

Variation of radionuclides and trace elements from source to sink in UHT terrane, Eastern Ghats Mobile Belt, India

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Beach placers associated with Ultra-High Temperature (UHT) terranes host a diverse assemblage of heavy minerals, including zircon, monazite, garnet, rutile, ilmenite, and sillimanite. This study aims to investigate the geochemical variations of these elements from their source to the depositional environment, alongside their quantification, to better understand their enrichment processes and potential economic significance. A multi-element based geochemical survey of source rock, alluvial and beach placers was carried out along the eastern coast of India to emphasize the role of stream and river tributaries in the transportation and deposition of heavy mineral placers. The Σ REE contents in rocks of the study area is in the following order: charnockite > khondalite > granitoids. Radioactive counts in the granulite terranes vary from 10 to 120 μ R/h depending on the abundance of radioactive minerals in different lithologies. The lithology of the river basin, the nature and number of channels, the meandering nature, delta and slope of the river influences the distribution of heavy minerals as placer deposits. The morphology of river basin along with the elevation profile plays a significant role towards the enrichment of heavy minerals. It was observed that the Σ REE content was ~ 5.2 and ~ 23.83 times higher than the UCC values for the Rushikulya River and Mahanadi River sediments, respectively. The Σ REEs were ~ 90 times higher in the Podampata beach sediments and ~ 20 times higher in the Paradeep beach sediments compared to UCC respectively, and exhibit a negative Eu anomaly. Th/U ratio is higher in beach sediments than the river sediments as compared to the UCC, which indicates the presence of radioactive heavy minerals in the former. The concentration of radionuclides as well as REE's, exhibit specific enrichment for the beach sediments, at particular locations. Mixed parentage of felsic as well as mafic rocks is observed in Mahanadi River placers while the felsic source rock source is more dominant in the Rushikulya river placers.