

REE Resource Estimation in the High Background Radiation Areas (HBRA's) of Coastal Odisha, India

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The beaches along the eastern coastal region of India have a High Background Radiation. The beach sand consists of minerals like ilmenite, rutile, garnet, zircon, monazite, sphene, sillimanite, etc. Among the heavy minerals the presence of the mineral monazite and zircon, which consists of radioactive elements thorium and uranium, ensures that the area is designated as an HBRA. Monazite is a thorium phosphate which consists of Rare Earth Elements (REE). The mineralogy of a placer deposit depends upon the geology of the surrounding area. The Eastern Ghats Mobile Belt (EGMB) lying adjacent to these coastal areas is the main source for the elevated background radiation of these placer deposits. The major rock types of this region are charnockite, khondalite and granite which are the source of the heavy minerals present in the beach placers. The heavy mineral enrichment of the beach placers is due to the coastal sedimentary processes which plays a significant role in the sorting of the lighter and heavier particles. Apart from these the effect of the recent marine transgression contributes to the enrichment of the heavy minerals in the beach placers.

Twenty four sand samples were collected from three different locations along the beach areas of the state of Odisha, India. These have been analysed, to study the radioactive as well as the REE concentrations, with the help of High Purity Germanium Detector (HPGe) and Inductively Coupled Plasma Mass Spectrometry (ICPMS) respectively. The result shows that the study area has a comparatively higher concentration of thorium than uranium followed by potassium. The average Th/U ratio in the area of study is about 29, which is almost 8 times higher than the crustal ratio of 3.8. The REE analysis of the study area shows a high concentration of LREE than HREE. The average LREE concentration of the area is 5723 ppm which is almost 45 times higher than the crustal abundance. Along with LREE the area also shows a high concentration of the element Dysprosium. The average concentration of Dy is 35 which is about 9 times higher than its crustal concentration. A positive correlation between Th and REE is observed in this area. Hence, the concentration of thorium can be used for in-situ and rapid assessment to delineate the presence of REE on field in the study area. Both the radioelement and the REE show a distinct Northeast Southwest trend.