TIMREX: An EIT-Labelled Master's Program Transforming Mineral Exploration Education for Innovation, Entrepreneurship, and Sustainability

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The European mineral exploration landscape is evolving rapidly, with Nordic and West Balkan countries becoming key investment areas for mineral projects. However, a shortage of skilled personnel, especially in the West Balkans, presents a significant challenge. To address this, a consortium consisting of the University of Miskolc (Hungary), University of Zagreb (Croatia), Wroclaw University of Science and Technology (Poland), and Luleå University of Technology (Sweden), has created an EIT-labelled, innovative joint master's program: TIMREX. These universities are implementing the programme through a curriculum focusing on future mineral exploration professionals.

The TIMREX curriculum centers on state-of-the-art raw materials exploration techniques, emphasizing innovation, entrepreneurship, and social responsibility. It incorporates cutting-edge exploration methodologies, sensitive equipment, robotized tools, and advanced data processing for large datasets. This curriculum aligns with industry stakeholders' vision of mineral exploration, covering field geology, exploration methods, data processing, sustainability, and societal and regulatory considerations.

The program integrates EIT Overarching Learning Outcomes (OLOs) as core components, emphasizing innovation, entrepreneurship, sustainability, creativity, leadership, and intercultural competences. Notably, cross-organizational components, including an Exploration entrepreneurship course, Summer field camp, Internship, and Social and civic internship, foster these essential skills. The whole joint programme and especially the OLOs are achieved by a strong collaboration of the participating universities with eight non-academic partners of the consortium. Addressing the mineral demands of the European Green Deal and COP26 necessitates increased resource production, including for critical raw materials. TIMREX focuses on innovative field techniques and advanced data processing, alongside nurturing an entrepreneurial mindset and promoting sustainability and societal awareness as crucial soft skills for future mineral exploration professionals.

This publication outlines TIMREX's curriculum development and its alignment with EU Education strategies, with emphasis on field education. The fieldwork modules aim to cultivate robust practical skills encompassing cutting-edge exploration technologies and traditional geological mapping techniques. These field activities are complemented by lectures that establish a strong theoretical foundation. Field exercises are conducted in the classic Skellefte mining district of Northern Sweden, and aim to simulate the discovery of a volcanogenic massive sulphide (VMS) deposit through a hands-on mapping campaign and the successful application of a VMS exploration model.

Practical activities include the examination of historic exploration drill cores, drill core logging practice, and discussions regarding mapping implications. Industry experts active in the exploration sector deliver presentations on various topics, including exploration business models, social license to operate, research and development, exploration success stories, and career development. The course employs a flipped classroom approach, providing extensive study materials such as theoretical backgrounds, instructional videos, and photogrammetric outcrop models via an online platform before the field mapping week in Sweden. This approach not only enriches the learning experience but also prepares students for the collaborative and interdisciplinary nature of real-world mineral exploration teams.