Sustainable mineral resources by utilizing new Exploration technologies

Results in Brief

High-tech and legacy data open new avenues to deep mineral exploration

There are challenges to deep mineral exploration whether in areas that have either been previously developed (brownfield) or could be developed anew (greenfield). The EU-funded Smart Exploration project is introducing solutions for both area types.

Introducing the project, coordinator Alireza Malehmir, professor at Uppsala University in the Department of Earth Sciences, notes: “The main goal of Smart Exploration is to develop cost-effective and environmentally friendly solutions for deep mineral exploration in brownfield and greenfield areas.” The work is centred on the development of five system prototypes and six improved methods for 3D imaging and modelling. “The newly acquired data, through the prototypes combined with the new methodologies, provide better target and geological characterisations at greater depths,” Malehmir reports.

Mapping mineralisation

The GPS-time synchronisation system (for denied-access environments such as underground mines) and an electric seismic source with broadband frequency (E-
Greenfield innovations

The project’s validation sites have either primary resources (EU-listed critical raw materials) or host them as secondary resources. Malehmir explains that in certain sites, steep topography makes it extremely difficult to impossible to use conventional geophysical methods for rock characterisation and structure imaging. “As a solution, the developed helicopter transient electromagnetic method (HTEM) prototype, which has already been tested at the Ludvika brownfield site, will be flying over our greenfield sites in Greece and Kosovo to detect deep targets.”

Smart Exploration also employed machine learning algorithms to reinterpret existing geochemical-geological-geophysical data, providing potential porphyry Au-Cu (gold and copper) targets in Greece. “The innovation here lies in the way the data have been harmonised and validated through geostatistical approaches,” the coordinator reveals.

Looking ahead

Project partners also had to overcome challenges off the slopes. The teams adopted agile engineering in instances where delivery of parts was delayed, and they built a custom-made drone to reduce noise level in the unmanned aerial vehicle system.

Next on the agenda is exploitation and commercialisation. Smart Exploration will introduce the solutions to relevant companies through exploitation tours, mining events, workshops and direct engagement. In the meantime, “Smart Exploration supports more than 20 young professionals from academia, SMEs and mining
companies,” Malehmir concludes. “This younger generation is the key asset for the mineral exploration industry but also maybe future entrepreneurs who have learned how collaborative work can lead to commercial solutions and open up new businesses.”

Keywords

Smart Exploration, mineral exploration, greenfield, mining, legacy data, brownfield, geological, geophysical, 3D imaging, seismic survey, agile engineering

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UPPSALA UNIVERSITET
Sweden

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