

UNDERCOVER
Redefining deep-earth exploration



HE UNDERCOVER

GTK S&I Day, 17.8.2025

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Research Professor, ore geology

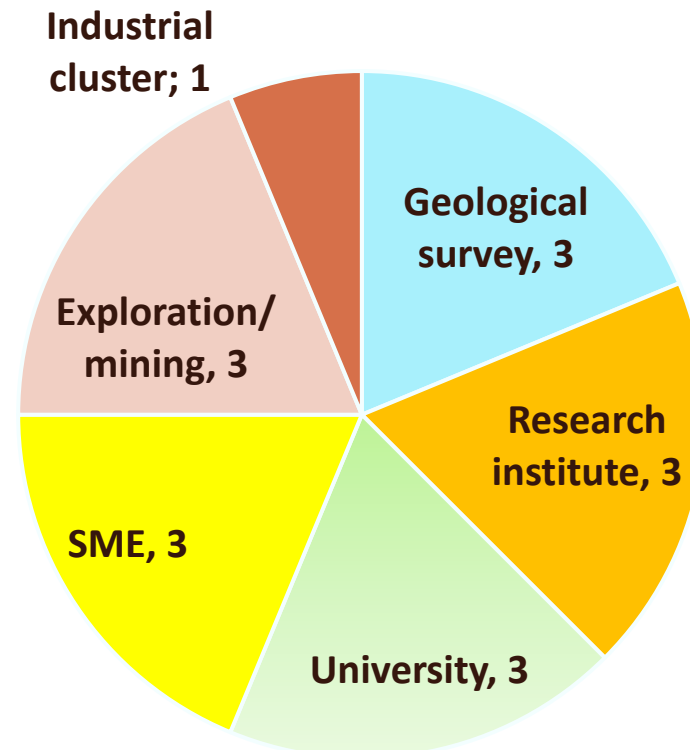
GTK MTR Unit



The UNDERCOVER project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement N.101177528.c

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



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%)

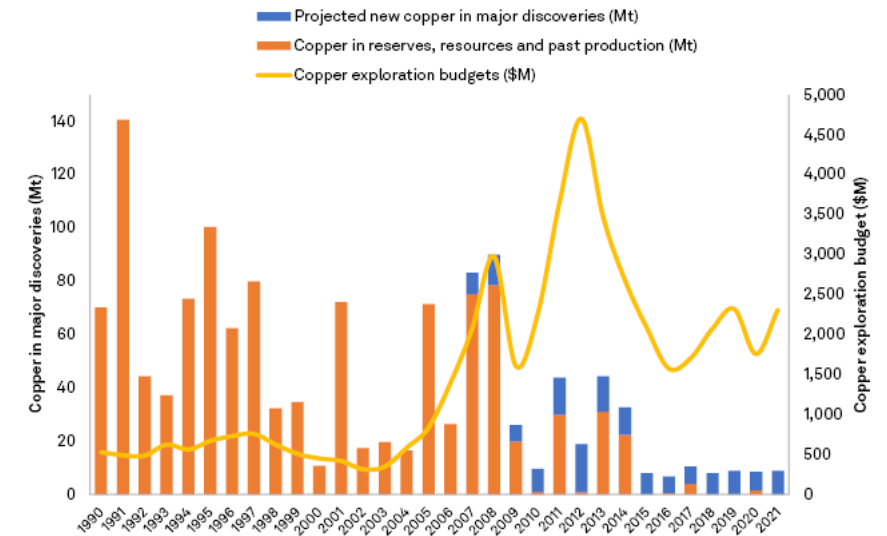
- UNIVERSITAT MUNSTER (UM), DE
- UNIVERSIDADE DE EVORA (UDE) (Affiliated Entity), PT
- TECHNISCHE UNIVERSITAT BERLIN (TUB), DE



THE PROBLEM

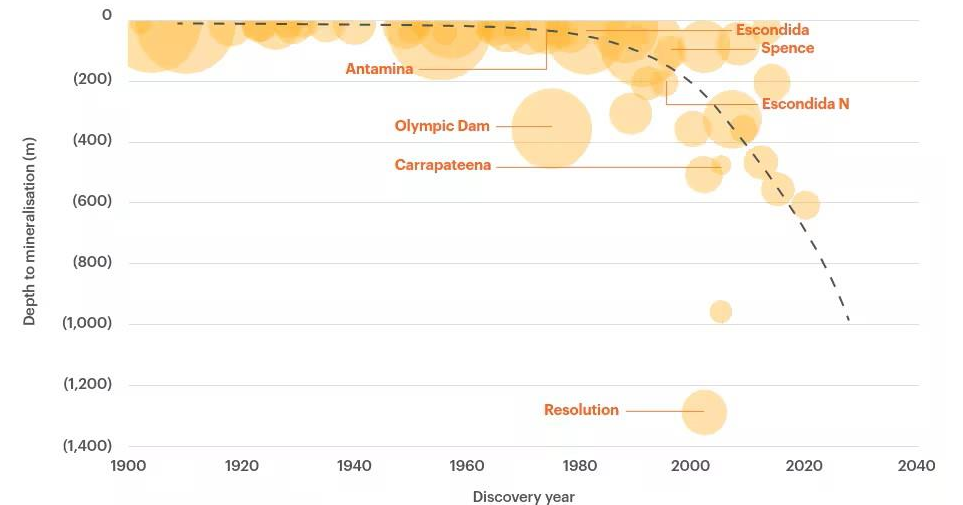
- New mineral deposit discoveries are becoming scarcer despite increasing exploration expenditures
- Increasing depth of new discoveries
 - Exploration moves to deeper levels esp. in brown fields areas
- At the same time: demand is expected to drastically increase
- New, cost-effective, efficient exploration models and techniques are needed

Major Cu discoveries vs. exploration expenditures



Data as of May 10, 2022.
* Annual average London Metal Exchange Copper Grade A cash price.
Source: S&P Global Market Intelligence

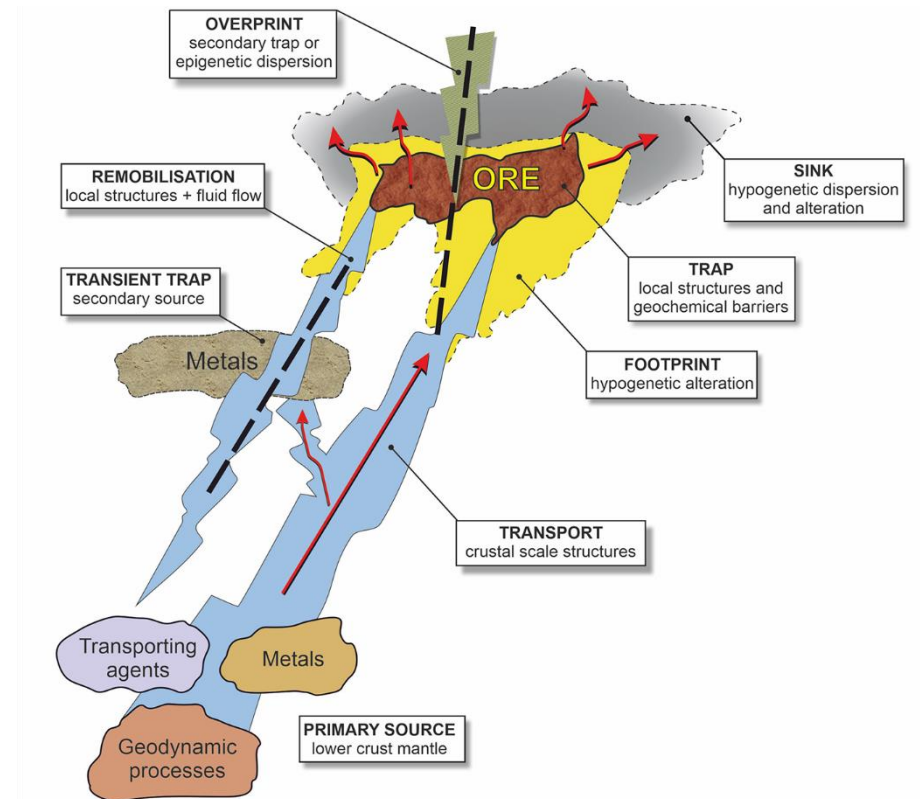
Major (>3 Mt Cu) discoveries vs. depth



Source: MinEx Consulting; BHP analysis.

UNDERCOVER – Application of mineral system approach

- Define the relevant **mineral system** (and refine it to fit local environment)
- Define *the critical mappable components* (vectors to ore)
- Map the critical components in 2D/3D/4D space
 - **Signals from geology, geophysics, geochemistry**
 - **Data integration** using e.g. machine learning and AI methods
- Generate **prospectivity maps** for target or target area generation (scale dependent)
 - Knowledge-driven vs. Data-driven approaches
 - Machine learning (& AI) used when applicable



Case study areas

FINLAND: Kuusamo Schist Belt

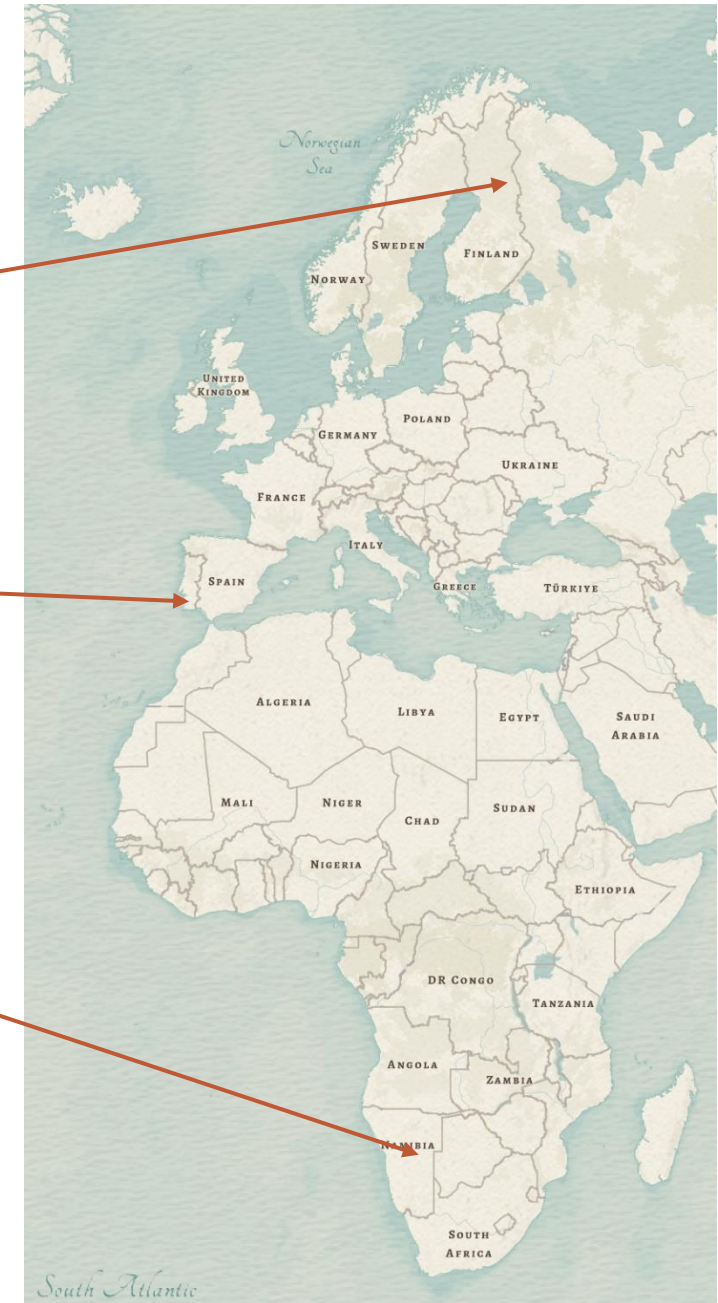
- Orogenic Au-Co \pm Cu, REE mineral system

PORTUGAL: Iberian Pyrite Belt

- VMS Cu-Zn-Pb \pm Sn, Ag, Au, In, Ga, Ge, V and Se mineral system

NAMIBIA: Kalahari Copper Belt

- Sediment hosted Cu mineral system



UNDERCOVER – Signals from the mineral system components

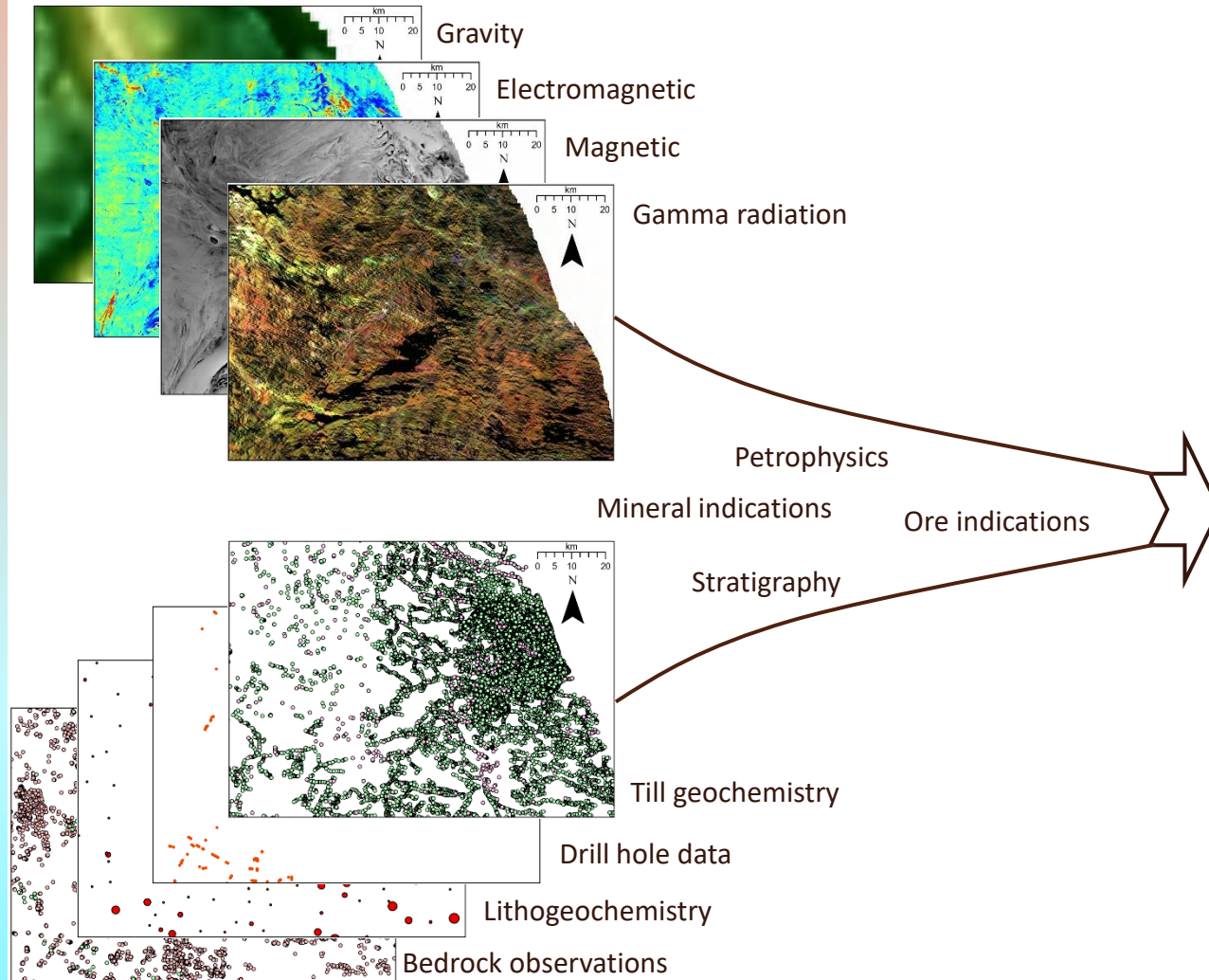
Data collection

- Application of deep penetrating geophysical methods from belt to camp scales
 - Audiomagnetotellurics
 - Active & Passive seismics
 - Semi Airborne EM
- Geochemistry (till- and lithogeochemistry)
- Geochronology (Lu-Hf, U-Pb)

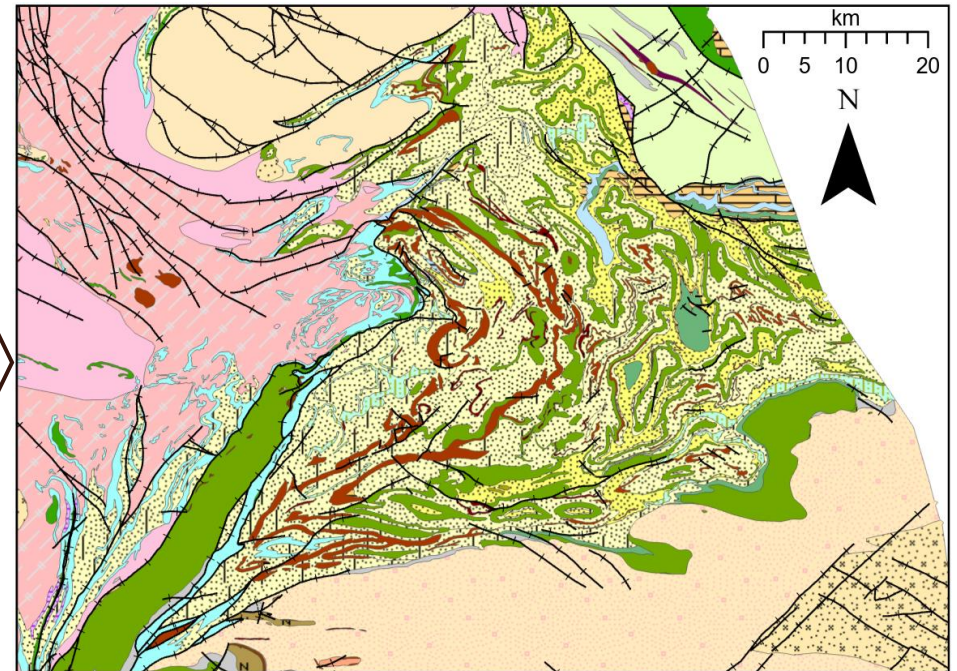
Processing & Interpretation

- Joint inversions
- Data integration
- 2-4D interpretations
 - Machine learning & AI where applicable
- Target & target area generation through prospectivity modeling
 - Machine learning & AI where applicable

Application of AI case: Generation of bedrock map in data rich environment

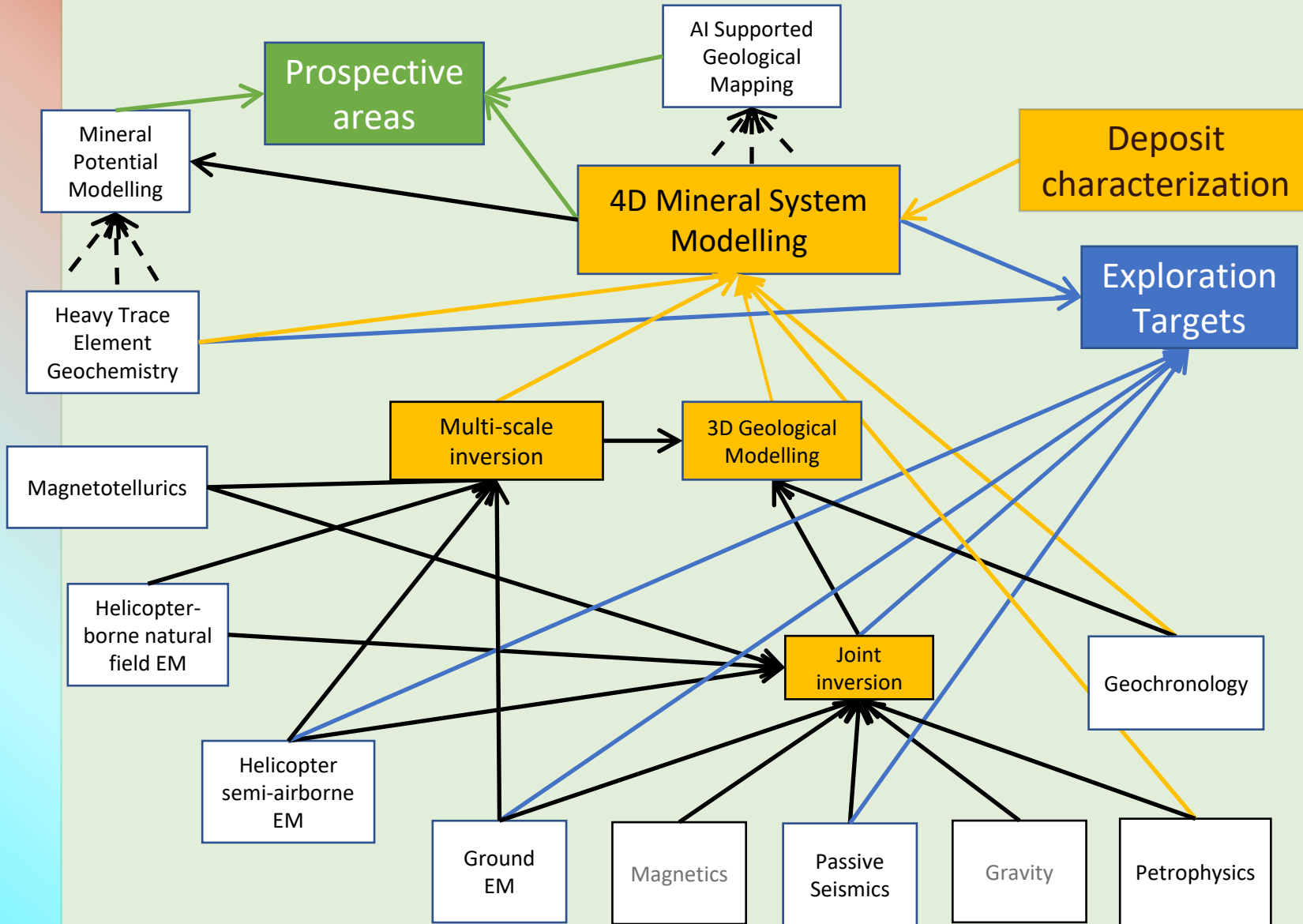


Can AI deliver same level (or better) interpretations as an expert using same data set?

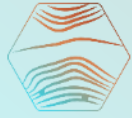


GTK digital bedrock map, Kuusamo Schist belt

UNDERCOVER "NEUROWORK"



- Integration →
- Identification of prospective areas →
- Detection of exploration targets →
- Basis for 4D mineral system →



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Thank you.

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