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Distribution and Percentage of Heavy Minerals in Coastal Geomorphologial Landforms in Palk Strait, Southeast Coast of India

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Abstract: Placer mineral are formed as a result of disintegration of heavy minerals as suitable places. The heavy minerals serve as an index for stratigraphic correlation of unfossilferrous strata. The study area extends from Thondi to Manamelkudi in the Palk Strait, Southeast coast of India. A base map was prepared by using the Survey of India's toposheet No. 58 0/1 and 0/2, 58 N/4 and N/8 in scale of 1: 50000. For sieving, ASTM sieves from +18 to +120 mesh sizes were taken in such a way to maintain 1/2 phi interval. Ro- tap sieve shaker were employed for separation. The present study aims to identify the nature and the type of associated heavy minerals in different coastal geomorphological landforms. The highest percentage of heavy minerals shown at R.Pudhupattinam (38.64 %), is ascribed it accurate coast line and lowest percentage of heavy minerals recorded at Thondi 0.86%. The landforms help to infer the various stages of sea level regression and transgression takes place in the study region.

Key words: Heavy mineral · Geomorphology · Distribution · Percentage

INTRODUCTION

Detrital minerals are the secondary minerals, liberated from the pre-existing rocks of igneous, sedimentary and metamorphic origin by the action of various agents. This placer mineral are formed as a result of disintegration of heavy minerals as suitable places. From the nature of specific gravity, inherent inert chemical composition, resistance for transportation, detrital mineral can be divided into two groups' namely light and heavy minerals.

Geomorphology of the coastal landforms consists of three major types such as Aeolian landforms deal with inland sand dunes, while the fluvial landforms pertain to flood plain and the coastal landforms to cusp, beaches coastal dunes, berm, lagoons, ridges, mudflat, mudflat with vegetation, tidal creek and mangroves [1]. Heavy minerals are economically valuable. This mineral serve as an index for stratigraphic correlation of unfossilferrous strata [2]. An initial study has been attempted [3] to relative abundances of heavy minerals to differentiate among the marine, fluviatile and marine- fluviatile realms of depositon in Yaquina Bay, Oregon, United States. Rajamanickam, [4] has defined the Cretaceous-Tertiary boundary of Pondicherry area by heavy mineral assemblages. A study of sediments from the Quaternary landforms around parangipetti, south arcot by [5, 6]. The beach morphology and the inferences from heavy mineral assemblage from mandapam to kanyakumari coast, south east coast of India, [7]. Then the evolution of Quaternary sediments along the coast between Vedaranyam and Rameswaram, [8]. In the present study, the distribution and percentage of heavy mineral and have been used to differentiate the different depositional environment in various coastal geomorphological landforms are being arrived at.

MATERIALS AND METHODS

Base Map: The study area extends from Thondi to Manamelkudi in the Southeast coast of India. The latitude is 9°44' to 10°03'N and longitude is 79°02' to 79°15'E. A base map was prepared by using the Survey of India's toposheet No. 58 0/1 and 0/2, 58 N/4 and N/8 in scale of 1: 50000. Naval hydrographic charts and admiralty charts as a prelude to undertaking this study. The base map thus prepared provide a complete picture of required information's and this serve as launching for undertaking detailed investigations.

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Sampling: The onshore sediment samples of different coastal geomorphological landforms were collected from 2006-2007 with the help of the hand auger to a depth of 1m. Almost care was taken for collecting samples of undisturbed nature. The locations of sediment sample were carefully marked on the survey of India toposheet. The sediment trapped in the core catcher was transferred to polyethylene bags and these bags kept in a cloth bags after labeling. While sampling, special attentions like photographing, additional sampling, etc., after proper labeling, they were brought to laboratory for further analysis.

Pretreatment of Samples: The samples brought from the field were subjected to a constant temperature of 60°C in a hot air oven to remove the moisture. In order to ensure the uniformity of heavy mineral distribution, about 100grams was removed by repeated coning and quartering method, while the remaining samples were kept for further references. Then the samples were washed mechanical stirring, with liberal amount of distilled water and decanted carefully to see that no silt was escaped, until a clear water column was noticed, the process of washing and decantation was repeated. After decantation the samples were kept for drying. The dried samples were weighed and the weight loss noted down as the weight of silt and clay particles.

The 30% by volume of H_2O_2 was added to the sample to remove the organic debris mixed up in the sediments. It was washed with distilled water and dried. After drying it was weighed and loss was encountered for the organic material. The same samples were treated with 1:1 HCl to remove the calcareous materials present in the sediments. After proper washing and drying, the sample was weighed and the weight loss was taken as the weight of carbonates.

Sieving: For sieving, ASTM sieves from +18 to +120 mesh sizes were taken in such a way to maintain 1/2 phi interval. Ro- tap sieve shaker were employed for separation. To maintain a constant timing, the sieve shaker was attached to a timer and every sample was sieved for about 15minutes. The sieved materials were weighed separately. Then the values of all the fractions were weighed properly tabulated and the sands of the respective fractions were kept for further studies.

Heavy Mineral Separation: The sieved fractions of the samples from +18 to +120 mesh were separated into heavy mineral fractions by following procedure mentioned in [2] since the coarser fraction found difficult to pass through the separating funnel, only those fractions (+18 to +120) which can smoothly pass through the separating funnel were taken up for heavy mineral separation by using Bromoform of 2.89 specific gravity. Then the separated heavy fraction were washed with methyl alcohol and then washed with distilled water. The washed fractions were dried under the hot air oven (60°C), until the entire moisture was completely removed. Then the dried fractions were weighed and the values noted down.

RESULTS

Beaches: Beach is a temporary or short lived deposit on the shore. Most of the materials are of sand and slit the waves and tides have played a major role in the shaping of shore line. For example the beach length of Manamelkudi is 12 meter and Avudaiyarpattinam beach length is 30 meters. The beach station includes the Station numbers are 5, 7, 8 and 6. It show a predominantly distribution of heavy mineral percentage. The heavy mineral concentration of Station number 5 is 38.64%, Station number 7 is 23%, Station number 8 is 37.39% and Station number 6 is 19.51% (Table 1 and Fig. 1). The concentration of heavies and an increase this percentage is to the intensive role of winnowing action of waves and currents.

Sand Dunes: A dune consisting of loose sand piled or heaped up by the wind, commonly found along the low-lying seashore above high-tide level, more rarely on the border of large lake or rivers valley, as well as in various exerts regions and generally wherever there is abundant dry surface during some part of the year. The heavy minerals concentration of sand dunes is seen to be low in the Station number 4 is 0.92% (Table: 1 & Fig. 1) It is interesting to note that heavy mineral concentration is kept at minimum level in cases of early formed sand dunes.

Berm: The berm station include the samples are 3, 2 and 1. The heavy mineral concentration of Station number 3 is 0.86%, station number 2 is 8.03% and Station number 1 is 3.94 % (Table 1 and Fig. 1).

Lagoons: Lagoons are water bodies which are surrounded by sands and gets water supply through different inlets (creeks) during high tides. In lagoon heavy mineral concentration is represented by a range of the station number 10 is 7.37% (Table 1 and Fig. 1).

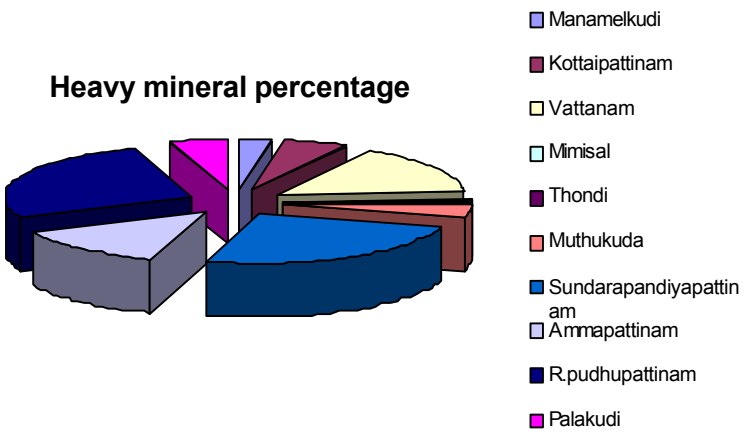

Fig. 1: Showing the Heavy mineral percentage in different stations *Spits*

Table 1: Weight Percentage Distribution of Heavy Minerals in ASTM Mesh Size

Stations and Station Numbers	Land Forms	Medium (g) +50,+60,+70	Fine (g) +80,+100,+120	Very Fine (g) -230	Total Heavy mineral %
Manamelkudi (1)	Berm	0.54	2.17	1.23	3.94
Kottaipattinam (2)	Berm	0.83	1.47	5.73	8.03
Vattanam (7)	Beach	2.12	10.16	10.72	23
Mimisal (4)	Sand dune	0.22	0.48	0.22	0.92
Thondi (3)	Berm	0.15	0.22	0.49	0.86
Muthukuda (9)	Spit	2.49	2.30	0.56	5.35
Sundara pandiyapattinam (8)	Beach	20.53	8.03	8.83	37.39
Ammapattinam (6)	Beach	9.61	8.20	1.70	19.51
R.pudhupattinam (5)	Beach	3.17	14.83	20.64	38.64
Palakudi (10)	Lagoon	3.42	3.78	0.17	7.37

The lower percentage in this region due to lesser influence of detrital input from the fluvial environment Spit is an elongate ridge of sand that project from the land into the mouth of an adjacent Bay. The spit concentration of heavies is represented by about 5.35% in the Station number 9 (Table 1 and Fig. 1). As the spit sediments are fine grained in nature.

DISCUSSION

In the present study region, different coastal geomorphological land forms available have been projected in the geomorphological map. The samples were collected in the different coastal geomorphological land forms like beach, berm, sand dune, spit and lagoon. The distribution of heavy minerals of them is influenced by variety of factors which must be carefully considered .The principle factors such as the source rock composition, mineral shape, specific gravity, size, density as well as stability during weathering, velocity of transporting agents and segregation of heavies [4] has established the source rocks for offshore ilmenite placers through the variations of trace elemental concentration of ilmenite and magnetite, demarcated the boundary of palaeo- placer. Then Hurford, [9] have differentiated sand stone bodies by the age distribution of detrital zircon. Darby, [10] has deduced provenance and sand dispersal pattern by the analysis of trace elements in ilmenite. The marine transgression, taken place in the yellow sea region in china, has been confirmed with characteristic variation of heavy mineral assemblages [11]. Then Udaya Ganesan, [12] has study the detrital minerals from the sediments of vippar basin, Tamil Nadu. Mohan, [8] has described the distribution of heavy minerals in parangipettai beach, Tamil Nadu. Then [7] and [13] analyzed the quantification of heavy minerals in sand samples. Dhana Raju, [14] has carried out potential target of Exploration of heavy minerals The result of the present study is the percentages of heavy minerals, in the beach region have the heavy mineral concentration ranges from 19.51 to 38.64 %. Then the berm regions have the heavy mineral percentages ranges from 0.86 to 8.03 %. Then the sand

dune concentration is 0.92 % and spit have 5.35 % and lagoon have the concentration of heavies is 7.37 %. All the heavy mineral percentage is tabulated in the Table 1 and Fig 1.

Distributions of heavy minerals of the beach stations are sample no 5, 7, 8 and 6. It shows the predominately distribution of heavies ranges from 19.51 to 38.64 % (Table 1 and Fig. 1). The progressive rise of heavies in the region reflects the deposition of winnowed heavies brought by river velar and pamparu. The concentration of heavies and an increase this percentage is to the intensive role of winnowing action of waves and currents. In the beach station have the highest percentage of heavy mineral ranges from 19.51 to 38.64 %. This highest weight percentage of heavy minerals in this area only because of tsunami. So, this tsunami is vulnerable one for this higher percentage.

The berm station include the samples are 3, 2 and 1. The heavy mineral concentration of berm to be varying from 0.86 to 8.03 % (Table 1 and Fig 1). The heavy mineral concentration of sand dune is to be low about 0.92 %. It is interesting to note that heavy mineral concentration is kept at minimum level in cases of early formed sand dunes. The spit concentration of heavy mineral is represented by about 5.35 %. As the spit sediments are fine grained in nature. The poor concentrations of heavies in some stations are early described in Table 1. Primarily to the progradational activity in the area, have shown that the hook- like pattern of spit development at muthukuda is due to sediments deposited by northerly moving long shore currents. In lagoon heavy mineral concentration is represented by a range of 7.37 %. This poor percentage in this region due to lesser influence of detrital input from the fluvial environment.

The present study, exhibits various geomorphic landforms such as beach, berm, sand dune, spit and lagoon. The landforms help to infer the various stages of sea level regression and transgression takes place in the study region. Heavy mineral distribution in different size fractions shows in generated, density segregation from Thondi to manamelkudi. The nature of concentration of heavy mineral is suggestive of the influence of northerly different currents. A poor concentration of heavy mineral percentage in Thondi station has been attributed to large progradational activity and low energy wave condition. A higher concentration of heavy minerals in R.Pudhupattinam, is ascribed it accurate coast line. More over, it also suggests that these minerals are derivatives of common source namely, palaeo-sediments which are reworked and added up in present day river line and marine environment.

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