

Factors affecting REE migration, enrichment and differentiation in regolith in tropical region: A case study of Menghai REE Deposit

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Ion-adsorption rare earth element (REE) deposits are the primary global source of heavy rare earth elements (HREEs), supplying over 90% of HREE products. Similar deposits were identified in the tropical regions of Southeast Asia, specifically Myanmar and Thailand. The surging global demand for rare earth elements has intensified exploration efforts for ion-adsorption deposits in Southeast Asia. However, there is still a lack of comprehensive understanding of the characteristics and genesis of these deposits. Recently, tropical REE deposits have also been discovered in the Menghai area of Yunnan Province. Studies on the Menghai deposits will promote the understanding the mineralization processes of ion-adsorption REE deposits in tropical regions. This study examines the hydrographic structure, topographic characteristics, geochemical and mineral composition of regolith in the Menghai area, to reveal variables influencing the migration, enrichment, and differentiation of rare earth elements in tropical deposits.

The tropical climate has concurrent rainy and hot season, which induce intense chemical weathering in the Menghai area. Primary minerals undergo extensive weathering, resulting in the development of thick regolith with elevated CIA values. The REE minerals serve as the primary source of exchangeable REE in the orebody. Thereby, dissolution of REE minerals is promoted, especially for the weather-resistant minerals, thereby facilitating the release of REE ions from REE minerals. The migration, enrichment, and differentiation of REE ions are regulated by the hydrodynamic zonation of regolith. REEs were vertical leached in the rapidly percolating vadose zone and subsequently accumulated in the capillary fringe where seepage velocity diminishes. As REE-bearing fluids permeate the capillary fringe, LREEs and HREEs undergo fractionation, resulting in the accumulation of LREEs in the upper level and HREEs in the lower level.