Moritz Kirsch, Helmholtz Institute Freiberg for Resource Technology
INTMET Clustering Conference, Seville, 23 January 2019
A NEED FOR RAW MATERIALS

- Rising demand for metallic raw materials and complex metal alloys

⇒ Need to invigorate exploration

Source: http://energiesysteme-zukunft.de
Europe's import dependency for selected raw materials

- Antimony
- Cobalt
- Molybdenum
- Niobium
- Platinum
- Rare Earth Elements
- Tantalum
- Titanium minerals
- Vanadium
- Natural rubber
- Bauxite
- Tin
- Manganese ore
- Iron ore
- Zinc
- Copper
- Chromium ore and concentrates

Need to reduce import dependency

Exploration expenditure by location (2011–2020)

Source: S&P Global Market Intelligence (2016)

Need to invigorate exploration in Europe
Depth of cover for primary gold discoveries in the World 1950–2016

- Surficial deposits have largely been mined, current exploration focusses on mineral deposits located deeper and in more remote locations

⇒ Need to develop more efficient, innovative exploration technology
Q: Do companies make efforts to behave responsibly towards society in our country? Average values for the EU by type of company.

- **Food production and agriculture companies**: 70% YES, 26% NO, 0% Not applicable, 4% Don't know
- **Retail and supermarkets**: 57% YES, 30% NO, 0% Not applicable, 3% Don't know
- **Information, comm. and tech. (ICT) companies**: 62% YES, 29% NO, 1% Not applicable, 8% Don't know
- **Clothes and shoe manufacturing**: 51% YES, 41% NO, 1% Not applicable, 7% Don't know
- **Pharmaceutical companies**: 50% YES, 44% NO, 1% Not applicable, 6% Don't know
- **Construction companies**: 49% YES, 43% NO, 1% Not applicable, 6% Don't know
- **Chemical companies**: 40% YES, 44% NO, 1% Not applicable, 15% Don't know
- **Financial and banking companies**: 34% YES, 62% NO, 0% Not applicable, 4% Don't know
- **Mining and oil & gas companies**: 34% YES, 55% NO, 1% Not applicable, 10% Don't know

Source: European Commission, Flash Eurobarometer 363, 2013

- Paradigm shift needed. Focus on non-invasive exploration technology. Social dialogue!
CHALLENGES FOR THE MINERAL EXPLORATION INDUSTRY

1: LAND WITHDRAWALS
2: EXPLORATION EFFICIENCY
3: REGULATORY DELAYS
4: REMOTE ACCESS COSTS
5: SECURING A SOCIAL LICENSE

Funding organization: EU/ H2020
Funding amount: 5.6 Mio €
Timeframe: Nov 2017 – Oct 2020
17 partners from research and academia, industry, state and NGOs from seven countries

Objectives:
Engage society
Develop innovative exploration technology

PARTNERS
COORDINATOR
HZDR

SOCIAL DIALOGUE & ENVIRONMENT

IMPLEMENTATION & BUSINESS MODEL

TECHNICAL DEVELOPMENT & EXPLORATION
NON-INVASIVE EXPLORATION TECHNOLOGY

- Contact-less and non-destructive → no damaging of soil and vegetation
- E.g., airborne and remote sensing techniques
- Benefits:
  - Energy efficient
  - Time-saving
  - Safe
  - Low environmental impact
  - Socially acceptable
INNOVATIONS IN NON-INVASIVE EXPLORATION

- Airborne SQUID-based full tensor magnetic gradiometry
- Ground floor EM
- Airborne long-wave infrared hyperspectral imaging
- Drone-borne sensors (magnetics, hyperspectral, LiDAR, EM, thermal, gravimetry, radiometry)
- Extraction of IP data from airborne EM
- Passive seismic
- Muon tomography
- Gravity gradiometry
- ...

*methods in **bold** will be trialled during INFAC
Establish reference sites

- Geographically and socially representative, geologically relevant
- Existing drillhole database
- Acquisition of state-of-the-art geophysical data

Definition of benchmark targets

Certification
## INFACT – TECHNICAL APPROACH

### Exploration Test Site Services

<table>
<thead>
<tr>
<th>Country</th>
<th>Technology Applications</th>
<th>Test Site Attributes</th>
<th>Services</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Multi-system</td>
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<td>Magnetic</td>
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<td>Radiometrics</td>
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<td>Hyperspectral</td>
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<td>Gravity gradiometry</td>
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<td>Electromagnetics</td>
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<td>Hydrogeology</td>
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<td>Monitoring</td>
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<td>Airborne IP</td>
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<td>Used for airborne tests</td>
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<td>Used for ground data</td>
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<td>Shallow sources</td>
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<td>Directly detected sources</td>
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<td>Accessible</td>
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<td>Suitable test site</td>
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<td>Calibration facility</td>
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<td>Environmental impact</td>
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<td>Social acceptability</td>
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<td>Technical certification</td>
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### Table Example

<table>
<thead>
<tr>
<th>Exploratory Test Site</th>
<th>Technology Applications</th>
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<th>Services</th>
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<td>Sakatti</td>
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</table>

AEM – Airborne Electromagnetics; AIP – Airborne Induced Polarisation.

- Caters for multiple technologies
- Evaluates environmental and social impact
INFECT – SOCIAL APPROACH

- Stakeholder engagement events
- Interviews with local and regional decision makers
- Roundtable discussions
- Online surveys
- Expert workshops

Best practice recommendations
to policy makers, regulatory organisations and the exploration industry
REFERENCE SITE SAKATTI (FINLAND)
REFERENCE SITE SAKATTI (FINLAND)
REFERENCE SITE SAKATTI (FINLAND)

Geological benchmarking data

Source: AA Sakatti Mining Oy, 2018
REFERENCE SITE SAKATTI (FINLAND)

Data acquisition (state-of the art techniques)
Data acquisition (state-of-the-art techniques)

Magnetetics (TMI)  Radiometrics (ternary)  VTEM (dB/dt ET)

Provides a reference against which emerging exploration technology can be measured.
Data acquisition (innovative tech)

Sakatti site, August 2018

Source: Queitsch (2017)
STAKEHOLDER ENGAGEMENT ACTIVITIES

"I trust that the mining industry in Finland/Germany/Spain acts in a fair and responsible manner."

- Finland
- Germany
- Spain

"Drones in action do not bother me"

- Finland
- Germany
- Spain
STAKEHOLDER ENGAGEMENT ACTIVITIES

Flight path vs. reindeer path
THANK YOU FOR YOUR ATTENTION!

Contact:

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