

The Economic Impact of Geoinformation with Special Reference to Finland's Mining Industry

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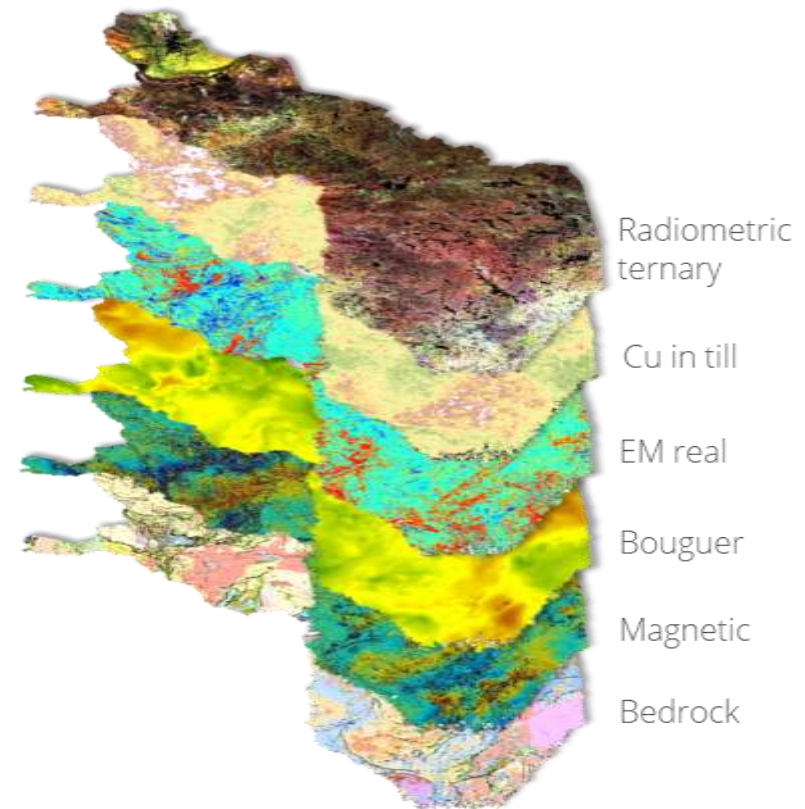
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The logo for Penurco, featuring the word "Penurco" in a white serif font on a blue rectangular background.

Talk Outline

- Why Geological Knowledge is Needed?
- Geodata and knowhow in Finland
- Mineral sector development in Finland
- Economic value and impact of geodata and information
- Conclusions



Why Geological Knowledge is Needed?

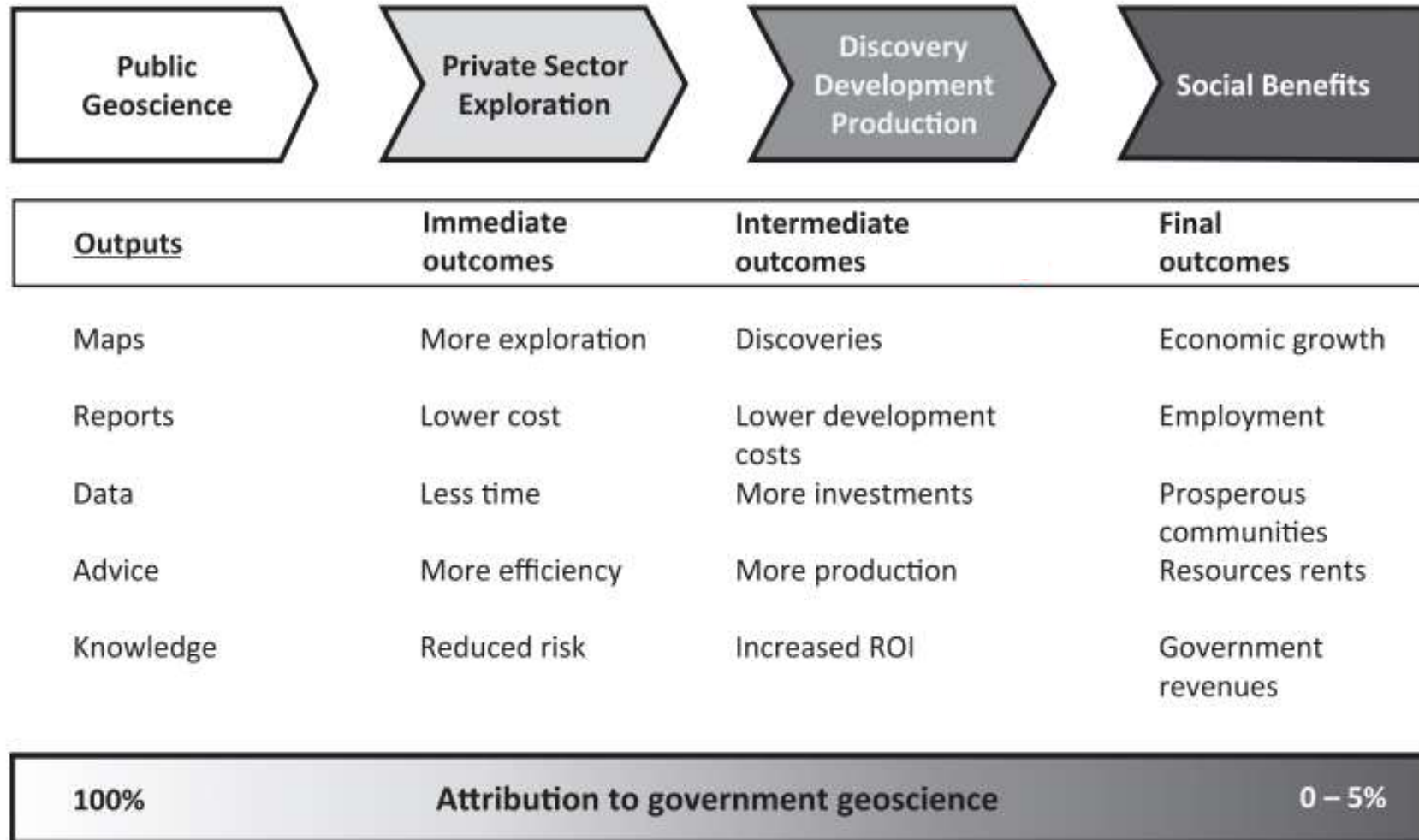
Geodata and knowledge are of crucial importance in solving global challenges

Geological knowledge allows:

- access to mineral resources and sustainable mining
- improve the access to better quality underground water resources
- a better use of the geoenergy potential for heating, cooling and energy storage
- better land use planning (for agriculture or urban development, and reduce environmental degradation)
- forecast, prevent and manage the impact of climate change and natural hazards

Needs for information vary considerably from country to country depending on geology and the economics and societal factors

Public Geoscience Value Chain in Mining



GTK - over 135 Years of Geoscience



GTK was founded in 1886 for mapping and exploring earth resources

Long-term mapping, exploration and research activities have led to world-class geoinformation and geoscience knowhow

GTK has historically been one of the key players in mineral exploration in Finland, which has led to the initial discovery of over 20 deposits for mine development

Total value of produced metals of these mines is €32 bill., and remaining in situ metal value of resources in active mines is ca. €150 bill.

Changes in business environment and societal needs, combined with restructured financing has led to proactive development of GTK mission, strategy and business concept over the last decades.

Mines with initial GTK discovery



Outokumpu Cu 1910



Kemi Cr 1966



Kittilä Au 2006

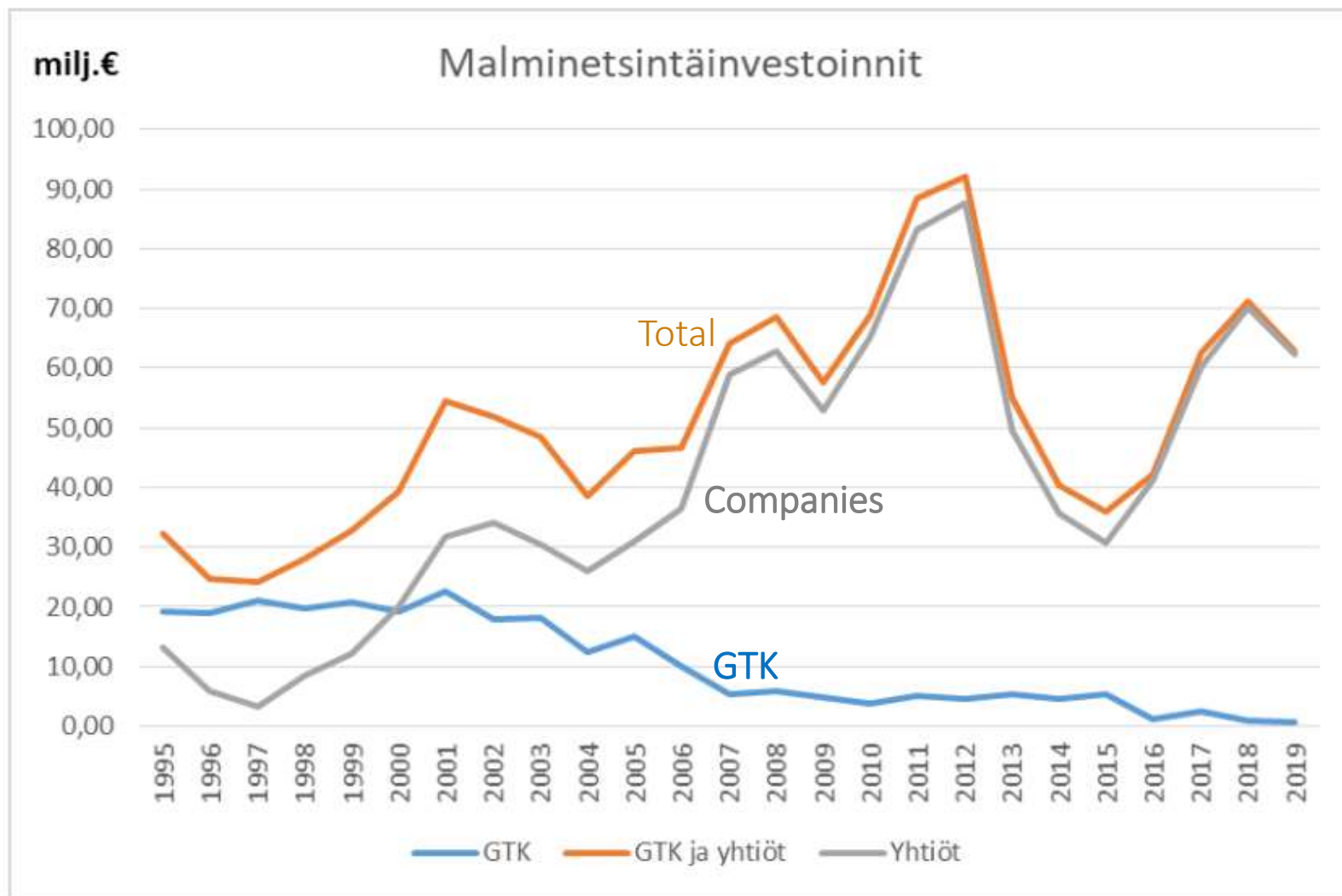


Talvivaara/Terrafame 2008



Kevitsa 2011

Exploration Expenditure in Finland



Geodata and On-Line Services in Finland

GTK geodatabase

- Mineral resources
- Bedrock
- Geophysics
- Geochemistry
- Quaternary geology
- Marine geology
- Geoenergy
- Peat resources



Finnish spatial data,
documents and metadata
database service



Map services



GTK library



Sample archives and
collections

Over 130,000 visitors annually!



Interface services



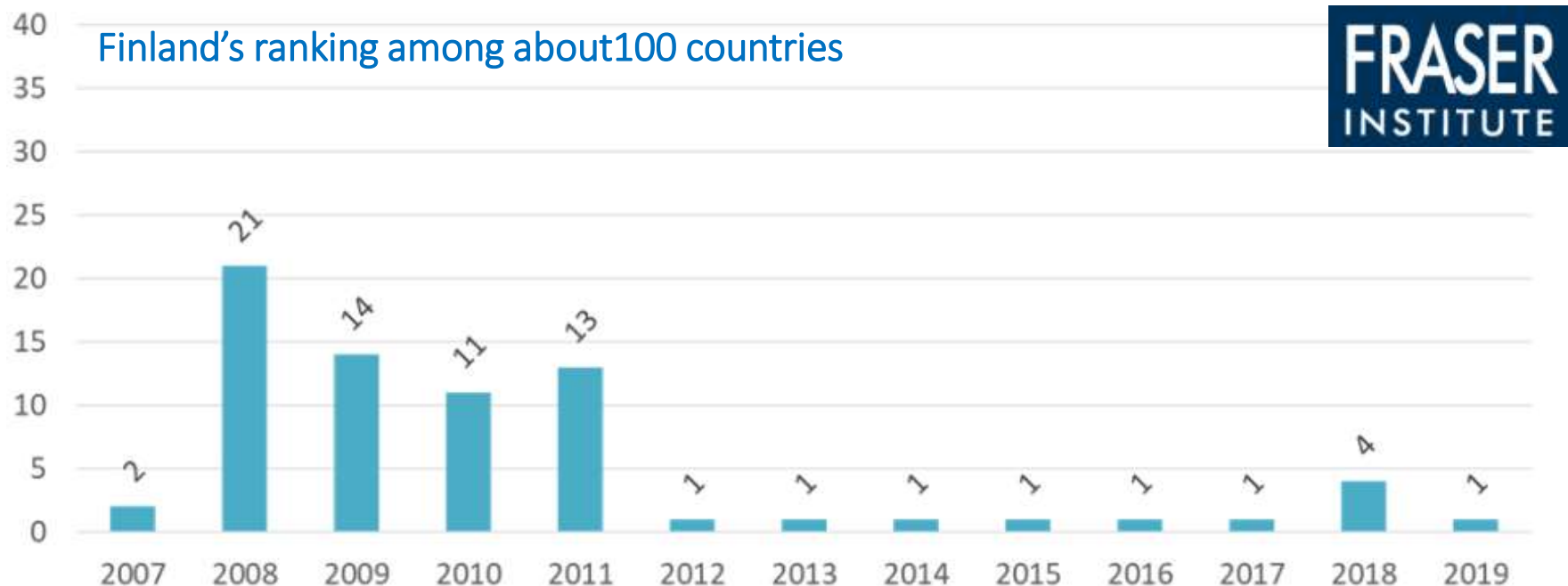
National geological database

GTK Geodata for Exploration and Mining

Airborne geophysics	Nationwide coverage of low-altitude magnetic, electromagnetic and radiometric data(200 m line spacing, 30–40 m terrain clearance). Total of 1.94 million line-km.
Ground geophysics	Various ground surveys, 63 million points.
Regional gravimetrics	300,000 points (included above).
Reflection seismics	2820 line km.
Petrophysics	5 million samples.
Nationwide till geochem.	82,000 samples (nominal density 1 sample per 4 km ²).
Detailed till geochem.	710,000 samples.
Rock geochem.	Nationwide survey: 6544 samples, 54 elements.
Bedrock map	Nationwide seamless bedrock map database (nominal scale 1:200,000).
Bedrock mapping	679,000 observations.
Drill-core archive	37,500 drill cores.
Age determinations	1450 samples (zircon U/Pb).
Mineral occurrences	1016 occurrences.

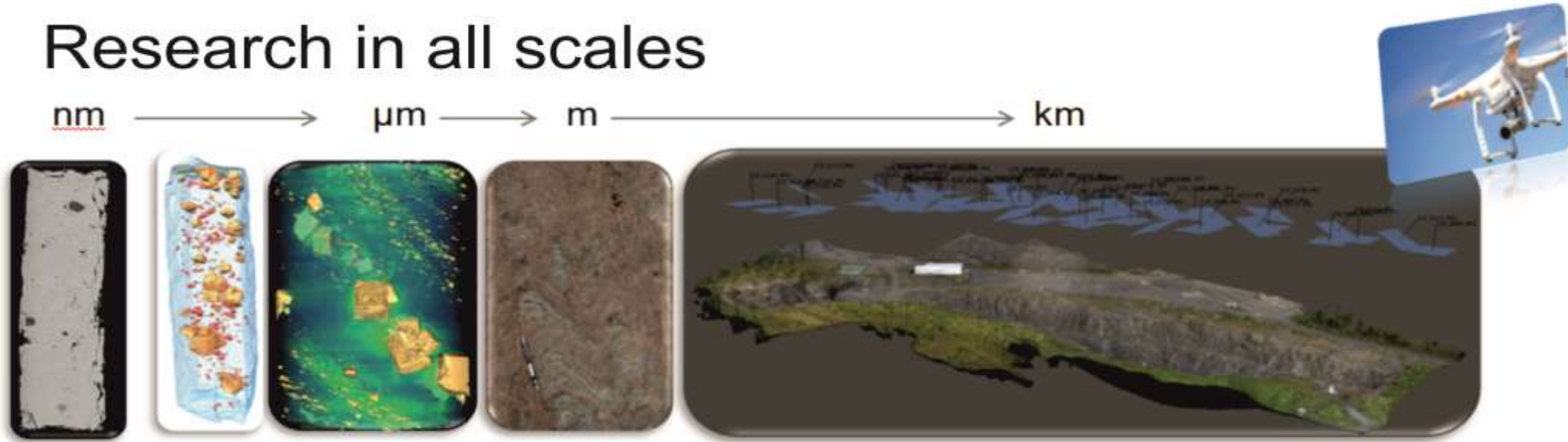
Global Ranking of Finland's Geodata

The Fraser Institute's Annual Study of Mining Companies



Mineral Potential and System Research

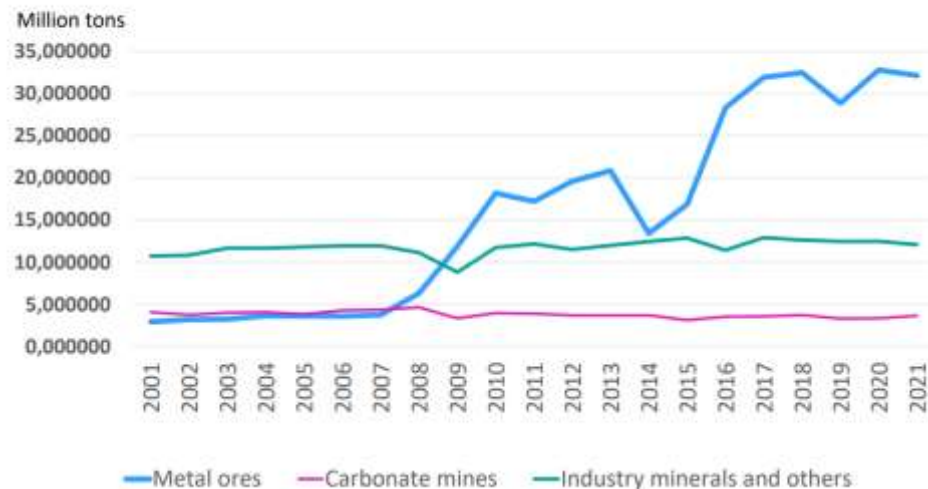
Research in all scales



Source: GTK

Mineral Exploration Booms in Finland

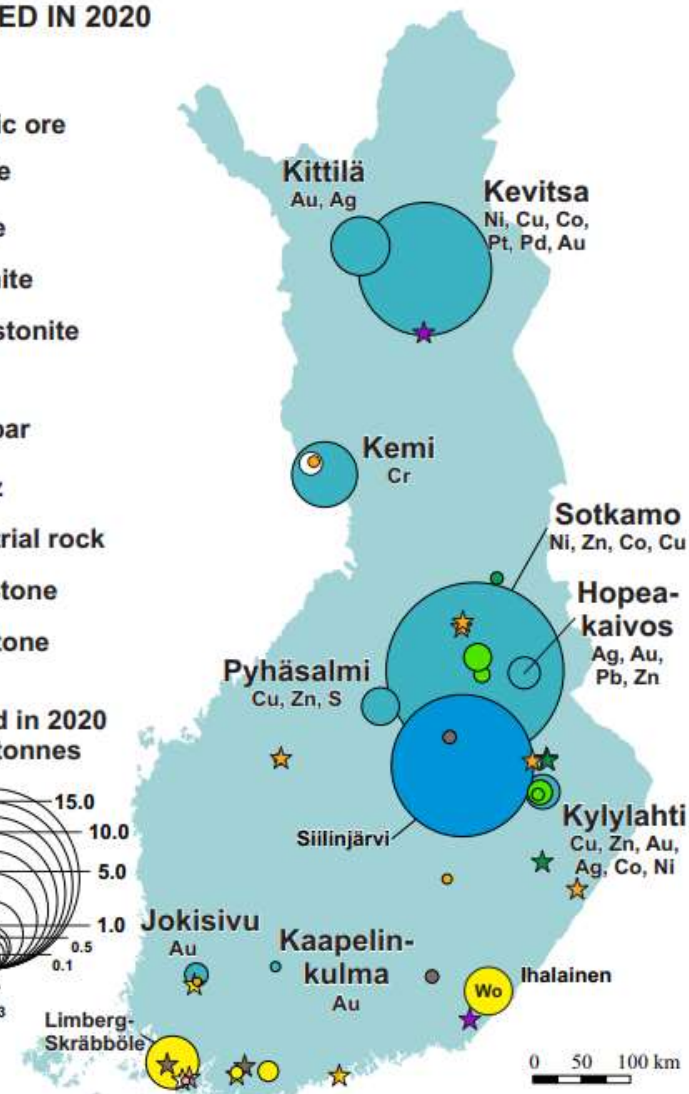
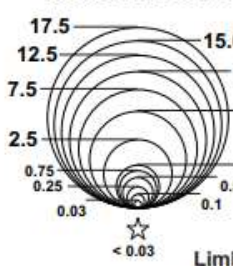
Investments in ore prospecting 1995–2021



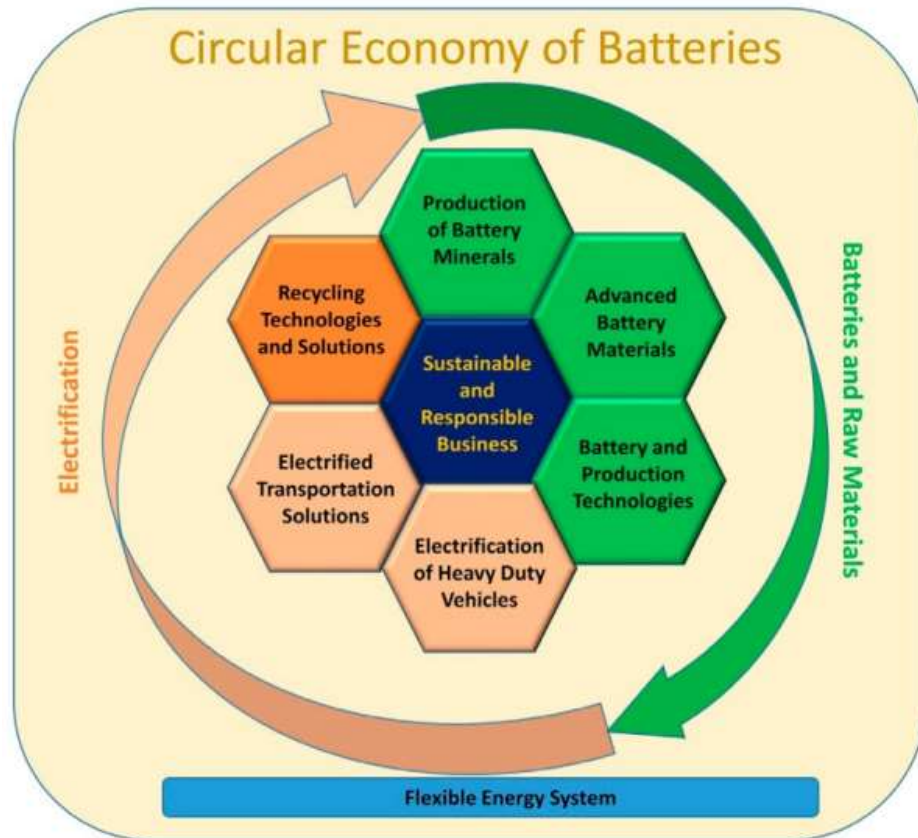
ORE MINED IN 2020

- Metallic ore
- Apatite
- Calcite
- Dolomite
- Wollastonite
- Talc
- Feldspar
- Quartz
- Industrial rock
- Soapstone
- Gemstone

Ore mined in 2020 Million tonnes

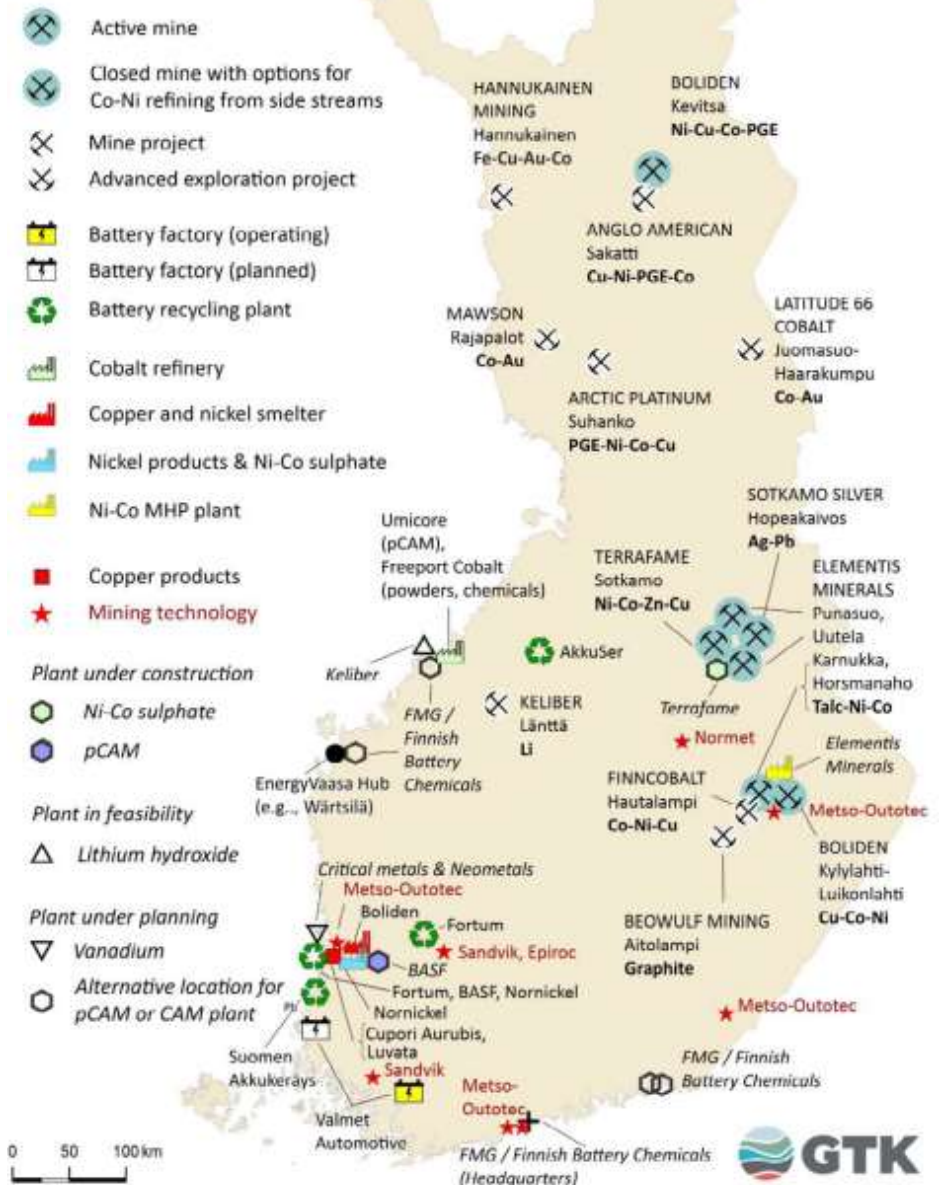


Finland's Battery Strategy and Ecosystem



Finland's Battery Strategy (TEM 2021)

BATTERY MINERAL MINES AND PROCESSING PLANTS



The Economic Value of Finnish Geoscience Database Estimated by Savikko et al. 2020

- The cost value of the Finnish geodatabase, that are important from the perspective of the mineral economy, is approximately €1330 mill.
- **€2.4 of turnover, €1.1 of value added and €0.5 of tax revenue have been generated per €1 invested in the acquisition of the geodatabase.**
- The estimated value of Finnish geodatabase is about **€5.15 bill. to the national economy in terms of the benefits.**
- Based on the avoided costs, the annual social value of the national geodatabase is estimated at €17.9 mill p.a.



Impacts and Users of Public Geoscience Information (PGI)

- The main users of the national geodata are mining and mineral exploration companies, various planning and engineering organizations, universities, research institutes, municipalities and cities, provincial associations and authorities.
- PGI not only affects the exploration and mining industry but has a key role in the sustainable development of a country.
- There are several indirect economic benefits, such as employment, regional development, intersectoral links and downstream mineral business.
- It has positive effects on other natural resources industries, on environmental planning and land management, and on a wide spectrum of other social and economic activities.
- Geodatabase can further be developed towards new types of applications and uses, identified through regular surveys to data users.
- Significant savings could be achieved through avoided costs in the society.

Scientific Studies on the Impact of Public Geoscience Information (PGI) in Other Regions

Queensland, Australia

Scott et al. (2002) conclude that \$1 invested on PGI in the State of Queensland, Australia could generate between \$3.8 and \$5.8 in tax revenues, with an IRR of the investment of 23%.

Western Australia

Fogarty and Sagerer (2016) report an average return to government that varies from 5.2 to 9.0 in Western Australia.

Chile

Gildemeister et al. (2018) demonstrate that \$1 invested in PGI during the past three decades could have generated \$11.5 dollars of government tax revenues from the mining industry (in terms of its NPV), with an IRR of around 21%.

Conclusions

- Geodata and geoscientific knowhow are of crucial importance for solving global challenges.
- Needs for information vary considerably from country to country depending on geological environment, and the economical structure and societal factors.
- Based on global benchmarking, Finland is one of the leading countries in terms of the availability and coverage of the geodata, which have been collected and stored using the best available methods.
- Geodata has had a crucial impact on top-level attractiveness of mineral exploration investments in Finland and led to considerable added value in important industrial ecosystems.
- Public long-term investment into geodata collection and geoscientific knowhow building has shown to be economically feasible and to create huge cross-sectorial benefits for the sustainable development of societies globally.

**SUSTAINABLE
DEVELOPMENT** **GOALS**



Aitäh!

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