

## ABSTRACT

Beach placer deposits are an important repository for heavy minerals. The coastal areas of the peninsular India especially the south-western and the eastern region are highly enriched with heavy minerals. These deposits are dependent upon the sediment supply from its hinterland rock type. The study area for the present work is situated along the southern coastal areas of Odisha, India. Adjacent to the study area lies the eastern ghat mobile belt (EGMB), which is the source of the heavy mineral bearing beach placers. The EGMB is a high grade metamorphosed terrain consisting of rock type's charnockite, khondalite, migmatite and granite. The placer deposits have been studied by both non-invasive and laboratory methods. The non-invasive methods are used to delineate the lateral and vertical distribution of the beach placers in the area under study. For the laboratory analysis, beach sand samples have been collected along the study area and investigated for their major element, trace element, rare earth element (REE) and their radioactive element concentration. The heavy mineral shows a patchy distribution along the beach area. The 2D inverted resistivity section shows the presence of a low resistivity zone extending upto a depth of 20-25 m from the surface, in profiles lying along the beach. In profiles located close to the river mouth, this low resistivity zone lies at a considerable depth, in the form of pockets. This low resistivity zone is interpreted as heavy minerals, primarily because the minerals present in the placer (heavy mineral) deposit are ilmenite and rutile which have a high conductivity and low resistivity. The value of this low resistivity zone ranges between 0.1 to 1.1 ohm-m. A comparison is done between the DC resistivity and the radioactivity data measured on-field by a Geiger Mueller counter. The radioelement concentration of the beach placers measured with the help of High Purity Germanium detector (HPGe) shows a high thorium and a low uranium and potassium concentration, respectively. The average Th/U concentration of the study area is 11. The total REE (TREE) concentration of the beach placers as measured with the Inductively Coupled Plasma Mass Spectrometry (ICP-MS) varies between 104 to 10,657 ppm respectively with an average of ~4243 ppm, which is almost 29 times higher than the average crustal value of the REE's. The study area shows a high LREE (average ~ 4200 ppm) and low HREE (average ~ 43 ppm) concentration with a

pronounced negative europium anomaly. A comparison between the REE concentration measured with the help of ICP-MS and Instrumental Neutron Activation Analysis (INAA) shows correlation coefficient ( $R^2$ ) varying between 0.6 -0.8. The thorium and the TREE concentration in the beach placers exhibit a positive correlation, thereby indicating that the thorium prospectivity could be used in the in-situ exploration of the REE's in the study area. The calculated weathering index based on the major element concentration of the beach sands show a moderate to high degree of weathering. The beach placer deposit in the study area shows a felsic composition. A comparison between the major element and REE concentration of the beach sand and the surrounding rock types shows that the beach sands exhibits a charnockite provenance.

*Keywords- Monazite, Thorium prospectivity, DC resistivity, Rare Earth Element (REE), ICPMS, INAA, Odisha.*