo of the full, 13 m long till, varved silt and weathered bedrock sample core (top on the up left and bottom on the down right) from eastern Rovaniemi as an example of methodological testing for the deep till sampling done in the NovTecEx project. The sample core was drilled using sonic drilling method. Photos by P. Sarala.



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