

The AIMEX Project: ESG data in study of public acceptance of mineral exploration

Toni Eerola^{a*}, Bijal Chudasama^a, Nike Luodes^a, Janne Juntunen^b, Emmi Vähä^b

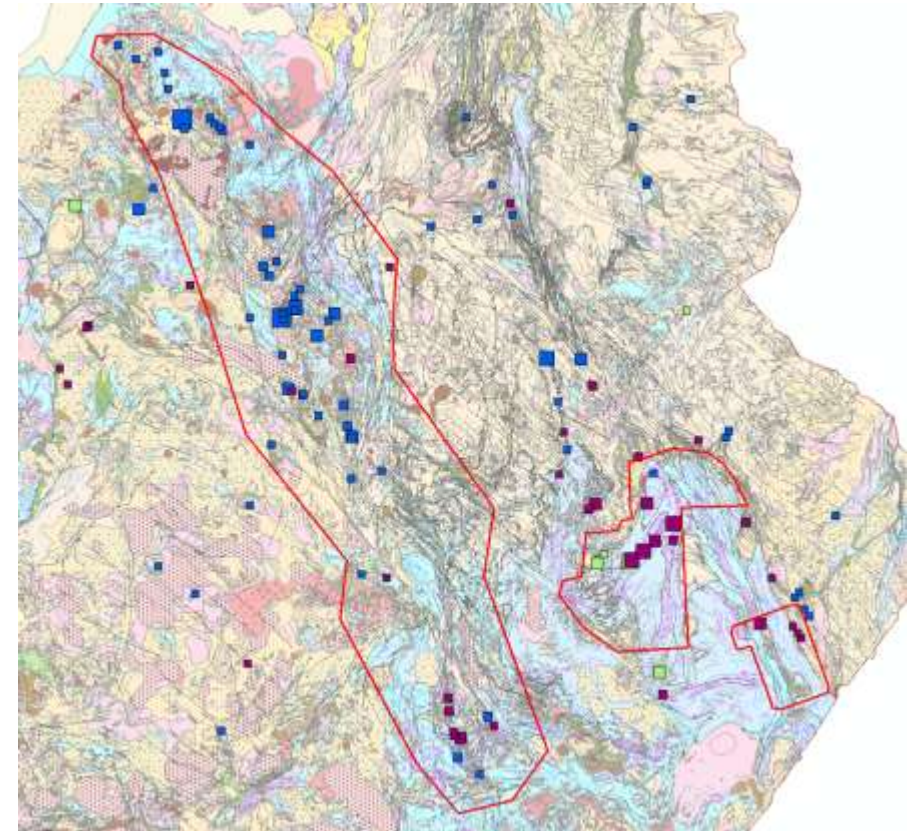
^aGeological Survey of Finland, P.O. Box 96, FI-02150;

^bFinnish Environment Institute, Latokartanonkaari 11, 00790 Helsinki, Finland

*toni.eerola@gtk.fi

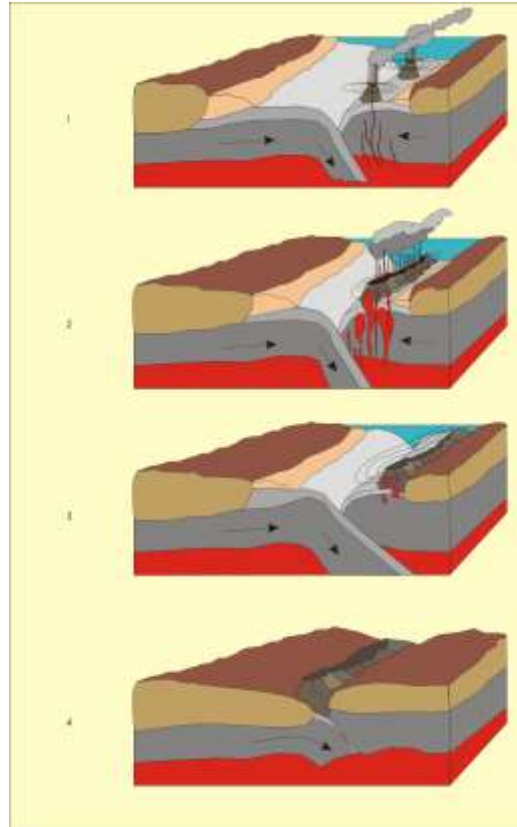
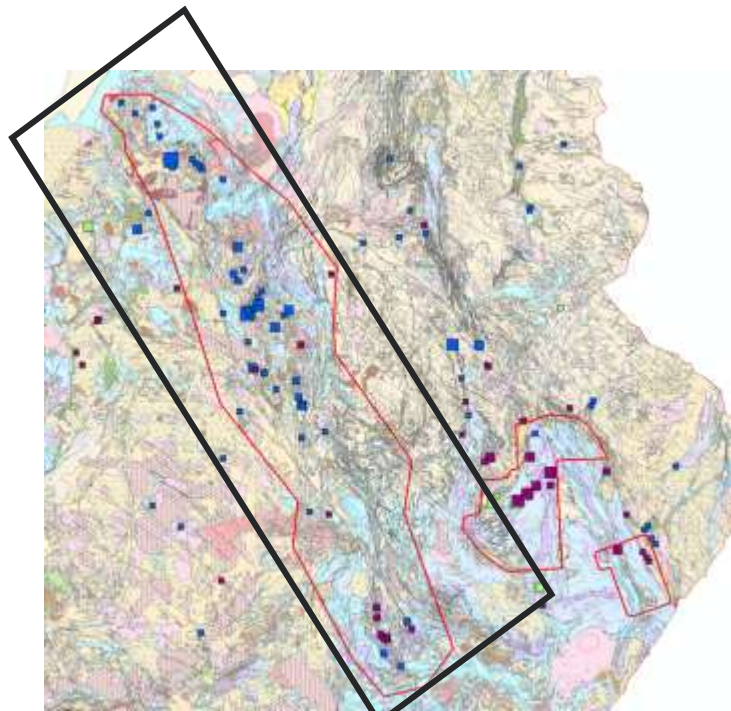
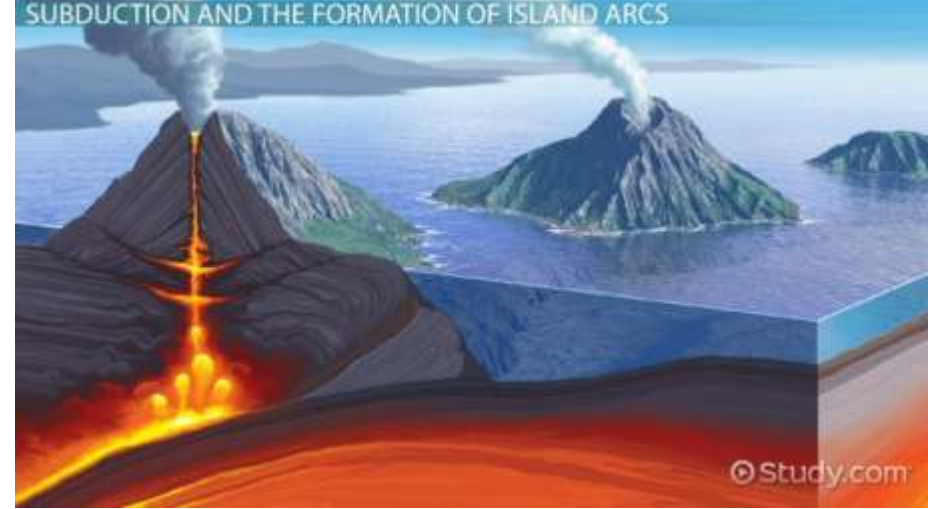
AIMEX (Artificial Intelligence in Mineral Exploration) Project (Lead by GTK + SYKE + partner companies)

- **Prospectivity** (geological, geophysical, geochemical data);
- **ESG** (Environmental, Social and Governance data)
- **Aim:**
 - Consideration of land use, social and governance issues;
 - Prediction of disputes;
 - Improve public acceptance of mineral exploration;
- **Case study areas:**
 - **Vihanti-Pyhäsalmi;**
 - **Outokumpu-Hammaslahti;**
 - **Sokli (P, Nb, U, REE);**
 - **Rompas-Rajapalot (Au, Co).**
- **Methodology (GIS):**
 - Selection and categorization of data;
 - Identification of sensitive land use contexts prone to disputes;
 - Demographic data and governance (regulation, municipality role, corporate conduct);
 - Their combination;
 - Machine learning.

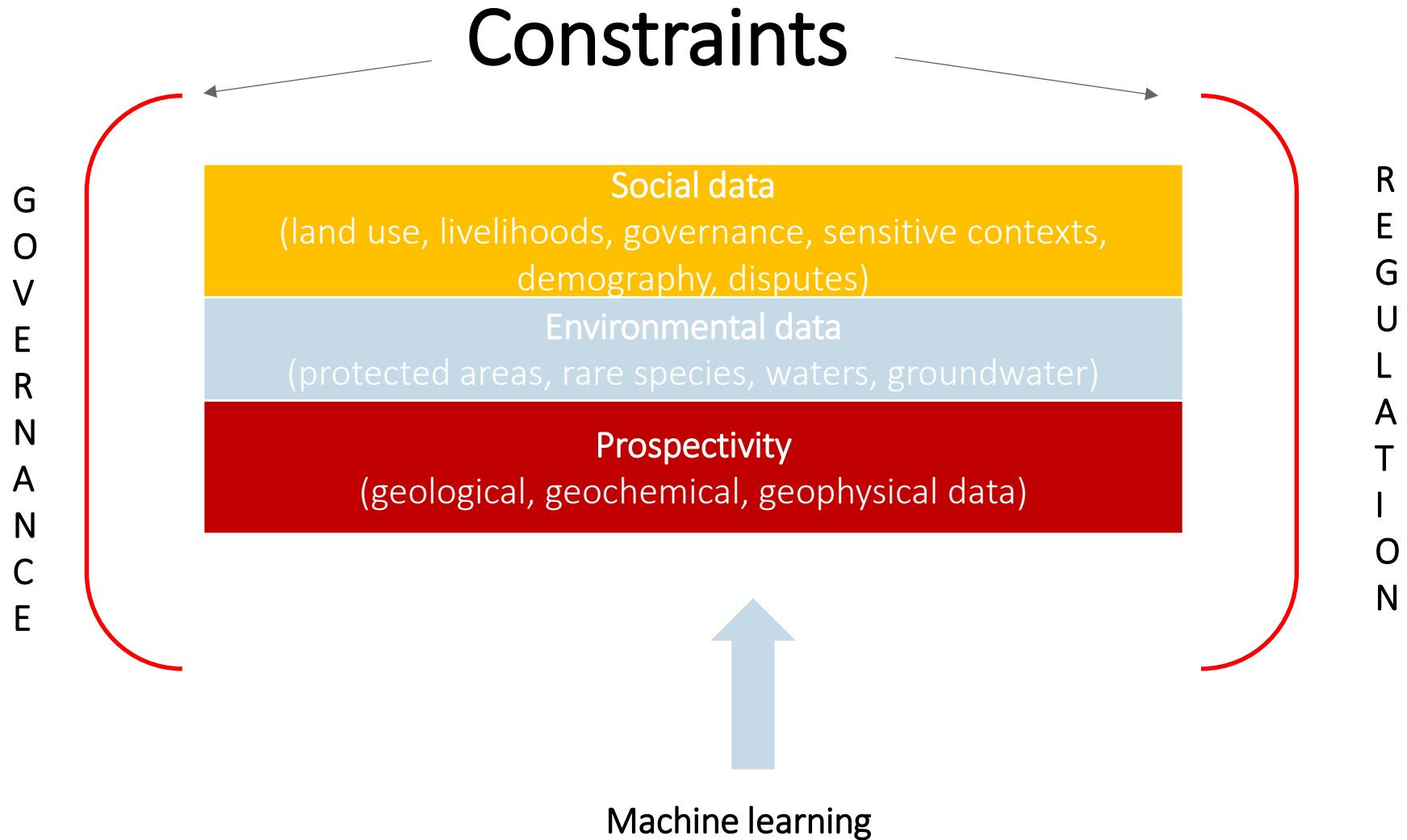


Case study area: Vihanti-Pyhäsalmi Volcanic Massive Sulfides (VMS) Belt:

- Paleoproterozoic volcanic island arc systems;
- Suitable conditions and processes for ore generation (VMS);
- Collision with a continent and deformation
- Modern analogues: Ryukyo, Aleutian, Caribbean;
- Prospectivity, mines and mineral deposits



AIMEX Data Layers



Environmental and Social Datasets



Environmental Datasets	Details
Natura 2000 network	SPA and SCA, The network protects the habitats and habitats of the species defined in EC's Habitats Directive (Directive 92/43/EEC) and Birds Directive (Directive 2009/147/EC)
Nature Conservation and Wilderness Areas	Special protection areas , National Parks, Grove-, Bog-, Old forests- PAs. The Nature Conservation and Wilderness Areas data includes nature conservation areas established by law or decree for state areas under the Nature Conservation Act and wilderness areas established under the Wilderness Act.
Important groundwater areas (I, IE)	Groundwater area important for water supply, on whose groundwater a surface water or terrestrial ecosystem is directly dependent. Information can also be used to support land use planning and groundwater protection.
Especially important habitats	Small-scale areas that are important for the conservation of species and thus forest diversity, and that stand out from their environment, and whose characteristics have been preserved in a natural or near-natural state. Are defined in the law called Metsälaki
Nationally valuable landscape areas (VAMA 2021)	<p>Nationally valuable cultural environments, natural heritage, forestry landscape and historically and scenically significant landscape attractions.</p> <p>The national land use objectives (VAT) of the Land Use and Building Act (132/1999, MRL) require that care be taken to safeguard these. According to Section 24 of the Land Use and Building Act (MRL), this must be taken into account in the activities of state authorities, in regional planning and in other land use planning. VAMA is a national inventory prepared by the authorities, which forms a data base for considering the cultural environment values in accordance with the use objectives of national areas.</p> <p>Purpose: The map material has been created for the management of landscape-related information and its application.</p>
Natural Monuments	It includes Natural monuments established under the Nature Conservation Act, data provided by Metsähallitus. Sites on state land have been established by decision of the area's owner authority (usually Metsähallitus),Some of the natural monuments are located in courtyards protected by domestic law.
Salmonid fish stocks in stream waters (endangered species)	The salmonid fish stocks in stream waters are data describing the occurrence of salmonid fish stocks in stream waters. These also define the boundaries of the ELY Centres' environmental and natural resources responsibility areas produced by the National Land Survey of Finland. Contains upstream catchment areas that are of significant in terms of water management

Environmental and Social Datasets

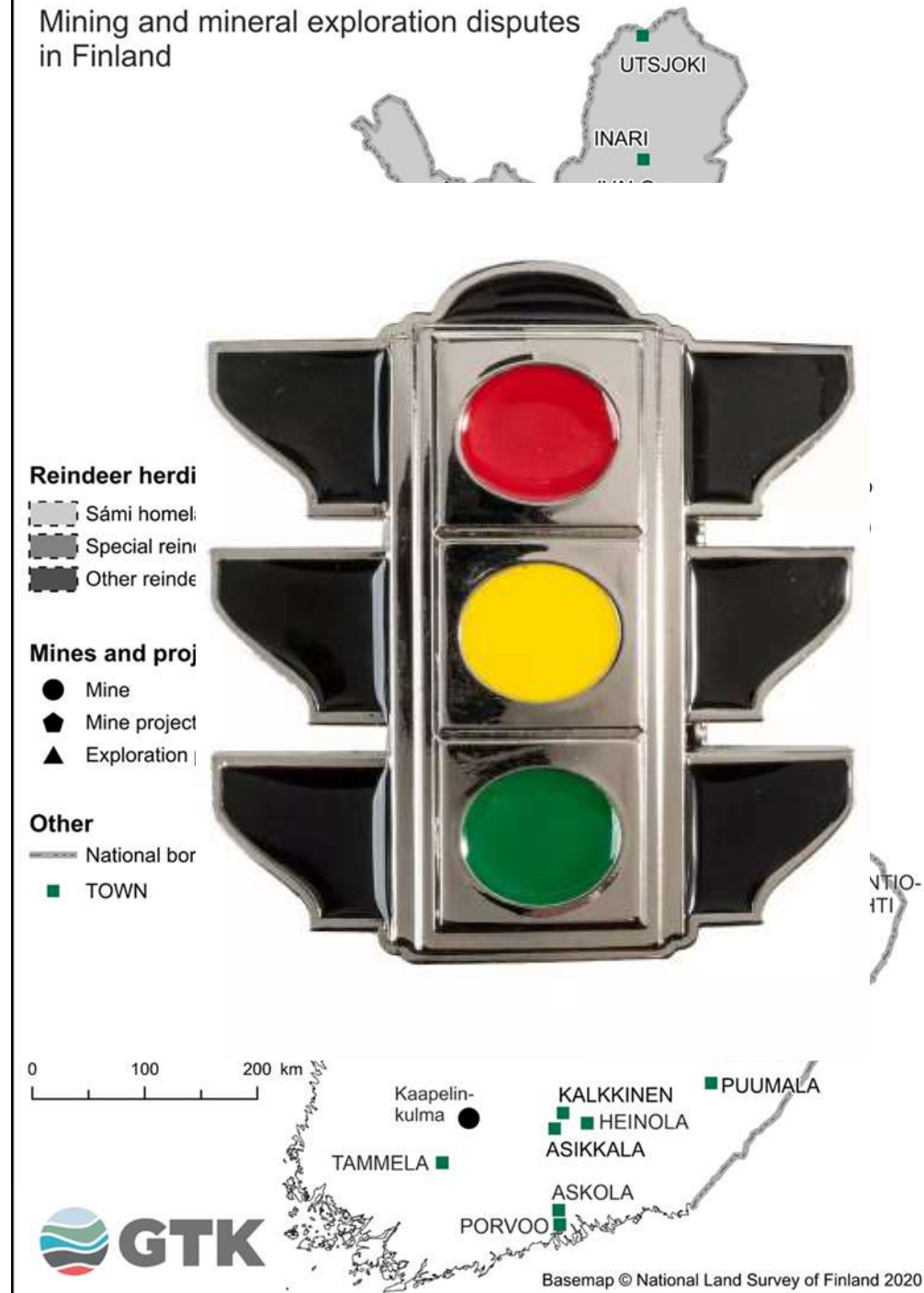


Environmental Datasets	Details
State, other protected areas	Data from the Metsähallitus system. It includes state areas that will later be established as nature reserves by law or decree (211,212,221) and such area types under the management of Nature Services (in the balance sheet of public administrative tasks) (231,232) that have been established by decision of Metsähallitus for conservation purposes and that are considered “protected areas” in national protected area statistics. The establishment of the former as nature reserves is based either on a government decision (211) or on a confirmed plan (221). In addition, they include areas acquired by the state for the METSO programme through voluntary transactions (212).
Serpentine Rocks	Protected habitat type serpentine rocks, rocks and gravel pits of the new Nature Conservation Act (Nature Conservation Act 9/2023). The data set includes the status of each site as defined in the Nature Conservation Act. as a habitat type
Nationally valuable aeolian and littoral deposits; Nationally valuable moraine formations, Nationally valuable rocky outcrop areas for nature and landscape conservation; Nationally valuable block field sites	
Social Datasets: Land use type	
Second Homes	
Tourism and Recreation Areas	
Agricultural and Pastoral Land	
Industrial and Commercial Areas	
Other construction sites	

A "Warning System"

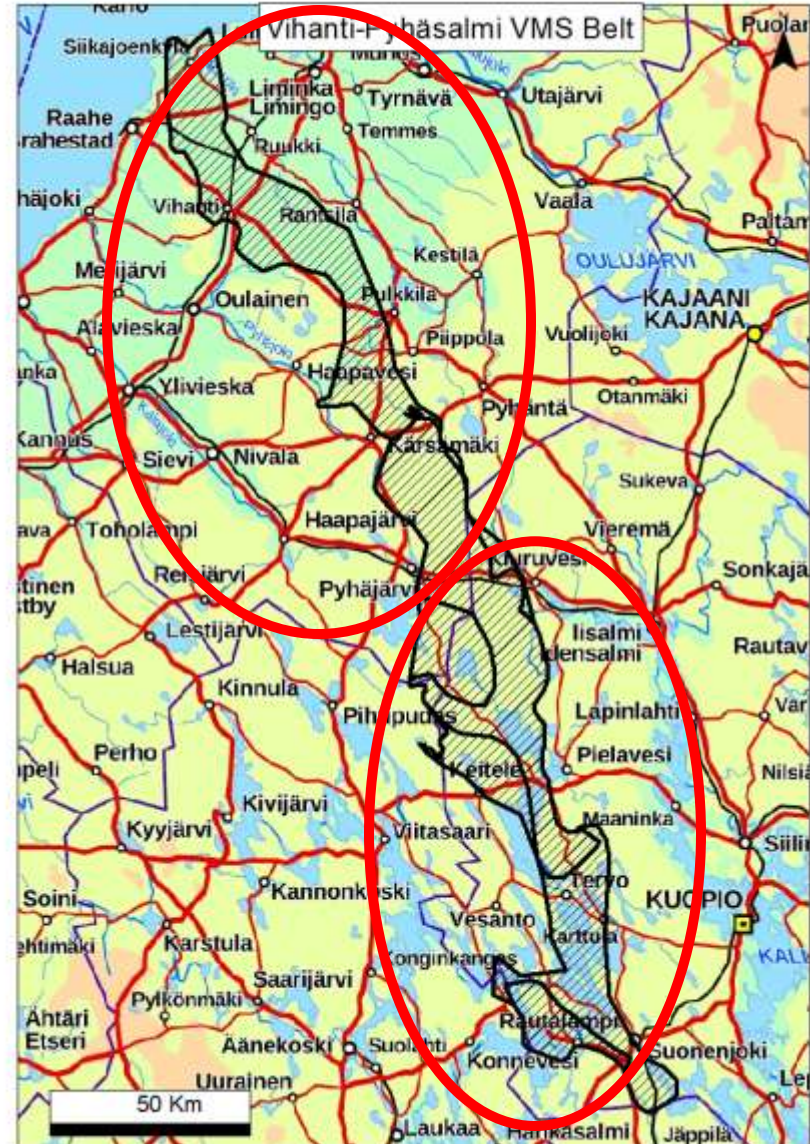
- Sensitive contexts prone to disputes:
 - *Indigenous Sámi homeland;*
 - *Reindeer herding;*
 - *Protected areas (National and natural parks);*
 - *Lakes with second homes;*
 - *Tourism destinations;*
 - *Groundwater areas;*
 - *Associated uranium;*
- Their overlapping;
- Case by case and in diverse scales (regional specificities);
- Traffic light system;
- Prospectivity and land use: Prediction of disputes

Mining and mineral exploration disputes in Finland

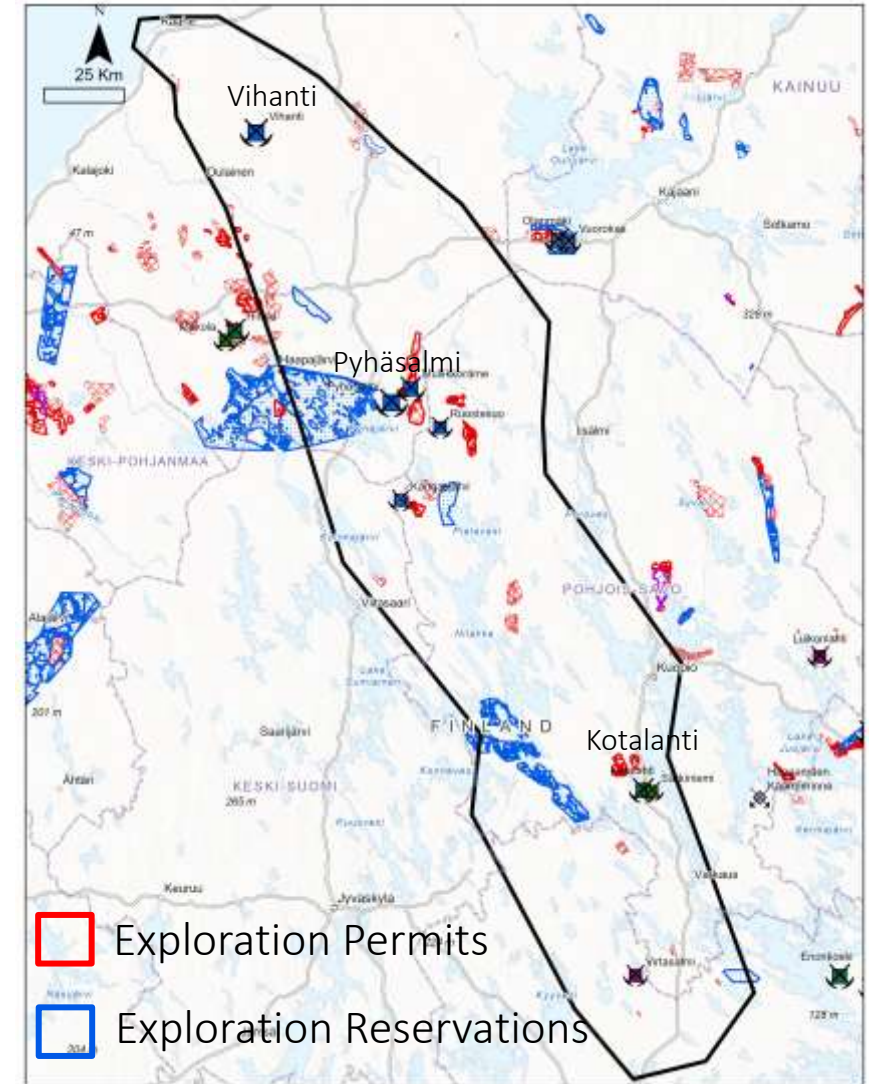
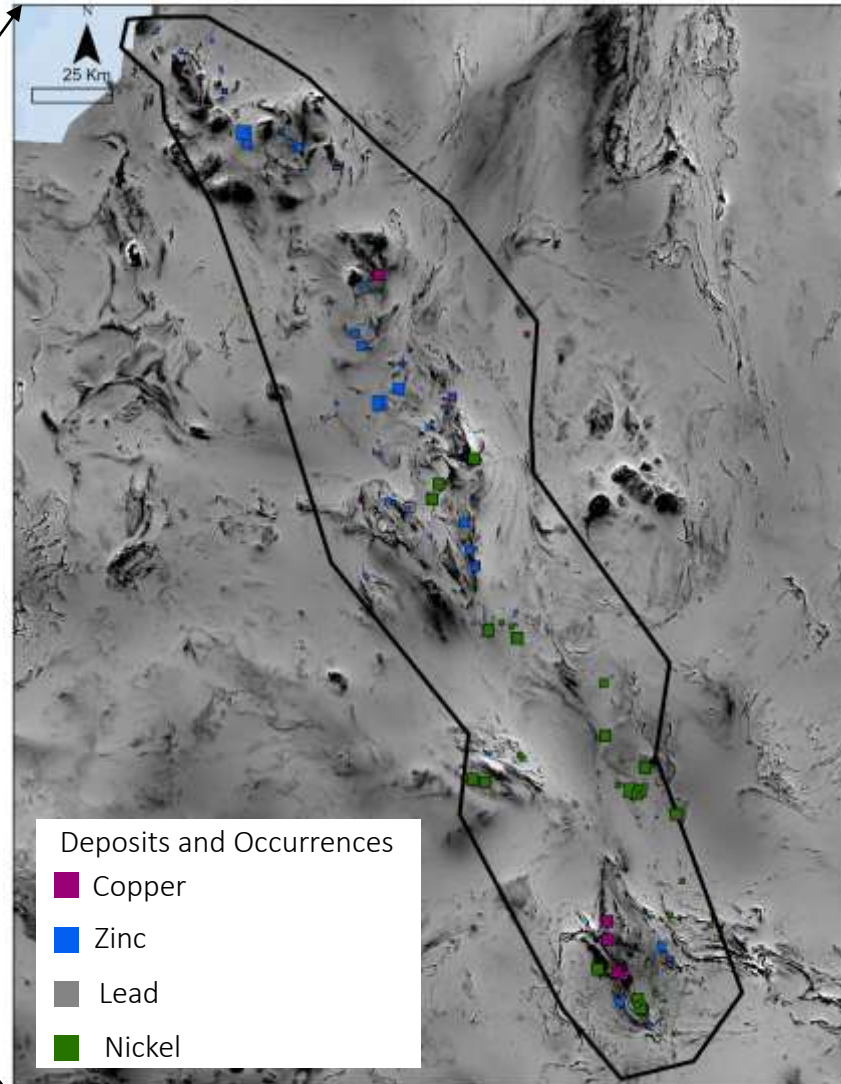


Vihanti-Pyhäsalmi VMS Belt

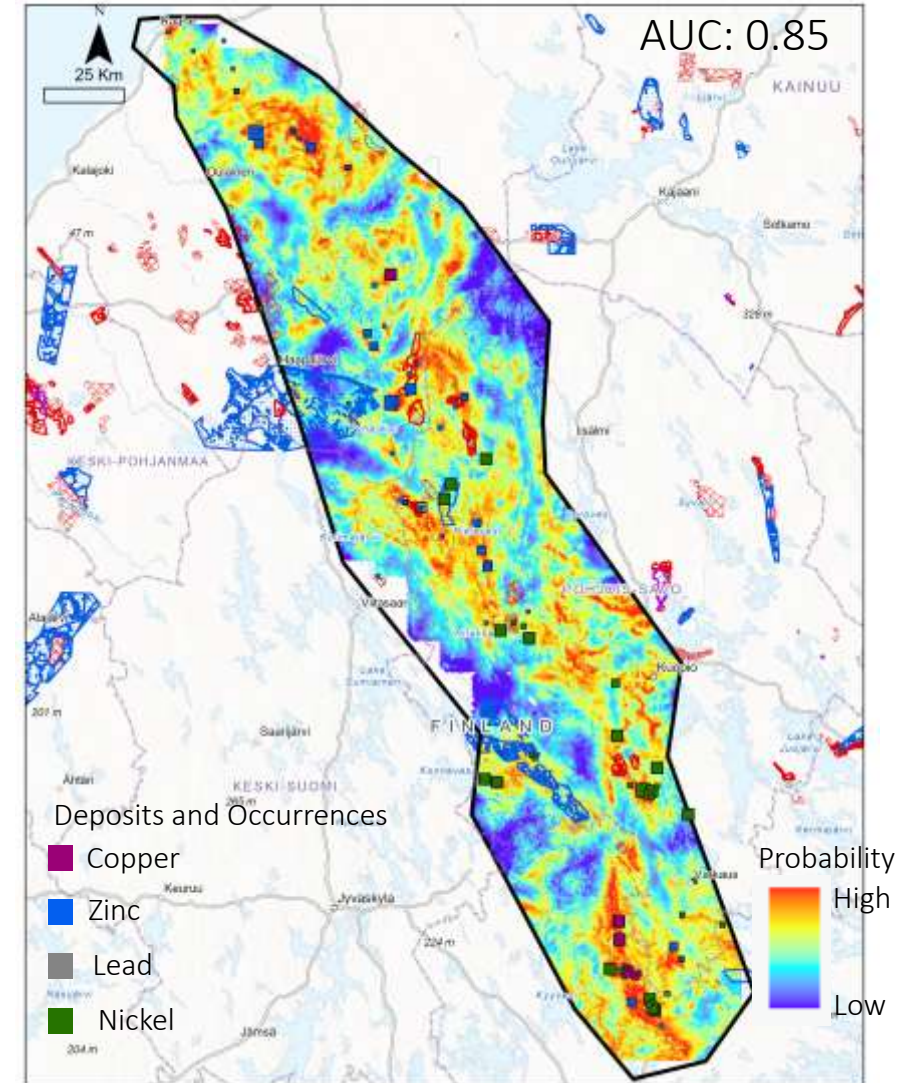
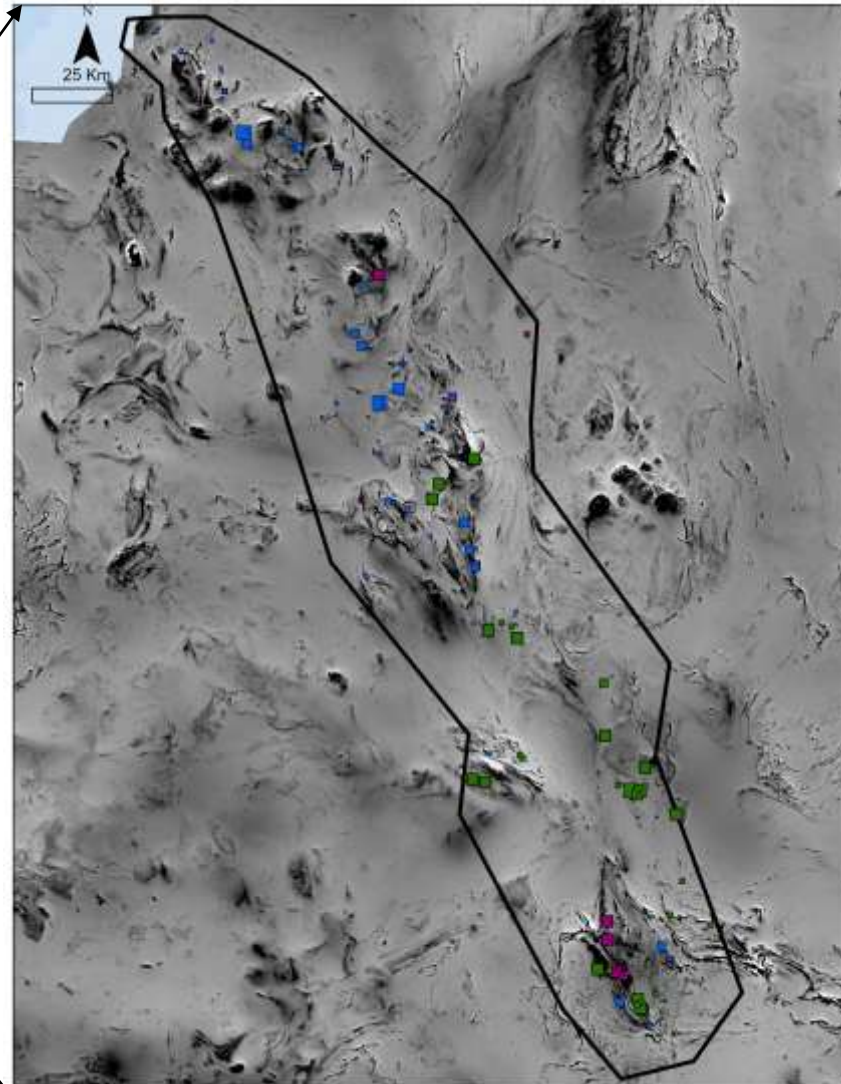
- Regional overview;
- Length: ~300 km;
- From Raahe (Ostrobothnia, N) to Viratsalmi (South Savo, S) ;
- Extensive exploration in the past and ongoing (energy transition);
- Brownfield;
- **Two domains:**
- ***Southern*** (N-S Savo) side: lake area (cottages, summer tourism):
 - *Viitasaari, Vekseli, Virtasalmi, Rantasalmi, Rautalampi, etc.*
- ***Northern side:*** no known disputes (beyond Laiva gold mine, Raahe)
 - *Ostrobothnia: conservative, natural resource-based economy, coastal area industrial, unperception of environmental injustice;*



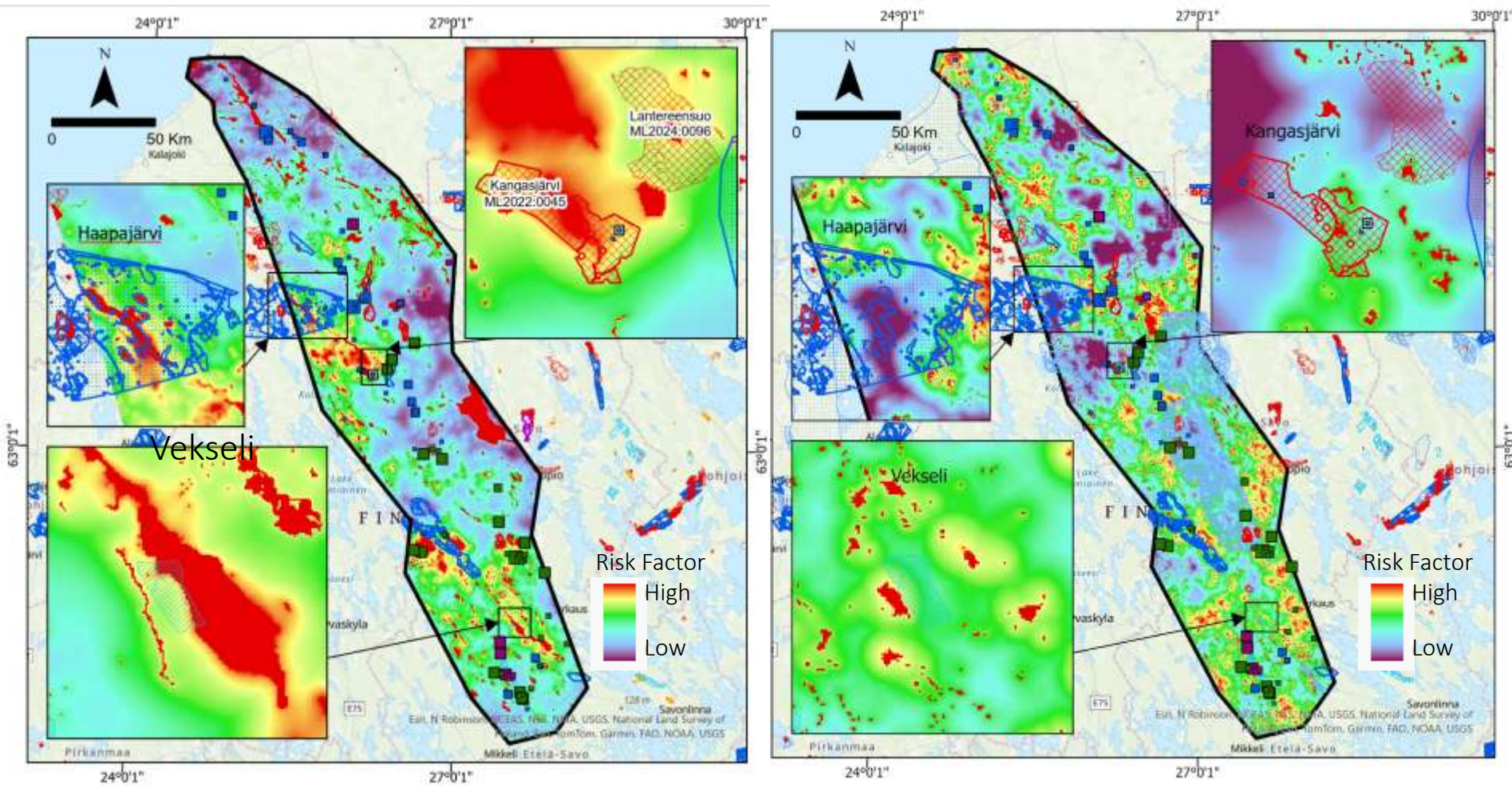
Pyhäsalmi-Vihanti VMS Belt



Pyhäsalmi-Vihanti VMS Belt – Prospectivity Map



Environmental and Social Risk Map for Pyhäsalmi VMS Belt



Environmental Proxies

- Important Groundwater bodies
- Salmonid Stocks in stream waters
- Nature conservation and wilderness Areas
- Especially Important Habitats
- Nationally Valuable Landscapes.
- Natural Monuments

Social Proxies

- **Second Homes**
- **Tourism and Recreation Areas**
- Other Industrial and Commercial Areas

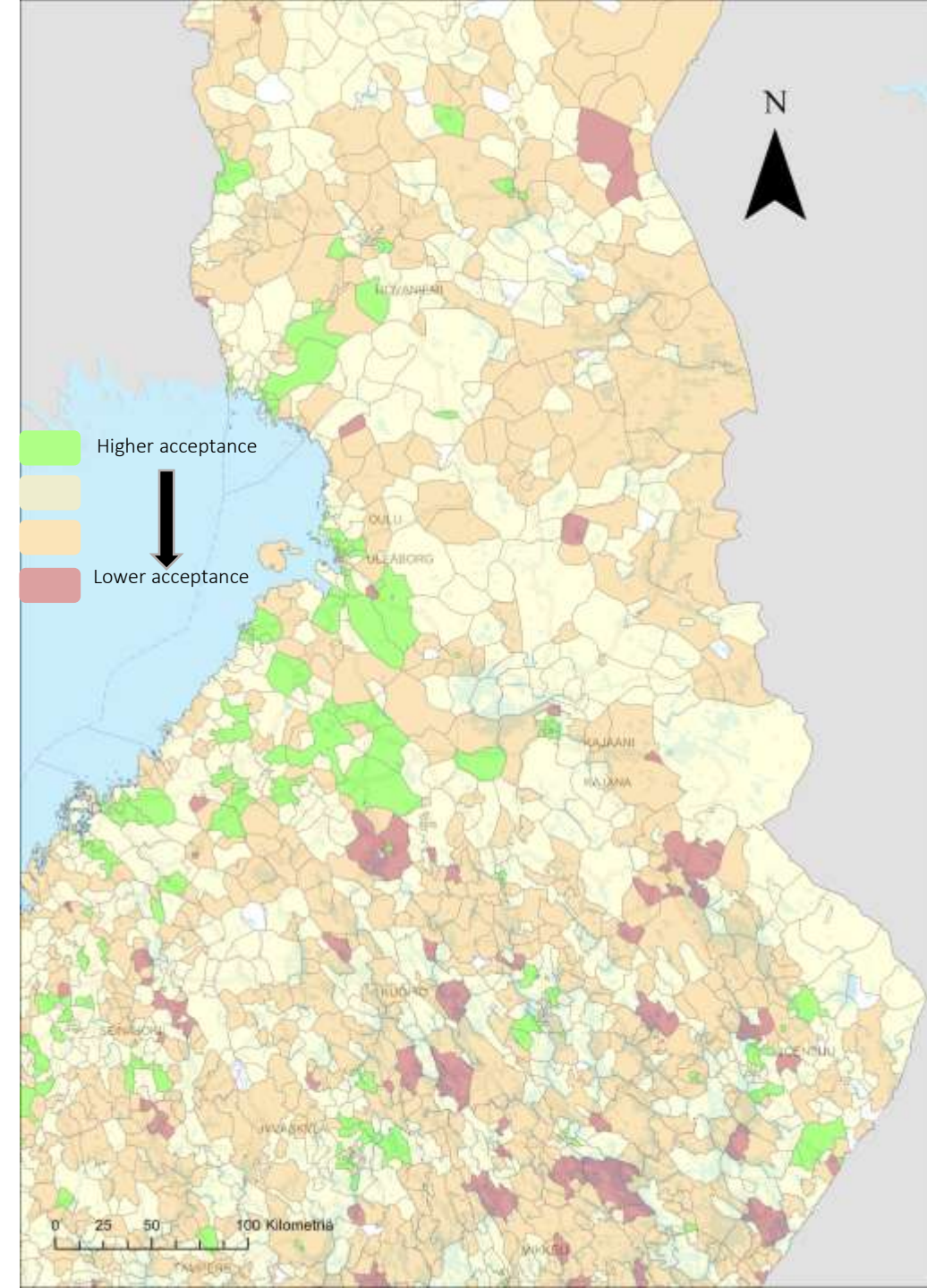
Combined effects of demographic aspects

- The rate between Women and Men: women more concerned about the environment and possible impacts on the family and the children.
- Educational rate between higher educated vs lower educated: low-skilled labor could easily find employment in mining, while those with higher education can be more critical.
- The rate of professions affected and benefitted.
- The rate of ree-time residences (for private use or rent) vs. dwellings in residential buildings and other buildings

Data source: Paavo postal code area statistics 2025

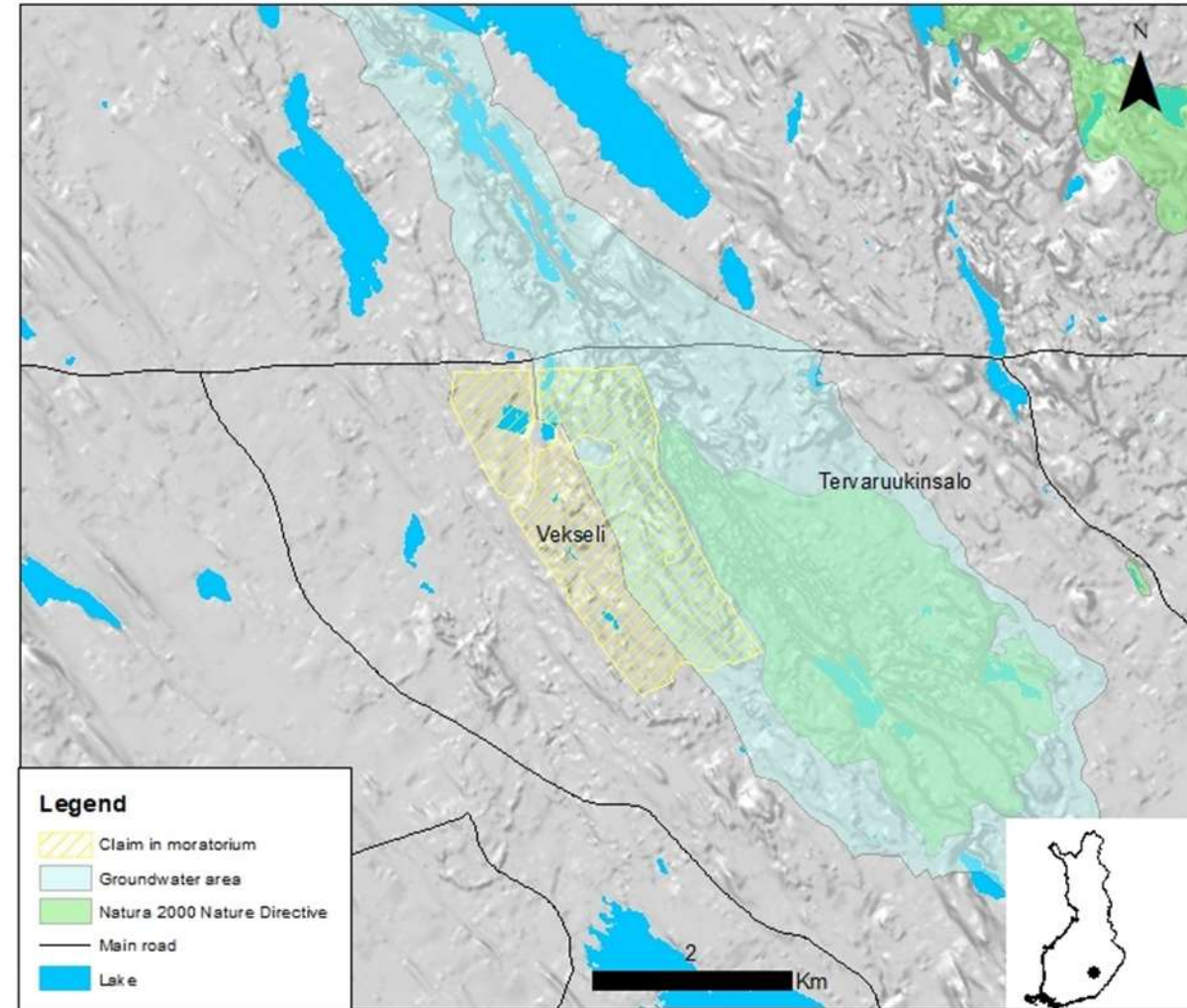
Demographic data might have relevance within a time assessment, before vs after mining activity, but there is lack of georeferenced historical data freely available.

Local community and political aspects cannot be generalized!



Vekseli (Vihanti-Pyhäsalmi VMS Belt, southern domain)

- Pieksämäki-Joroinen;
- Boliden;
- Mineral exploration;
- Permit application overlapping;
- Quaternary esker (glacio-fluvial gravel and sand deposit)
- E1 groundwater area (water supply and ecosystem);
- Natura 2000;
- Land use ignored;
- Pro Pieksämäki;
- Pro Joroinen;
- Constraints for drilling;
- Boliden abandoned the permit;



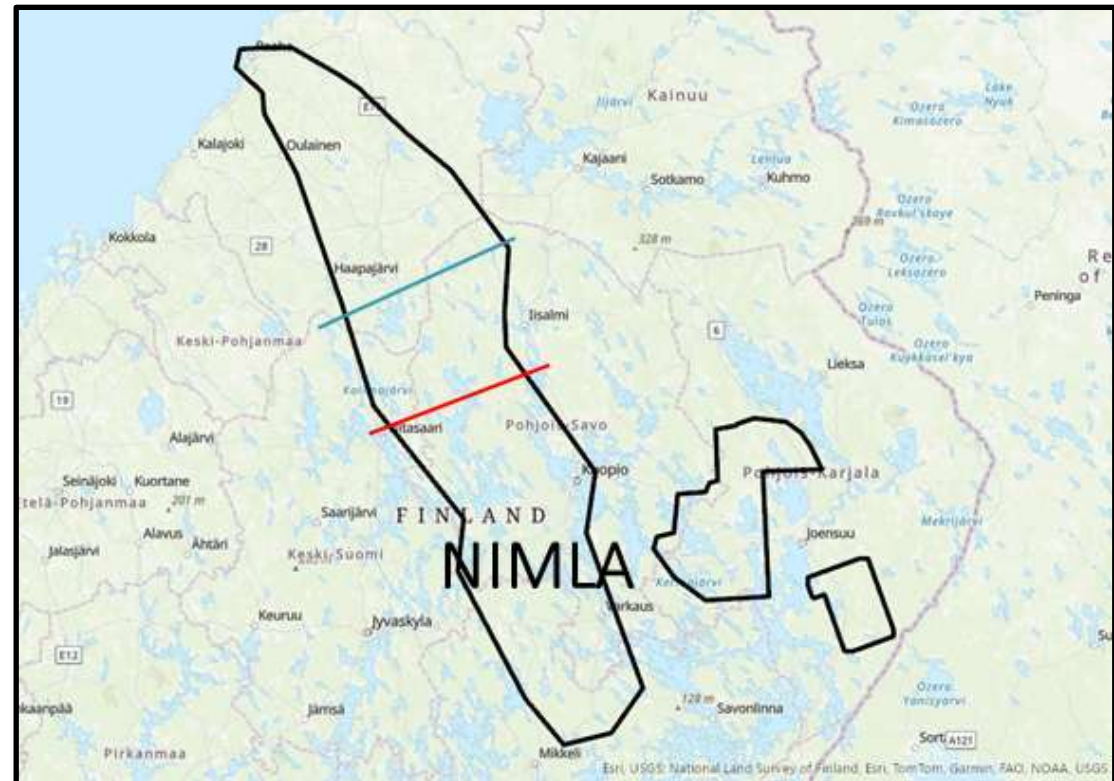
Rautalampi (Vihanti-Pyhäsalmi VMS Belt, southern domain)

- Rio Tinto;
- Aerogeophysical surveys;
- Konnevesi National Park;
- No stakeholder engagement, nor communication;
- Lack of information;
- Pro Rautalampi;
- Company's bad reputation;
- Abandoned area;
- Ended its mineral exploration in Finland;
- Other companies have inherited the dispute;
- 'Not in my leisure area!' (NIMLA) (second homes, summer tourism);



Conclusions

- Vihanti-Pyhäsalmi VMS Belt examined;
- ESG data analysis;
- Social acceptance of mineral exploration;
- Two domains: North and South;
- North: Ostrobothnia – brownfield, pro-mining
- South: Lake area – NIMLA
- Local cases: Vekseli, Rautalampi, Virtasalmi
- Protected, groundwater, and second home areas and summer tourism destinations;
- Geology, physiography, culture, livelihoods;
- Companies need to aware of the land use issues;
- Consideration in target selection;
- Stakeholder engagement and communication.



NIMLA = 'Not in my leisure area!'

THANK YOU!



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[GeologiantutkimuskeskusGTK](https://www.youtube.com/channel/UCGeologicalSurveyFinland)

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