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ABSTRACT BOOK
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The Geoscience paradigm:
resources, risks and future perspectives

Screening tests on potential recovery of strategic and critical raw materials from mining waste facilities in Italy

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European Union has recently developed policies aimed at the increase of production of Strategic (SRMs) and Critical Raw Materials (CRMs) within its borders. These new regulations are designed to promote the recovery of significant amounts of materials from existing mining operations throughout the continent while contributing towards achieving the ambitious objectives of the European Green Deal and attaining Climate Neutrality. The ultimate goal of this action is to ensure a sustainable and secure supply of crucial raw materials for the European Industry by leveraging internal primary and secondary sources. According to the Italian registry of abandoned mining waste storage sites updated by ISPRA in 2022 (ISPRA, 2022), there are 562 abandoned mining sites in the Italian territory resulting from ceased activities in the last 100 years. In many cases, valuable minerals nowadays reported as SRMs or CRMs, are available or present in these areas. Th e importance of having a multi-step approach to the definition of sampling and characterization strategies for waste facilities recovery has been underlined in previous works (Dino et al., 2018; Nwalia et al., 2021). In this work, we present a novel approach to implementing a screening methodology suitable for background definition, sampling, characterization, mapping, treatment and recovery of valuable minerals from existing mining wastes in Italy. The procedure is proposed in order to achieve an efficient and reproducible method aimed at the potential recovery of valuable minerals according to theoretical and experimental data. In the first phase, the target site is individuated according to relevant information from official or governmental databases, scientific literature and industrial documents. In addition, already available topographic data can be considered to better confine the area of investigation. The collection of representative waste samples is planned by GIS tools according to standard procedures. The planning is designed for individuating accessible areas for operators and sampling representative portions of the target areas. Main mineralogical and chemical features are characterized using analytical multi-modal methodologies. Consequently, lab-scale mineral processing tests are performed in order to assay the technical potential recovery of target minerals dispersed in the waste material collected. The evaluation of tests is performed by calculating the final products' grade and separation yield of the proposed processing flow sheet. Data collected from laboratory testing are implemented in the GIS model in order to define the detailed mapping phase. A portable XRF mapping campaign and UAV-driven hyperspectral photogrammetry surveys are realized for the digital modelization of waste facilities. As a result, data obtained from remote sensing are matched with the ones coming from preliminary screening. The final model is drawn underlining the concentration of target elements and minerals highlighting the areas having a greater recovery potential. The development of this multi-modal and data-driven procedure for screening mining waste facilities' recovery potential will hopefully deliver a reliable tool for the recovery of SRM and CRM in Italy.

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