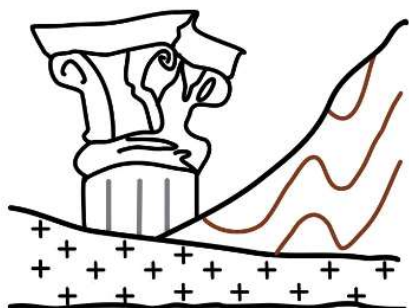
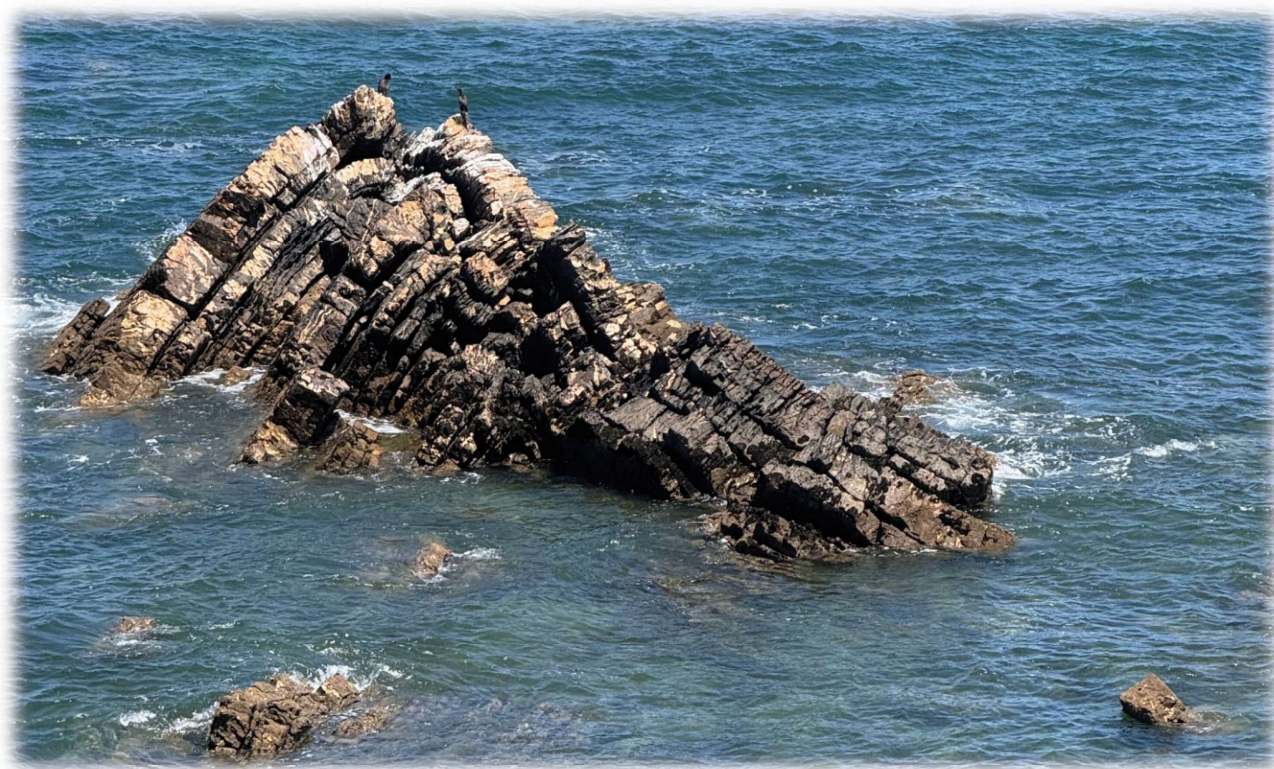




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Livro de Resumos

Coordenado por:

Pedro Nogueira, José Roseiro e Noel Moreira

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Characterization and recovery of critical raw materials using innovative techniques – case study of the XTRACT project: São Domingos Mine, Portugal

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Resumo

The Iberian Pyrite Belt (IPB) is one of the world's most significant provinces of Volcanogenic Massive Sulfide (VMS) deposits, hosting both world class orebodies and medium sized systems such as the São Domingos Mine. This deposit consists of a steeply dipping, E–W elongated mass of cupriferous pyrite with associated zinc and lead sulfides, emplaced within a tectonically complex volcanic sequence overlain by thick turbidites and the allochthonous Phyllite Quartzite Group. Historical exploitation from the mid 19th to the 20th century, involving incineration, smelting, heap leaching and cementation, generated extensive waste dumps, slags and leaching piles. These materials remain enriched in potentially toxic elements (Zn, Pb, Sb, Cu, As, Hg, Cd), and ongoing sulfide oxidation and Fe hydrolysis promote acid mine drainage, enhancing metal mobility and creating persistent environmental contamination hotspots. Modern assessment of these legacy wastes requires advanced analytical and monitoring technologies. High resolution geochemical mapping, supported by drone based remote sensing, enables precise delineation of critical raw material enrichment zones and accurate estimation of waste volumes and tonnage. Emerging geophysical tools, including the Airborne Geophysical Electromagnetic System and integrated ground and air borne remote sensing platforms for tailings content assessment, provide detailed subsurface information on conductivity, internal heterogeneity and structural controls. Muon tomography offers unique density imaging capabilities for detecting cavities, collapse zones and remnant sulfide bodies in inaccessible areas. For sustainable metal recovery, bioleaching technologies represent an eco-efficient approach capable of mobilizing Cu, Zn, Co and other strategic elements from low grade materials. The integration of these state-of-the-art methodologies positions São Domingos as an exemplary natural laboratory for developing innovative strategies in mine waste valorization and environmental risk mitigation, directly supporting the overarching objective of the XTRACT project: establishing a sustainable ecosystem for innovative resource recovery and complex ore extraction within a low impact, circular economy mining paradigm.

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