SPECIAL TOPIC

Near Surface Geoscience

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New ways of exploring subsurface with Smart Exploration Solutions

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Smart Exploration is an ambitious project, funded under the EU’s Horizon2020 Research and Innovation Programme, responding to the call for ‘New solutions for sustainable production of raw materials – New sensitive exploration technologies’. The project’s main objective is ‘developing cost-effective, environmentally-friendly geophysical solutions for mineral exploration’. With a budget of €5.2 million ($5.9 million), Smart Exploration kicked off on 1 December 2017 and will be completed in November 2020.

Partners from 27 organizations and 9 EU countries with different specialisations are gathered to improve exploration techniques to help sustain raw materials critical for green technologies and smooth transition towards decarbonization. Of these 27 partners, 11 are SMEs, 11 are academic and research institutions, 4 are mining companies, and 1 is a municipality (Figure 1). Both SMEs and academic experts are working together to ensure that research and innovation go hand-in-hand in a practical and market-oriented manner. This combination allows a smooth transition from research to innovation, innovation to development, which is important for product realization and competitive growth.

The work is centred on the development of five prototypes and six new/improved methodologies for 3D imaging and modelling. Project partners have also used improved algorithms to successfully recover and reprocess a number of legacy data sets (see First Break August 2019 issue).

The five prototypes have been developed using a dedicated work package “WP2: New Instruments” and covering different types of solutions for specific needs and exploration conditions.

**UAV:** A modular-based, multi-functional and less sensitive to the system noise unmanned aerial vehicle (UAV) and ground-based geophysical system capable of acquiring magnetic, radio- and controlled-source electromagnetic (EM) data.

**HTEM:** A deep-penetrating TEM helicopter-based system providing higher resolution subsurface models in a faster and more cost-effective manner. It works like a big 3D-scanner of the ground using the same physical concepts as the MRI-scanner at the hospitals.

**Slimhole:** A slimhole modular-based digital seismic-magnetic-temperature system insensitive to electric noise to allow deeper penetration around boreholes.

**E-Vib:** Broadband electrically-driven seismic source. It is used to vibrate the ground and thus enables the mapping of the subsurface using broadband frequency signal to create sound waves, in a similar manner to a cinema’s sound system.

**GPS-Time Transmitter:** Mobile GPS-time system for time synchronization of in-mine–surface explorations and new processing approaches for full-scale active- and passive-seismic data recording to maximize their value along with higher-resolution exploration.

Thanks to the mining partners, the project has access to six test sites to conduct surveys and validate these new technologies in brownfield and greenfield areas; (a) Gerolekas Bauxite Exploration Site, Greece, (b) Skouries-Fisoka Copper-Porphyry District Exploration Site, Greece, (c) Neves-Corvo Base-Metal Mining Site, Portugal, (d) Ludvika Iron-Oxide Mines, Sweden, (e) Siilinjärvi Phosphate Mine, Finland, (f) Kosovo Chromite Greenfield Sites.

The newly acquired data through the prototypes at the test sites, combined with the new methodology, have proven to provide better targets and geological characterisations at greater depths.

In this special issue of First Break, the partners will reveal the details of these prototypes, how they are expected to make a difference for mineral exploration and at the same time how these prototypes can be beneficial for other applications.