

Comparison of Critical Metal Potential in Beach and Offshore Sediments of Pulmoddai, Sri Lanka

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Abstract

The global transition towards renewable energy resources for power generation has increased the demand for critical metals (CMs), including rare earth elements (REEs). This rapid growth of demand coupled with geological scarcity and geo-political concerns has posed great challenges in securing the supply chain of CMs. Therefore, prospecting new CM sources worldwide is of timely importance. In this context, the Pulmoddai coastal stretch in Sri Lanka has been recognized as a dynamic deposit with established potential for REEs and other critical metal resources, currently undergoing beach face mining operations. The focus of this study is to compare the critical metal potential in the beach and offshore sediments in Pulmoddai, Sri Lanka, crucial for determining the origin and delineating the extent of this deposit. Twelve onshore and nineteen offshore samples were collected and analyzed for CMs (V, Cr, Co, Ni, Cu, Zn, Ga, As, Rb, Sr, and Cs) and REEs. Based on the results, light REE content (LREE), heavy REE content (HREE), and total REE content (TREE) were computed for both onshore and offshore locations. For onshore sites, LREE, HREE, and TREE ranged respectively from 43.27 to 244.09 ppm, 19.62 to 92.29 ppm, and 62.92 to 336.39 ppm. Conversely, offshore locations exhibited higher concentrations with the corresponding values ranging from 116.12 to 363.62 ppm, 8.57 to 120.93 ppm, and 167.93 to 484.55 ppm. Sr, Ni, and Cr were determined as the most abundant CMs for both onshore and offshore locations. Sr, Ni, and Cr concentrations ranged from 227.17 to 674.58 ppm, 116.17 to 675.88 ppm, and 43.55 to 112.87 ppm respectively for the onshore locations. The corresponding ranges for offshore sites were determined as 370.86-754.30 ppm, 235.43-721.44 ppm, and 32.51-172.62 ppm. The higher CM content in offshore regions suggests an offshore origin to this dynamic deposit, which is enriched by the offshore sediments transported onshore and deposited on a long-term basis. Therefore, regulatory authorities overseeing the mining operations of Pulmoddai deposit should accurately delineate its extent, integrating both onshore and offshore regions as a unified system, rather than solely focusing on prospecting the longshore areas.

Keywords: Critical metals (CMs); Dynamic deposit; Pulmoddai coastal stretch; Rare earth elements(REEs); Sediments