

Beach Placers of South-Eastern Peninsular India: A Petrological, Geochemical, Geophysical and Radiometric Perspective

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Beach placer deposit along the eastern coast of peninsular India is highly enriched with heavy minerals like garnet, sillimanite, titanite, magnetite, monazite, and zircon. The presence of the mineral monazite and zircon ensures the presence of rare earth element (REE). Being placed adjacent to the eastern ghat mobile belt (EGMB), the beach placers are enriched with the weathered detritus from the EGMB. The EGMB is a high grade metamorphosed terrain comprising of varied rock types like charnockite, khondalite, migmatite, anorthosite and granite. The composition of the placer deposits varies with the mineralogical composition of its specific provenance.

The resource potential of a thirty kilometer long beach stretch along the coastal areas of southern Odisha, India has been studied. The spatial distribution and subsurface extension of the heavy minerals was estimated with the help of radiometric method and electrical resistivity methods respectively. The study area shows a low resistivity (0.1 to 1.1 ohm-m) with a high radioactivity indicating the presence of heavy minerals. The area shows a high background radiation because of the elevated concentration of radioelements ²³²Th, ²³⁸U and ⁴⁰K. Raman spectroscopy shows the presence of REE bearing minerals like monazite and zircon. The major element oxide data shows an enriched titanium oxide concentration. The total REE concentration shows a 29 times enrichment as compared to the crustal REE. A positive correlation is observed between ²³²Th and REE concentration. Hence, the thorium concentration can be used for an in-situ and rapid estimation of the presence of REE on field in the study area. The REE geochemistry shows an elevated light REE and depleted heavy REE with a pronounced negative europium anomaly, thereby indicating a felsic source. The varied texture of zircon grains observed with the help of petrological study points to a metamorphic origin of the heavy minerals. The major element and REE concentration of the beach sands indicates a charnockite provenance.