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Textural and Heavy Mineral Analysis of Beach Sediments of Shankumukam, Trivandrum, South West Coast of India

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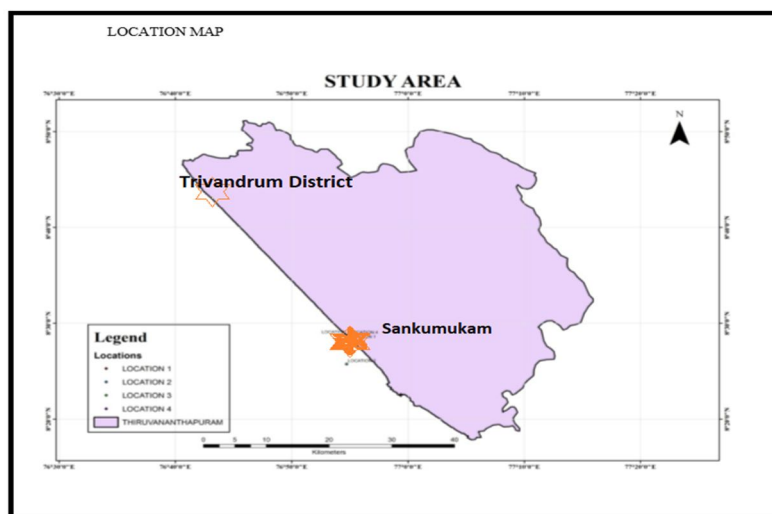
Abstract: The south-west coast of India is well known for its placer deposits. Considering these, an attempt has been made here to the study the textural characteristics as well as heavy mineral concentration in the beach sands of the coastal region of Shankumukam of Thiruvananthapuram district in Kerala. The grain size study and the heavy mineral analysis of the Shankumukam beach sediments from four locations have been investigated along the berm, high water line and low water line.

I. INTRODUCTION

The placer can be an accumulation of valuable minerals formed by gravity separation during sedimentary processes. The type of placer deposits are namely, alluvial (transported by a river), colluvial (transported by gravity action), eluvial (material still at or near its point of formation), beach placers (coarse sand deposited along the edge of large water bodies) and paleo-placers (ancient buried and converted rock from an original loose mass of sediment). The heavy minerals along with sediments which are derived mechanically from source rocks are contributed to the sea by various processes of transportation are selectively panned and sorted and then deposited at suitable locations, by the action of waves and currents. The factors controlling the formation of beach placers are source rocks, geomorphology of the area, climate, drainage pattern, coastal processes, neo tectonics etc. The heavy minerals are concentrated by a combination of these processes in the upper part of the beach, where the action of the wind may erode them and form heavy mineral rich coastal dune deposits. India has some of the largest placer deposits along its coast. The south –west coast of India is well known for its placer deposits. Considering these, an attempt has been made here to the study the textural characteristics as well as heavy mineral concentration in the beach sands of the coastal region of Shankumukam of Thiruvananthapuram district in Kerala.

A. Study Area

Shankumukam beach is situated on the west of Kerala, India. The area of investigation lies in between Latitudes N 8°28'43 to N 8°28'46, longitudes E 76°54' 45 to E 76°54' 43. Four stations were selected for the sampling of sediments and 12 samples were collected at a distance of 20 m representing Berm, High tidal region, and Low tidal region respectively from the all four locations. At each station sediment sample weight of nearly 500 g were collected in each environment.



II. METHODOLOGY

Laboratory works carried out in the Trivandrum University college, Geological Laboratory, the samples selected for study were dried in sunlight and mixed up thoroughly. Then the sample was reduced to about 30–50 g by repeated coning and quartering and this method is repeated by using that half of the sample, until we get the desired 30–50 g of sample. The samples were then transferred to 250 ml beakers and the beakers were labelled with sample number. Samples were treated with 10% HCl and kept overnight for the removal of organic matter. Sieving is commonly used in determining the grain size distribution of sand size particles. In the present work ASTM (American Society for Testing Materials) is used and samples were sieved at $1/2\phi$ (ϕ) interval.

III. RESULT AND ANALYSIS

The grain size study of the Shankumukam beach sediments from different locations have been investigated, which enabled to understand the grain size variations of berm, high tide and low tide regions. The sediment samples from various parts the beach indicates that the sediment size is medium sand, well sorted, fine skewed and platykurtic. The relationship between the statistical parameters has been established. The characteristics of grain size distribution of sediments are related to the source materials, processes of weathering, abrasion, and corrosion of the grains and the sorting processes during transportation and deposition. The size distributions of clastic sediments have revealed the existence of a strong statistical relationship between the different size parameters such as mean size, sorting. The major minerals are ilmenite, sillimanite, rutile, garnet, biotite, pyroxenes.

A. Location-1

- 1) *Berm:* The sediments at this location have heavy mineral concentration of 11.5%. The textural analysis data shows mean value is 1.088(ϕ), which shows the sediments are medium sand type. Sorting value of 0.354(ϕ) indicates well sorted. Skewness value of -0.354(ϕ) indicates high energy and winnowing action (removal of fines). Kurtosis value 1.083(ϕ) indicates the sorting agent was uniform for the entire grain size distribution.
- 2) *High Water Line:* The sediments at this location have heavy mineral concentration of 15.16%. The textural analysis data shows mean value is 1.264(ϕ), which shows the sediments are medium sand type. Sorting value of 0.388(ϕ) indicates well sorted. Skewness value of 0.085(ϕ) indicates symmetrical. Kurtosis value 2.474(ϕ) indicates leptokurtic grain size distribution.
- 3) *Low Water Line:* The sediments at this location have heavy mineral concentration of 4.04%. The textural analysis data shows mean value is 1.003(ϕ), which shows the sediments are medium sand type. Sorting value of 0.489(ϕ) indicates well sorted. Skewness value of -0.059(ϕ) indicates symmetrical. Kurtosis value 1.255(ϕ) indicates leptokurtic grain size distribution.

B. Location-2

- 1) *Berm:* The sediments at this location have heavy mineral concentration of 18.45%. The textural analysis data shows mean value is 1.415 (ϕ), which shows the sediments are medium sand type. Sorting value of 0.537 (ϕ) indicates moderately well sorted. Skewness value of -0.365(ϕ). Kurtosis value 2.052 (ϕ) indicates the very leptokurtic grain size distribution.
- 2) *High Water Line:* The sediments at this location have heavy mineral concentration of 12.5%. The textural analysis data shows mean value is 1.755 (ϕ), which shows the sediments are medium sand type. Sorting value of 0.742 (ϕ) indicates moderately sorted. Skewness value is -0.512 (ϕ). Kurtosis value is 0.578 (ϕ) indicates the platykurtic grain size distribution.
- 3) *Low Water Line:* The sediments at this location have heavy mineral concentration of 3.81%. The textural analysis data shows mean value is 1.244 (ϕ), which shows the sediments are medium sand type. Sorting value of 0.394 (ϕ) indicates well sorted. Skewness value is 0.102 (ϕ). Kurtosis value is 2.253 (ϕ) indicates the leptokurtic grain size distribution.

C. Location-3

- 1) *Berm:* The sediments at this location have heavy mineral concentration of 15.89 %. The textural analysis data shows mean value is 1.586 (ϕ), which shows the sediments are medium sand type. Sorting value is 0.561 (ϕ) indicates moderately well sorted. Skewness value is 0.381 (ϕ) indicates very fine skewed. Kurtosis value is 0.678 (ϕ) indicates the platykurtic grain size distribution.
- 2) *High Water Line:* The sediments at this location have heavy mineral concentration of 18.16 %. The textural analysis data shows mean value is 2.022 (ϕ), which shows the sediments are fine sand type. Sorting value is 0.907 (ϕ) indicates moderately sorted. Skewness value is -0.036 (ϕ) indicates symmetrical. Kurtosis value is 0.667 (ϕ) indicates the platykurtic grain size distribution.

- 3) *Low Water Line*: The sediments at this location have heavy mineral concentration of 5.03%. The textural analysis data shows mean value is 1.364 (phi), which shows the sediments are medium sand type. Sorting value is 0.629 (phi) indicates moderately well sorted. Skewness value is 0.278 (phi) indicates Fine skewed. Kurtosis value is 1.640 (phi) indicates the leptokurtic grain size distribution.

D. Location-4

- 1) *Berm*: The sediments at this location have heavy mineral concentration of 12.8 %. The textural analysis data shows mean value is 1.610 (phi), which shows the sediments are medium sand type. Sorting value is 0.605 (phi) indicates moderately well sorted. Skewness value is 0.490 (phi) indicates very Fine skewed. Kurtosis value is 0.753 (phi) indicates the Platykurtic grain size distribution.
- 2) *High Water Line*: The sediments at this location have heavy mineral concentration of 14.20%. The textural analysis data shows mean value is 0.695 (phi), which shows the sediments are coarse sand type. Sorting value is 0.473 (phi) indicates well sorted. Skewness value is 0.146 (phi) indicates Fine skewed. Kurtosis value is 0.788 (phi) indicates the Platykurtic grain size distribution.
- 3) *Low Water Line*: The sediments at this location have heavy mineral concentration of 7.25 %. The textural analysis data shows mean value is 0.982 (phi), which shows the sediments are coarse sand type. Sorting value is 0.429 (phi) indicates well sorted. Skewness value is -0.342(phi) indicates very coarse skewed. Kurtosis value is 0.857 (phi) indicates the Platykurtic grain size distribution.

IV. DISCUSSION

The grain size study of the Shankumukam beach sediments from different locations have been investigated, the grain size variations of berm, high tide and low tide regions. The sediment samples from various parts the beach indicates that the sediment size is medium sand, well sorted, fine skewed and platykurtic. The sediments of the berm in all four locations were showing medium sand type, Skewness values indicates high energy and winnowing action (removal of fines). Kurtosis values indicates the sorting agent was uniform for the entire grain size distribution. Heavy mineral concentration of berm shows in between 11.5%. and 18.45%. The textural analysis data shows well sorted sediments in the berm. The sediments from high water line shows the heavy mineral concentration between 12%. and 18%. The textural analysis data shows sediments are medium sand type. Sorting value of well sorted. Skewness values observed symmetrical to fine skewed. Kurtosis values of leptokurtic and platykurtic in different locations in the high-water line is showing the sorting of sediments. The sediments of low water line in the four locations of Shankumukam beach shows heavy mineral concentration from 3.8% to 7.25 %. The textural analysis data shows mean value shows the sediments are medium to coarse sand type and sorting indicates well sorted sediments. Skewness value varies from place to place shows symmetrical, fine skewed and coarse skewed. Kurtosis value indicates leptokurtic in three locations and platykurtic in one location.

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