

Indian Iron Ore Waste Mine tailings for Critical (Li) and REE minerals -Case Studies

Perumala Venkata Sunder Raju¹, Basant Rath²

¹National Geophysical Research Institute, Hyderabad, India, ²National Mineral Development Corporation, Hyderabad, India

Banded Iron Formations (BIFs) are among the most significant rock types of the Precambrian era, widely distributed across global shield regions. India ranks fourth in global iron ore production, contributing approximately 246 million tons, or 8% of the world's total. Enhancing the grade of iron ore is critical for efficient mineral beneficiation, where comminution plays a key role. Advanced in-situ mineral characterization techniques such as Light Microscopy (LM), Scanning Electron Microscopy (SEM), Powder X-ray Diffraction (PXRD), and automated tools like the Mineral Liberation Analyzer (MLA) provide precise data for developing effective beneficiation strategies. These methods have been successfully implemented at both laboratory and pilot scales. Furthermore, the exploration of Rare Earth Elements (REEs) and other critical minerals in weathered iron ores, mine tailings, and waste dumps has revealed significant potential. In the Ubrani area of Karnataka, lithium-bearing petalite has been identified within titaniferous magnetite seams. The lithium appears to be associated with hematitized V-Ti-Mg-rich zones and likely formed during late-stage hydrothermal processes, coinciding with a major orogenic gold mineralization event (2.45–2.60 Ga) in the Dharwar Craton. These findings open new avenues for critical mineral exploration in waste tailings as its cost effective