

ENRICHMENT OF RARE EARTH ELEMENTS IN RELATION TO MINERAL PARAGENESIS IN WEATHERED CARBONATITE ENVIRONMENT

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Increasing demand for Rare Earth Elements (REEs; Lanthanides + Sc and Y) driven by the hundreds of high-tech applications has led to the search for new economic sources. The majority of the world's REEs are associated with carbonatite rocks and their weathered derivatives. Since the REE content of the basement carbonatite rocks at Eppawala, Sri Lanka, has been reported to be high, there is a high potential for REE concentration in their weathered crust to be several orders of magnitude higher than in the parent rock. Identifying REEs enriched zones in weathered profiles using chemical methods is costly because of the high inhomogeneity developed during karstification. Here we aimed to study the relationship between the REEs composition and the mineral paragenesis in phosphate ores. Mineralogical compositions of the weathered carbonatite samples were determined using X-Ray powder diffraction analysis to identify the REEs bearing phases. Other than the primary minerals derived from the carbonatite body, the common secondary phases present in the weathered zones include different generations of secondary fluorapatite, carbonated fluorapatite, crandallite, gorceixite, florencite, and goyazite mineralized during the development of the weathering products. Further, iron oxyhydroxide minerals such as goethite formed by oxidation of iron oxide minerals were abundant in the intensively leached zones of the ore. Aluminosilicates such as kaolinite and montmorillonite can be found in the lateritic layers of the profile. Hydrated aluminium silicates and secondary phosphate minerals such as crandallite, gorceixite, florencite, goyazite, and goethite have a high propensity to scavenge REEs. In particular, aluminophosphate minerals have more affinity for light REEs. As a result, locations rich in certain minerals have an increased tendency for accumulating REEs and are hence appropriate for mining. Therefore, understanding the mineralogy is a facile and low-cost approach to identifying the REEs enriched zones compared to the expensive and complex geochemical analyses.

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