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Laboratory-scale reprocessing trials of historical mine waste from the Traversella mining district (Piedmont, Italy)

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Recent European Union policies are aimed at exploring extractive waste and potentially identifying alternative sources of Critical or Strategical Raw Materials. Italy had an active base metals mining industry throughout the 20th century. However, these activities were gradually abandoned starting from the 1970s due to political and economic factors. The Traversella mine district is located about 55km North of Turin, Piedmont, Italy and it is characterized by a polymetallic Fe-Cu-W pyrosomatic "skarn" deposit hosted in the Sesia-Lanzo geological unit. Historically, mining operations can be dated back to the Roman period through the Middle Ages. The modern exploitation of the deposit commenced in the XVIII century producing more than 300,000 metric tons of iron ore in its first century of activity. Due to the implementation of more efficient processing techniques, starting from the XX century Traversella mine also produced scheelite, chalcopyrite and uraninite concentrates. Mining operations ceased in 1971 due to economic reasons (Costa et al., 2019).

The presence of mining waste in the area is documented in the National Registry of Extractive Waste Facilities, particularly in regions proximate to the former processing plant and mine adits (ISPRA, 2022). This study encompasses the characterization and reprocessing trials of waste rock samples sampled from waste sites within the Traversella mining district for assessing the potential recovery of valuable minerals. Laboratory-scale mineral processing trials were conducted to produce mineral concentrates from the waste. Initial chemical and mineralogical characterization involved Optical Microscopy (OM), Scanning Electron Microscopy (SEM), and X-ray Powder Diffraction (XRPD) techniques. The analysis revealed the presence of metallic-bearing minerals in the waste, notably magnetite.

The designed process consisted firstly of a crushing and comminution circuit comprising a jaw crusher and a rod mill. For each stage of the crushing process, sub-samples were obtained to determine the free-grain size using OM and SEM image analyses. Comminution products were divided into two size classes suitable for magnetic separation. The coarser class between 0.250 and 0.125 mm was treated using a dry low-intensity magnetic separator (LIMS), while the finer size class below 0.125mm was treated using a wet high-intensity magnetic separator (WHIMS). Consequently, products with elevated concentrations of Fe and other minor components such as Cu, Mn, and W were obtained.

Costa et al. (2019) - The Traversella Mining Site as Piemonte Geosite. Geoheritage, 11(1), 55-70, https://doi.org/10.1007/s12371-017-0271-y.

ISPRA (2022) - Inventario nazionale delle strutture di deposito di rifiuti estrattivi, chiuse o abbandonate, di tipo A. Rapporto di aggiornamento 2022, https://www.isprambiente.gov.it/it/pubblicazioni/rapporti/inventario-nazionale-delle-strutture-di-deposito-di-rifiuti-estrattivi-chiuse-o-abbandonate-di-tipo-a-rapporto-di-aggiornamento-2022.