

UNDERCOVER

Redefining deep-earth exploration

UNDERSTANDING THE SCIENCE

MAKING MINERAL EXPLORATION MORE EFFICIENT

Combining airborne and ground-based electromagnetic methods across scales to advance electromagnetic exploration workflows and investigate critical raw materials hidden deep beneath the surface.

OVERVIEW

A key component of UNDERCOVER's multi-physics, multi-scale approach is electrical conductivity imaging using electromagnetic (EM) induction methods. UNDERCOVER combines several EM techniques at different scales: large-scale, ground-based magnetotelluric (MT) surveys map the deep structure of the lithosphere, while new helicopter- and drone-based EM systems — together with ground-based controlled-source surveys — provide more detailed images at the scale of mining camps and individual deposits. The main goal of UNDERCOVER's EM surveying approach is to combine all of this data, across all scales, into a single integrated model.

Why does it matter?

Gaining the overview – Deeply rooted electrical conductors imaged with MT can highlight regional-scale fluid pathways, providing key information for understanding ore formation and guiding the search toward potential deposits.

The airborne link – Spatial coverage and kilometre-deep penetration from novel helicopter- and drone-borne systems bridge the gap between the camp scale and individual deposits.

Highly focused – High-resolution surveys with drone-borne and ground-based systems in refined areas reveal small-scale structures, valuable for selecting drill sites.

Reducing risk – Linking regional context with local detail helps narrow down promising areas and avoid costly, blind drilling.

UNDERCOVER INNOVATION

The mineral system concept has been successfully applied to known deposits, but new discoveries based on it remain rare. By integrating cutting-edge multi-scale technologies, UNDERCOVER aims to extend the Mineral Systems Concept to exploration-relevant scales. We investigate how electromagnetic exploration can be performed more efficiently by combining methods sensitive at different resolutions — applicable from thousands of square kilometres down to just a few km². We also bring novel airborne techniques with greater depth of investigation into the workflow, supporting the search for critical raw materials that are often expected to lie beneath thick cover in Europe.

OUR PARTNERS

GTK · LGI sustainable innovation · brgm · LNEG · Institute of Geophysics · Leibniz IPHT · INRS Institut national de la recherche scientifique · Universität Münster · Technische Universität Berlin · Universidade de Évora · Ongwe · Latitude66 · REDCORP · Cluster Portugal Mineral Resources · supracon · Smart Seismic Solutions

How does it work?

Variations in a natural or controlled source field induce an electromagnetic field underground, which can be measured on and above the Earth's surface. Natural fields (e.g., excited by global lightning activity) provide low-resolution imaging at great depth, while controlled source fields can achieve high resolution at varying depths, depending on survey parameters and subsurface conductivity.

UNDERCOVER applies:

1. Ground-based natural field measurements on the regional scale
2. Helicopter-borne natural field measurements on the district scale
3. Helicopter- and drone-borne controlled field measurements using powerful ground-based sources
4. Purely ground-based controlled source measurements on the deposit scale

While a single method only captures a glimpse of the mineral system, combining different source types with airborne and ground-based receivers helps image the system as a whole — and, with a better understanding, makes mineral exploration more efficient.

Key technologies

It's the combination that makes the difference!

- **Deep-penetrating, regional-scale measurements guide the search for critical raw materials**
- **Novel helicopter- and drone-borne airborne survey techniques link regional data to small-scale investigation**
- **Highly focused ground-based measurements reveal ore potential**

BENEFITS

For exploration

- Improved understanding of ore-forming processes
- Consistent depth of investigation across all scales
- More efficient, lower-risk mineral exploration

For society

- Showcasing European electromagnetic exploration technologies
- Contributing to future approaches for locating deeply buried resources

Funded by the European Union

www.undercover-project.eu · contact@undercover-project.eu · @UNDERCOVER project