Ambitions of the IMMERSE Project - Immersive Virtual Tours on Critical Minerals for Clean Energy Transitions

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ABSTRACT

The circular economy concept looks beyond the traditional mantra of “take-make-dispose” and instead creates industrial circular systems with the environment in mind, following the "make-use-return" goal. In circular economies, mining is still vital to support the new industrial circular systems (Lottermoser, 2024; Figure 1). Here, the extraction, processing and use of raw materials including mineral resources is optimized and, there is little waste. In addition, historical or contemporary mine wastes are reprocessed, recycled, used or reused as raw material, and remaining minerals or metals are extracted.

Figure 1. The circular economy from a raw materials perspective (EIT RawMaterials 2023), illustrating the magnitude and challenge of significant waste production during mining, mineral processing, and metallurgical extraction

By the end of 2050, Europe must ensure the achievement of the European Green Deal and a full commitment to the United Nations Sustainable Development Goals (SDGs) (Gløersen et al. 2022). At the core of these efforts lies the critical need for a sustainable supply of critical raw materials (CRMs) since these materials are the foundation of diverse industries and have significant economic importance for key sectors in the European economy.

However, the European industry is exposed to significant risk in terms of the supply of CRMs due to its high import dependence on other countries outside of Europe and the high level of concentration of these materials in specific countries (Ragonnaud, 2023). Consequently, the challenge of ensuring that key sectors have access to a sufficient supply of minerals to facilitate the acceleration of the energy transition is considerable.

As the focus on sustainable resources increases, there is a rising need for skilled professionals to ensure the responsible and secure extraction of CRMs. This is essential to meet the growing demand for CRMs, strengthen Europe's competitiveness and to reduce its dependence on imports of CRMs. However, a notable challenge in Europe is the shortage of qualified specialists in the mining and mineral raw materials sector. In response to this pressing need, the collaborative IMMERSE project has been initiated as a collaborative effort between RWTH Aachen University (Germany), the Technical University of Crete (Greece), the University of Huelva (Spain) and the University of Tasmania (Australia). The objective of the project is to bridge the gap in the training of mining professionals through innovative learning and teaching practices, with a particular focus on the promotion of sustainable mining practices.

The main objective of the IMMERSE project is to establish Virtual Excursions (VEs) to enhance education in the critical raw materials sector, with a specific focus on the Life of Mine (LOM) cycle — from exploration through production of critical raw materials to closure and rehabilitation.

Furthermore, IMMERSE aims to contribute to the preservation of the environment and combat climate change by ensuring the sustainable supply of critical raw materials in Europe, thereby supporting the European Green Deal and the transition to clean energy. In addition, it strives to provide flexible, time and cost-saving teaching concepts to enhance the accessibility to educational materials. It also seeks to strengthen the collaborative capacity of universities for cross-border cooperation and networking in the extractive sector, particularly at the EU level. The IMMERSE project will have a significant impact on education in the CRMs sector, shaping a generation of knowledgeable leaders equipped to navigate the complexities of sustainable mineral extraction.

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