

ABSTRACT

The primary objective of the present research work is aimed at characterizing and assessing the resource potential of beach and alluvial placer along the eastern coast of India and Sri Lanka, in terms of the rare earth elements and thorium. In the present study, the author has endeavored to understand the role of the geomorphic agents for the enrichment of placer deposits in the area of study. River with meandering nature helps in the accumulation of beach placers. The presence of delta at river mouth, and spit along the coast provide a suitable environment for the prospect of rare earth elements. The topography and elevation profile of the river play a significant role in the transportation of sediments. It was observed that the total Rare Earth Element (REE) content for the Rushikulya River and Mahanadi River sediments was ~5.2 and ~23.83 times higher than the UCC values, respectively. Based on the recent studies, it was observed that REEs were ~90 times higher in the Podampata beach sediments as compared to UCC. Monazite, zircon, ilmenite, rutile, garnet, xenotime and associated minerals are more abundant in the eastern coast of India and Sri Lanka. Garnet is more abundant in Paradeep beach whereas enrichment of ^{232}Th and ^{238}U is relatively low. Mahanadi River placers are derived from both felsic and mafic source rock, while Rushikulya River placers are originated from the felsic source rock. The concordant geochemical nature of radioactive minerals and REEs suggest that the heavy minerals are derived from charnockite–granite gneisses whereas the calc-silicate rocks are secondary source rocks in the eastern coast of Sri Lanka. The majority of the heavy mineral grains were angular to sub-angular in shape and reasonably homogenous in composition with minor variations plausibly due to short distance fluvial transport. The subsurface deposits around 2-2.5 m depth are suitable for prospecting rare earth and radionuclides. The radionuclides are mainly concentrated within finer grains having a range of 125-180 μm . The geothermal anomaly obtained from satellite imagery is the ultimate tool for the identification of radioactive minerals in the inaccessible area and for monitoring mining activity. Metamorphic zircon obtained from the eastern coast of India shows characteristics of magmatic zircons due to the formation in equilibrium with partial melt. The similarity in lithology, especially abundance of charnockites, mineralogy, abundance of trace elements including REE elements, and similar age of detrital zircons indicates similar tectonic activity and the subsequent remnant in the eastern coastal regions of both India and Sri Lanka. Hence the river flowing through tectonically active regions could carry maximum heavy minerals and the alluvial and beach placers associated with delta, meandering, and spit could be used for potential resources.

Keywords: Rare earth elements; Thorium; Uranium; Trace elements; Thermal remote sensing; Radioactivity; Granulometric analysis; Textural analysis; Geomorphic agents; Geochronology of detrital zircons