Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37277

Linking Geochemistry and UAV Mapping to assess Metal Enrichment and AMD Potential at the Rosalgar Mine, Portugal

ROBERTO DA SILVA[1], RITA FONSECA[1], JOANA FERREIRA DA FONSECA ARAÚJO JR.[1], MARCELO SILVA[2], JOSÉ DIOGO ROSEIRO[2], MÁRCIO SANTOS[2], PEDRO NOGUEIRA[2] AND ANTÓNIO ALEXANDRE ARAÚJO[3]

[1]AmbiTerra Laboratory, Institute of Earth Sciences (IES), University of Évora
[2]GEO-DS lab, Institute of Earth Scientes (IES), University of Évora
[3]Institute of Earth Scientes (IES), University of Évora

The Rosalgar Mine, located between Cercal do Alentejo and Odemira in southwestern Portugal, is part of a major regional ferromanganese mineralization belt. Mining activity began in antiquity, including the Iron Age, Roman and Islamic periods, and intensified during the 19th and 20th centuries, operating until 2001 to supply iron and manganese ores to the national steel industry. The deposit comprises two quartz–baryte lodes enriched in Fe–Mn oxides, together with additional Fe–Mn impregnations in the surrounding schists. Today, this abandoned mine constitutes a valuable natural laboratory for investigating Fe–Mn geochemical systems and exploring remediation strategies focused on metal-rich residues and acid-neutralizing materials.

The field campaign yielded 31 background sediment samples and 36 samples from the mine area. Analyses included pH and electrical conductivity measurements, mercury determination, sulfate quantification, and partial *aqua regia* digestion to assess extractable metal fractions using ICP-OES. In parallel, high-resolution remote-sensing data were acquired with a DJI M350RTK UAV equipped with a Zenmuse L2-LiDAR system, and a Micasense RedEdge-P multispectral sensor, enabling detailed topographic and spectral characterization and integration with the geochemical dataset.

Results indicate pronounced spatial heterogeneity in metal enrichment within the mine area relative to background conditions. Enrichment Factor (EF) and Index of Geoaccumulation (Igeo) values identify Co and Ba as the most impacted elements, reflecting mining influence. Additional low-to-moderate enrichment of Pb, Zn, Mn, Cd, Hg and Ni is observed, largely controlled by Fe–Mn phases. Measured pH and Eh values indicate mildly acidic to near neutral and predominantly oxidizing conditions, consistent with Portuguese soil and sediment reference ranges, suggesting spatially limited metal mobility. Sulfate concentrations in the mine area are highly variable, with localized values exceeding 100 mg/kg and a maximum of 1108.95 mg/kg, indicating sulfide oxidation and potential acid mine drainage hotspots, while background levels (≈10–390 mg/kg) remain relatively uniform and lithogenically controlled.

The integration of high-resolution spectral imagery with geochemical data constrains spatial patterns of metal enrichment and sulfate distribution. Analysis of surface drainage pathways enables the identification of areas prone to acid mine drainage generation, flow directions affecting downstream systems, and priority areas for targeted remediation.