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2025 OECD Conference of Mining Regions and Cities: The GeoInnovation Session – 16–18 June 2025, University of Lapland, Rovaniemi, Finland

Abstracts

Vesa Nykänen, Nick Cook and Juha Kaija (eds)

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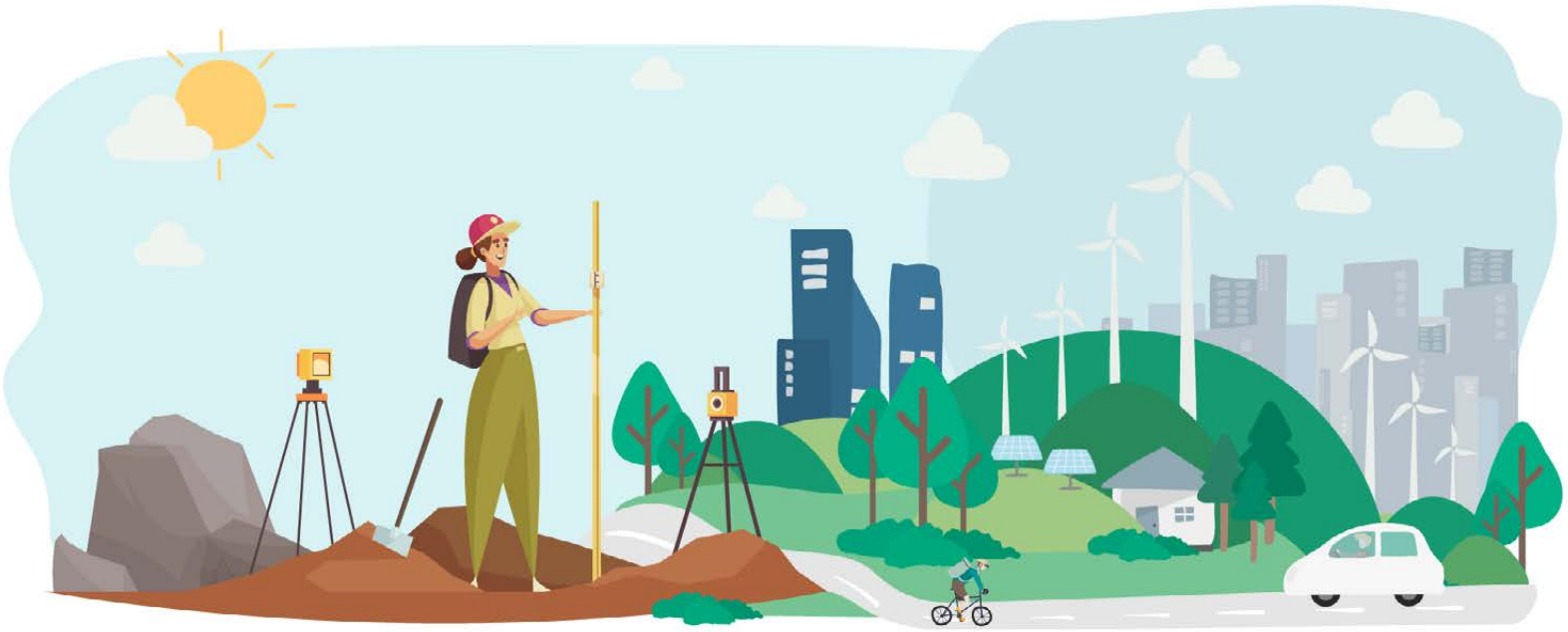

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Figures in each abstract are prepared by the author(s) of that specific abstract.

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The EU GeoInnovation Lapland Session, held on 18 June 2025 in Rovaniemi, Finland as part of the OECD Conference of Mining Regions and Cities, brought together experts from academia, research institutions, and industry to discuss critical raw materials within the European Union. The session featured 15 oral presentations and 13 posters, covering topics such as new practices to align exploration with ESG strategies, environmentally friendly exploration methods, and innovations in sustainable mining technologies. This proceedings publication by the Geological Survey of Finland compiles the extended abstracts from the session's oral and poster contributions.

Keywords: mineral exploration, geology, mining, critical raw materials, sustainable development, European Union

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DEEP EXPLORATION BOOSTED BY ADVANCED EXPLORATION TECHNOLOGIES – DEEPBEAT

by

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The discovery of deep deposits by surface methods is challenged by the distance from the surface to the mineralisation as a source of a geochemical signal. DeepBEAT is a Horizon Europe-funded project to advance geochemical methods for the identification of deep-seated mineral deposits, propelling Europe to the forefront of scientific innovation in the field. The aim of the project is to develop interdisciplinary, holistic, and sustainable exploration approach that combines deep geochemical knowledge to geophysics and social aspects. DeepBEAT will provide tools to comprehensively map available resources, facilitating informed planning for sustainable exploration and production practices aligned with the goals of responsible resource management. Recognising the crucial role of public support, DeepBEAT is dedicated to promoting awareness, aiming to engage scientists, exploration and mining companies, and stakeholders in meaningful interactions with the public.

The final outcome DeepBEAT will be a workflow which addresses these aspects by two means: I) DeepBEAT plans to engage with the local communities at the test sites to learn about concerns, hesitancy and what is the emotional core of these. Experiences from these events will be included in exploration workflow as an integral part, following the principles of free, prior, informed consent, which requires to interact with communities at a very early stage. II) DeepBEAT proposes ten novel technological developments, all designed to minimise impact on environment and maximise sustainability. These research and innovation developments have the potential to push the limits of surface geochemical exploration to another level.

They comprise a) new insights to ultra-high resolution analytical chemistry, b) increasing sampling strategy efficiency, c) introducing groundbreaking new concepts of dealing with elemental measurement data, d) reducing exploration costs by sample selection, e) testing novel phyto-geochemical media, and f) introducing UAV assisted biogeochemical sampling. Detailed understanding of the deposits complements the workflow to allow the understanding of the mineralization as part of mineral systems and AI-assisted 3D mineral prospectivity modelling.

The DeepBEAT project (2024–2027) is coordinated by Helmholtz-Zentrum DresdenRossendorf. The project consortium consists of eight partners and five associated partners from Germany, Finland, France, the Czech Republic, and Canada. Three test sites with varying deposit styles were chosen to conduct the research: Volcanic massive sulphide mineralisation system at Saramäki, Finland, granite-porphyry related Li-Sn-W deposits at Erzgebirge-Krušné hory area, Germany, and alkaline metasomatite REE-Zr-Mo mineral system at Hůrky, the Czech Republic. The progress of the project can be followed on the project webpage at www.deepbeat.eu, and in LinkedIn, X (Twitter) and Instagram. DeepBEAT is funded by the European Union under the GA number 101177617.

Fig 1. DeepBEAT samples plants, treetops, resin, mushrooms, soil, stream sediment or altered rock samples which capture a geochemical signal from deep sources. Portable tools like X-Ray Fluorescence (XRF) and Laser Induced Breakdown Spectroscopy (LIBS) enable rapid, on-site mineral analysis, while Triple Quadrupole Inductively Coupled Plasma Mass Spectrometry (TQ-ICP-MS) supply high-resolution data on the elements. UAV and LIDAR-assisted sampling design and sampling protocols streamline data collection of tree canopies. Furthermore, AI-driven 3D modelling reveals deeply buried or hidden deposits.