

UNDERCOVER

Redefining deep-earth exploration



UNDERCOVER – REDEFINING THE DEEP MINERAL EXPLORATION

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Agenda

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Ongoing raw materials related HE projects – GTK's participation

GTK coordinates:

- **UNDERCOVER - Unified Novel Deep Exploration for Critical Ore discovery** (Juha Kaija, Jochen Kamm, Tero Niiranen)
- **MultiMiner** - Multi-source and multi-scale earth observation and novel machine learning methods for mineral exploration and mine site monitoring (Pauliina Liwata-Kenttälä, Maarit Middleton)
- **ISLANDR** - Information-based Strategies for LAND Remediation (Juha Kaija, Kirsti Loukola-Ruskeeniemi)
- **EIS** - Exploration Information System (Hafsa Munia, Vesa Nykänen)

Coordination, Support Action, Networking

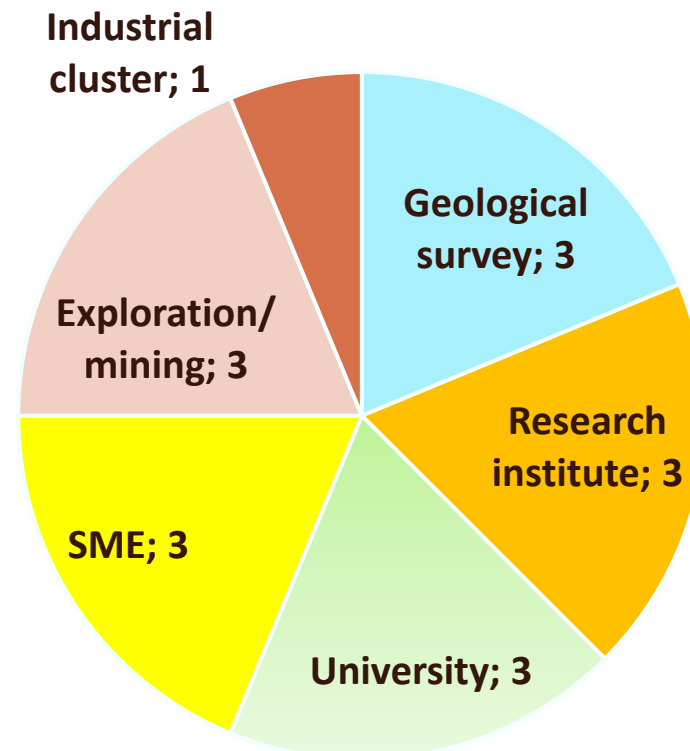
- **SCREEN3** - Solutions for CRITICAL Raw materials - a European Expert Network 3
- **CIRAN** - Critical RAW materials extraction in environmentally protected areas
- **EGT-TWINN** - Enhancing research capacity at the Geological Survey of Estonia
- **CSA GSEU** - Geological service for Europe

Research and Innovation Action

- **DeepBEAT** - Deep exploration BoostEd by Advanced exploration Technologies
- **GOLDEN RAM** - Earth Observation Platform Supporting Critical Raw Materials Industry in Europe
- **EXCEED** - Cost-effective, sustainable and responsible extraction routes for recovering distinct critical metals and industrial minerals as by-products from key European hard-rock lithium projects
- **MaDiTraCe** - Material and digital traceability for the certification of critical raw materials
- **AVANTIS** - International Innovation Network for the Development of Sustainable, decarbonised vanadium, titanium and iron extraction from Europe's low-grade vanadiumbearing titanomagnetite deposits
- **S34I** - Secure and sustainable supply of raw materials for EU industry
- **RAWCLIK** - Future RAW materials demand, supply and sustainability in the face of CLimate Change
- **REMHub** - Rare earth and magnets hub for a resilient Europe
- **MAGELLAN** - Magnets in resilient supply chains
- **FutuRaM** - Future Availability of Secondary Raw Materials

UNDERCOVER – basics

- **Funding programme:** Horizon Europe
- **Call & topic:** HORIZON-CL4-2024-RESILIENCE-01: Resilient Value Chains 2024; HORIZON-CL4-2024-RESILIENCE-01-01: **Exploration of critical raw materials in deep land deposits**
- **Type of action:** HORIZON-RIA, Research & Innovation Action
- **Duration:** 1.1.2025 - 31.12.2027
- **Total budget:** 4 999 987.50 €
- **Total person-months:** 452
- **Consortium:** Sixteen partners from 7 countries
- **Project Manager:** Juha Kaija, GTK
- **Scientific Coordinators:** Jochen Kamm & Tero Niiranen, GTK



Other projects funded under the deep exploration call

Total EU funding of four deep exploration projects is 19 332 149€ (~30% to industrial partners)

- **DeepBEAT** - Deep exploration BoostEd by Advanced exploration Technologies
 - **Coordinator:** HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF, Germany
 - **Partners include:** GTK, IMA Engineering Oy and FinnCobalt Oy
 - **EU funding:** 4 886 982 €
 - **LinkedIn:** [DeepBEAT: About | LinkedIn](#)
- **DEXPLORE** - Recognizing European potential for hosting deep land primary CRM by combining new mineral models and advanced exploration and visualization techniques
 - **Coordinator:** IBERIAN SUSTAINABLE MINING CLUSTER, Spain
 - **EU funding:** 4 669 429 €
 - **Website:** [Dexplore](#)
- **MINOTAUR** - Miniaturized Robotic Systems for Autonomous In-Situ Exploration of Critical Raw Materials In Deep Land Deposits
 - **Coordinator:** LULEÅ UNIVERSITY OF TECHNOLOGY - LTU
 - **EU funding:** 4 993 303 €
 - **Website:** [Minotaur](#)



UNDERCOVER – Consortium

INDUSTRY & SME's (7 partners, 26% of the budget)

- ASSOCIACAO CLUSTER PORTUGAL MINERAL RESOURCES (ACPMR), PT
- SUPRACON AG (SUPRA), DE
- LGI SUSTAINABLE INNOVATION (LGI), FR
- ONGWE MINERALS (PTY) LTD (ONGWE), NA
- LATITUDE 66 COBALT OY (LAT66), FI
- SMART SEISMIC SOLUTIONS (S3), FR
- REDCORP, LDA (REDCORP), PT

RESEARCH (6 partners, 58%)

- GEOLOGIAN TUTKIMUSKESKUS (GTK), FI
- BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES (BRGM), FR
- GEOFYZIKALNI USTAV AV CR, V.V.I. (IG CAS), CZ
- LEIBNIZ-INSTITUT FUER PHOTONISCHE TECHNOLOGIEN E.V. (IPHT), DE
- LABORATORIO NACIONAL DE ENERGIA E GEOLOGIA I.P., (LNEG), PT
- INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE (INRS), CA

UNIVERSITIES (3 partners, 16%)

- UNIVERSITAT MUNSTER (UM), DE
- UNIVERSIDADE DE EVORA (UDE) (Affiliated Entity), PT
- TECHNISCHE UNIVERSITAT BERLIN (TUB), DE



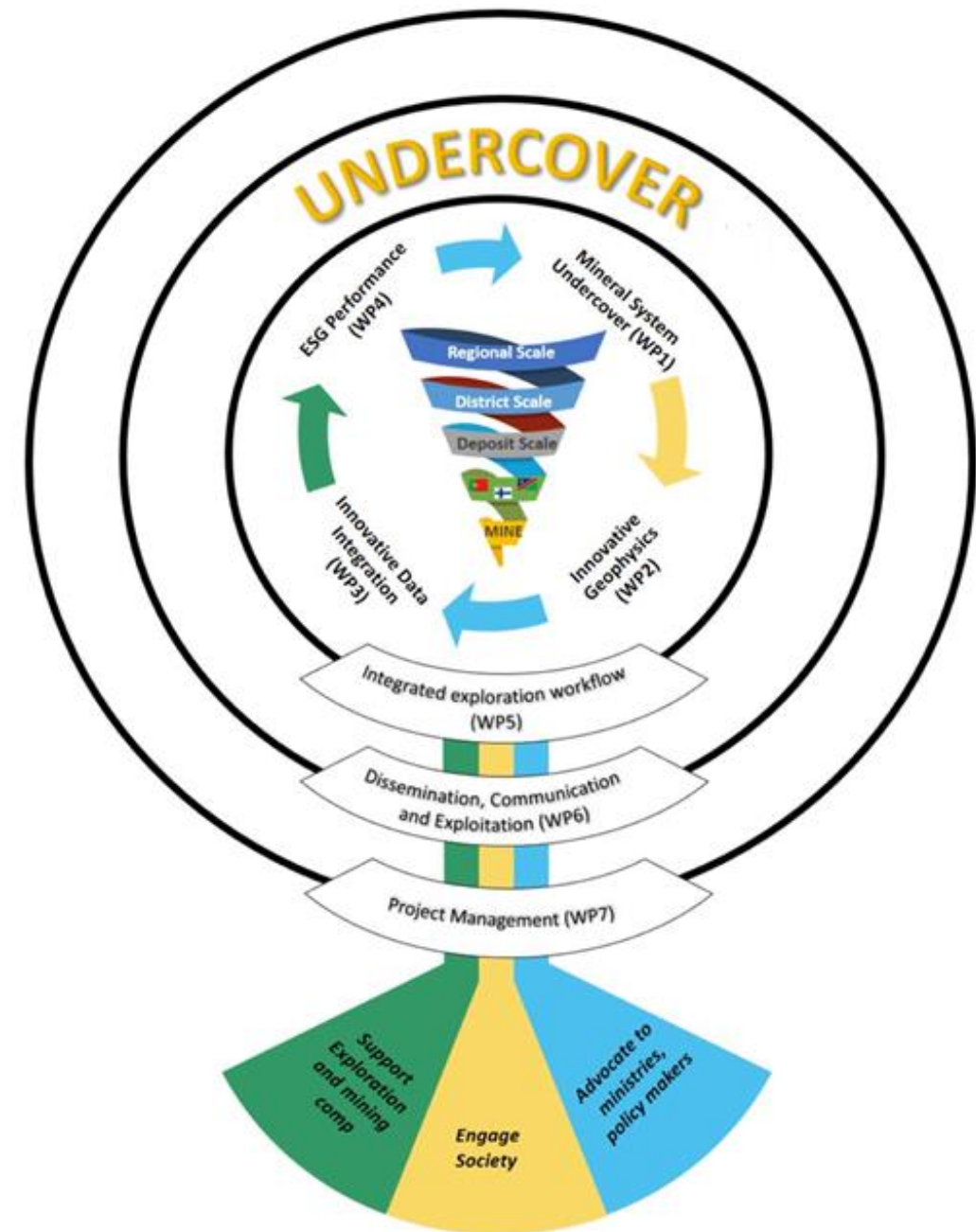
Main objectives

- Transform deep CRM exploration, introducing a paradigm shift by **extending the mineral systems concept**, currently underutilized in quantitative exploration, to deep exploration relevant spatial scales
- **Integrate** novel, cost-effective, and low-impact technologies and **methods for data collection and integration, including AI-based geological mapping and geophysical joint inversion.**
- Address and mitigate **environmental, social, and governance (ESG) aspects of mineral exploration at all stages.**
- **Map primary raw materials potential** in EU and non-EU countries across three major mineral belts
- Promote **the use of UNFC** for innovative and effective exploration strategies.
- **Advance deep mineral exploration technologies**, stimulate R&D, and ensure exploitation by EU stakeholders, inspiring confidence among policy makers and stakeholders.

The development of a comprehensive CRM exploration workflow suitable for exploration in both developed and remote areas.

Work packages

- WP1. Mineral Systems under Cover: Kathryn Cutts, GTK
- WP2. Innovative Geophysics: Graham Hill, IG CAS
- WP3. Innovative Data Integration: Mathieu Darnet, BRGM
- WP4. Environmental, Social and Governance: Sam Whittlesey, LGI
- WP5. Integrated Exploration Strategy: Michael Becken, UM
- WP6. Communication, Dissemination & Exploitation: Capucine Pineau, LGI
- WP7. Project Management: Juha Kaija, GTK



Case study areas:

B

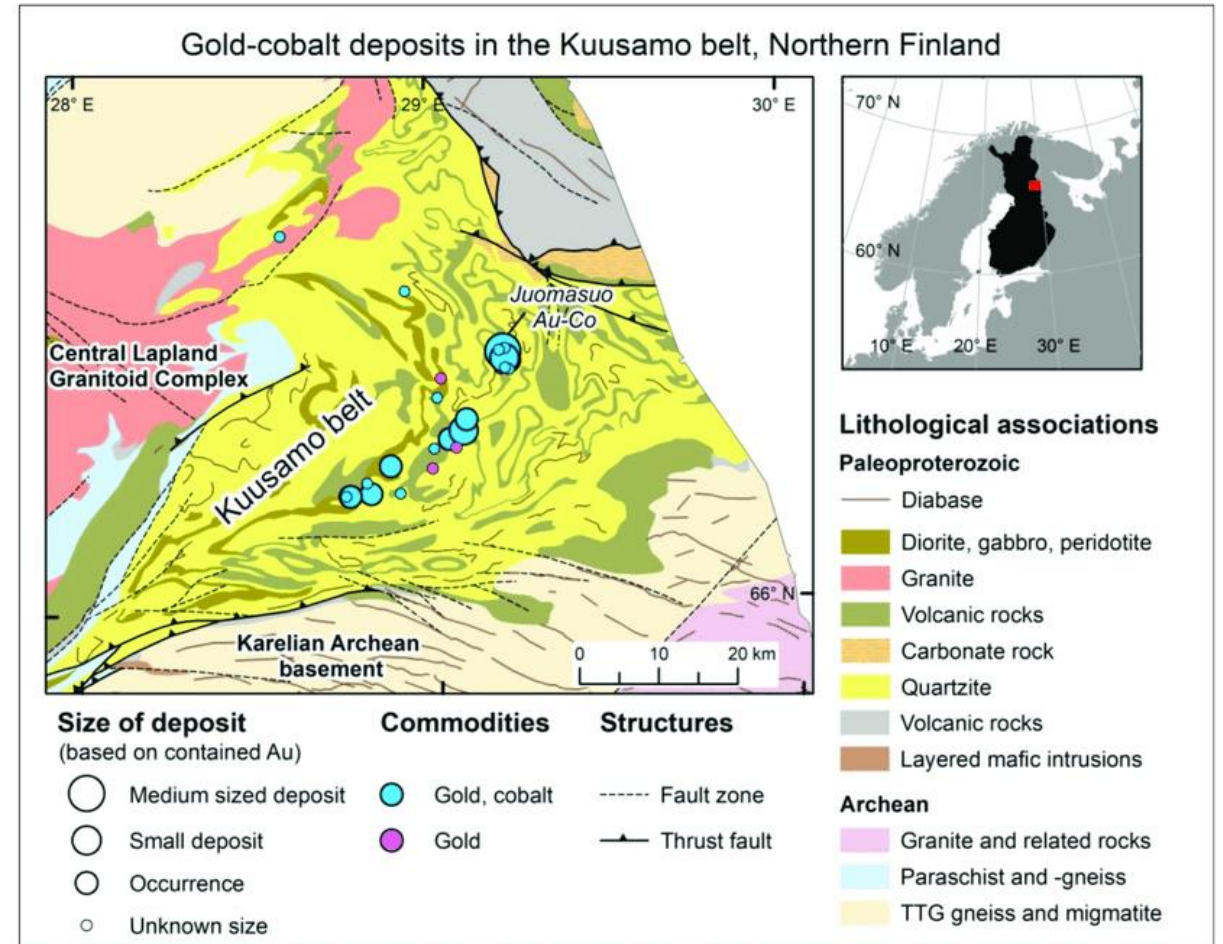


- **Kuusamo Schist Belt (Finland)** – Co, Au, REE and Cu
- **Iberian Pyrite Belt (Portugal)** – Cu, Pb, Zn, Sn, Ag, Au, In, Ga, Ge, V and Se
- **Kalahari Copper Belt (Namibia)** – Cu

UNDERCOVER in Kuusamo Schist

Brief outline of the tasks to be done

- Geophysical measurements
 - Belt-scale MT
 - EM in central part of the KB
 - Passive seismic in core area
- ESG-SLO work
- Compilation of relevant existing data sets
- Generation of initial & subsequently refined mineral system model (based on the results)
- Development of geochemical exploration methodology (MinExTarget BoT)
- Geochronology (Lu-Hf + conventional U-Pb)
- Data integration
- 3D modeling (Geophysics-Geology)
- GIS based prospectivity modeling – application of AI based prediction algorithms in data preprocessing



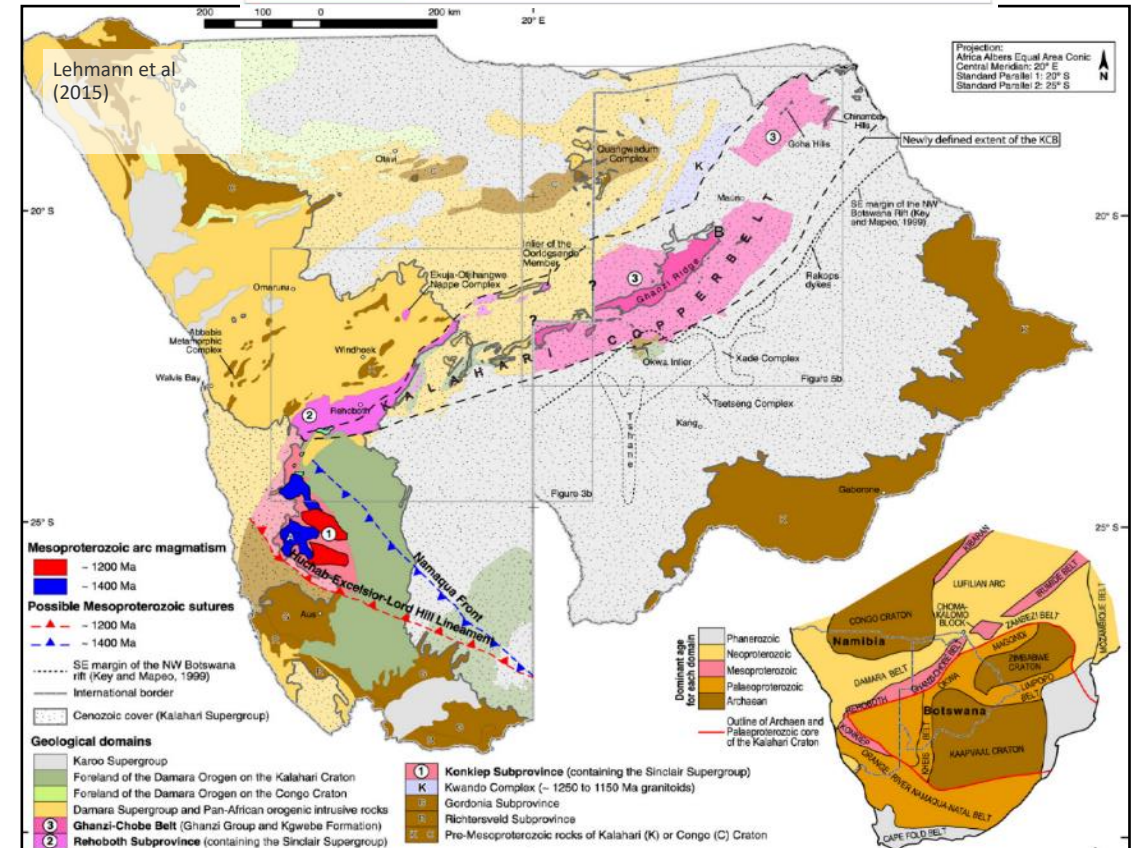
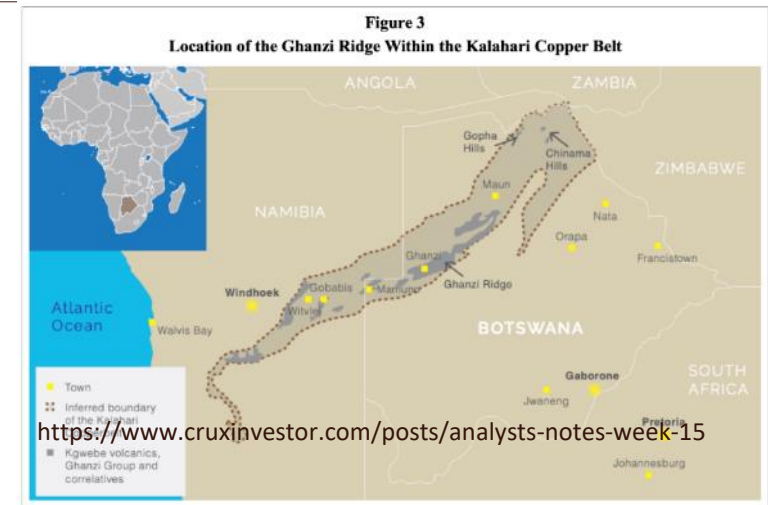
The Kuusamo Schist Belt and its gold-cobalt deposits, including the Juomasuo deposit. Guzik et al. 2021 modified after © Geological Survey of Finland 2020.

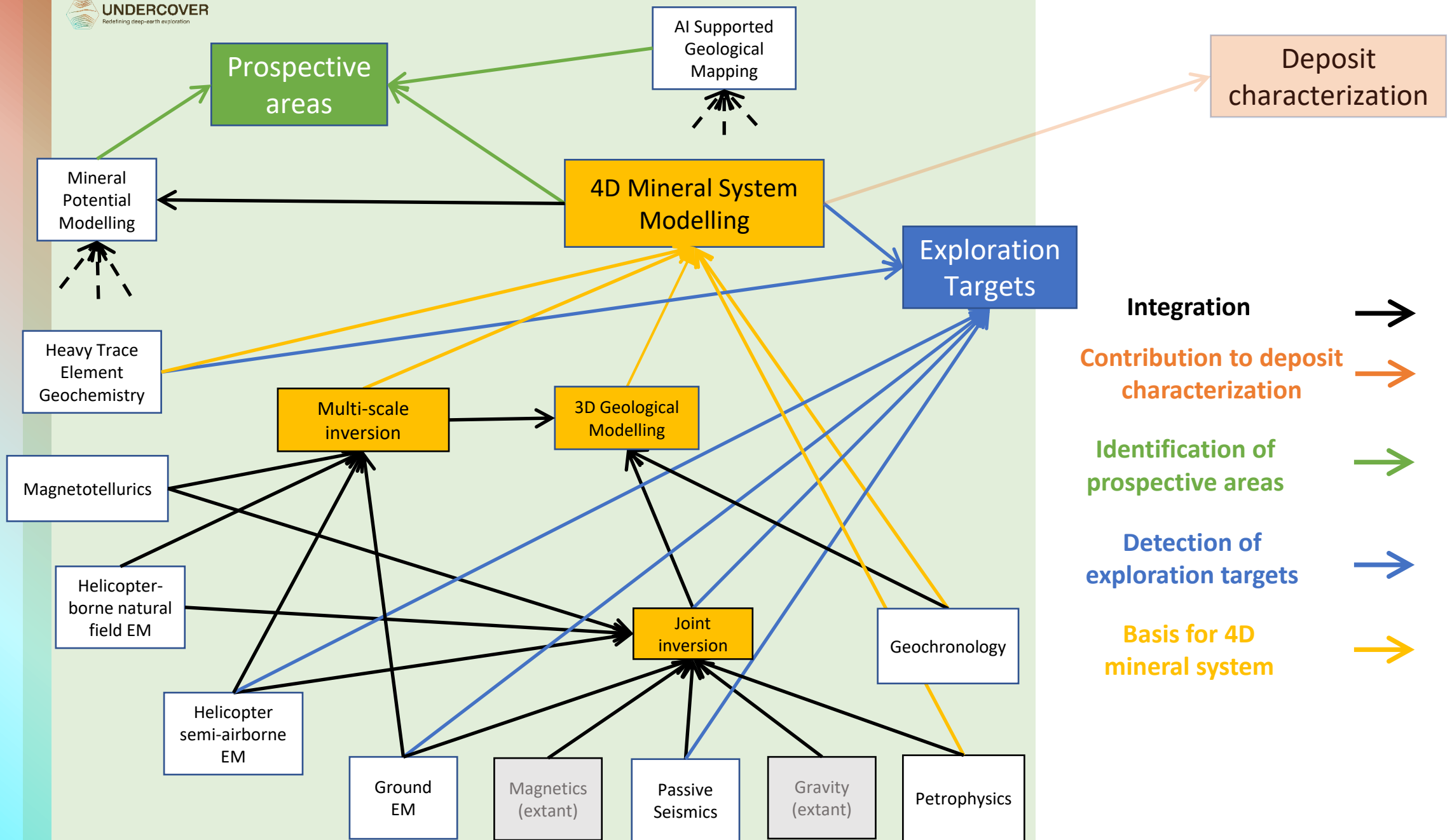
UNDERCOVER in Kalahari Copper Belt

- Ongwe Minerals, holds ~963 000 ha of exploration licenses on the Kalahari Copper Belt
- Limited historical exploration proved the fertility of the Copper Belt in Namibia
- Ongwe has identified multiple targets that require follow-up geophysics & drill testing

UNDERCOVER:

- Initial mineral system model
- Multicopter semi-airborne EM
- 3D inversion of semi-airborne EM data
- ESG studies





Upcoming conferences

The 2025 OECD Conference of Mining Regions and Cities
16 – 18 June 2025 in Rovaniemi, Finland.



Social License to Operate Conference - Responsible Mineral Exploration SLO Conference Tallinn 2025

16 September 2025 in Tallinn, Estonia





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Thank you.

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