Characterization and CRM evaluation in an abandoned silver mining district: the case of Monte Narba, SE Sardinia.

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The increasing demand for Critical and Strategic Raw Materials (CRM and SRM) represents a major challenge for the European Union, because of its dependence on non-EU-countries suppliers. In response, the EU adopted the Critical Raw Materials Act (May 2024), which promotes the sourcing and recovery of valuable materials from alternative and domestic sources, such as extractive waste (EW). In EU, EW account for nearly 622 million tons per year and represent the second-largest waste stream (26.6% of total share, according to EUROSTAT 2023). Much of this waste is largely associated with abandoned mining areas, posing environmental concerns but also holding the potential for CRM and SRM re-evaluation.

Sardinia (Italy) represents a strategic area of interest due to its rich mining legacy and the substantial volumes of mining waste left behind after the closure of the last active mines, which hold significant CRM potential.

This study focuses on the Monte Narba mining site, located a few kilometres south of San Vito and Muravera, in southeastern Sardinia (Sarrabus region). Mining in this area began in the second half of the 19th century. Monte Narba was the largest of the silver deposits in Italy, producing—at its peak—approximately 800–1,000 tonnes of high-grade silver ore per year. After manual sorting, the ore was crushed and gravity-enriched on site, producing two main concentrate fractions: one with Ag contents of 1.5–2.5 wt%, and another with 0.35–0.7 wt% (Mezzolani & Simoncini, 1889). Recently, the Monte Narba site attracted interest due to the presence of industrial minerals such as barite and fluorspar, both CRM, which in the past were considered waste, but today could be subject to economic recovery. Despite the renewed interest in the valorisation of these materials, detailed information on the status of mineral dumps remains limited. The available knowledge is mainly based on historical documents or surveys, which have identified two main types of waste: a main landfill with a volume of approximately 82,820 m³, mainly hosting waste rocks, and a second area of fine waste, resulting from hydrogravimetric separation, stockpiled in an area of 46,657 m² and a volume of 93,314 m³ (Regione Sardegna, 2003).

We carried out a systematic sampling campaign, during which 16 samples were collected, mainly from the fine waste stockpile. Additionally, 3 samples of heterogeneous waste (probably a mix of processing fines and waste rock) were gathered from areas upstream to the mining yard, near old mining adits. Preliminary XRF data show that the fines waste is enriched in Ag (500-600 ppm), together with Pb (0.9-1.2 wt%), Zn (1.3-1.9 wt%), F (6.9-8.7 wt%) and Ba (0.2-0.3 wt%). These results agree with the presence of galena, sphalerite, barite and fluorite in the dump bodies, as suggested by historical documents. Occurrence of fluorite and barite is confirmed by SEM-EDS first investigations performed on selected samples, which also evidenced the presence of LREE phosphates associated to quartz; pyrite is Ni-enriched. Further analyses (optical microscopy, XRD analysis, SEM-EDS) are currently underway to investigate texture and mineralogy of the waste materials. In addition, the study focuses on analysing potential environmental impacts by performing laboratory tests to simulate the release of metals into the environment, with a focus on the type of drainage through leaching tests (SPLP procedures).

Keywords: Sardinia, Mining waste, Critical Raw Materials
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