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5. Seasonal Impact of Beach Morphodynamics on Human at Barshiv Beach along Western Coast of Maharashtra

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Introduction

Changing sea levels all over the world is the major factor of coastal modification. There exist a vast number of studies on this aspect of coastal geomorphology (Carter R.W.G. 1988). Most of these studies describe local and regional variations in mean sea level. The Local and global variations in sea level have a direct bearing on shoreline changes either through its recession or progradation. Three sea level conditions namely rising, falling and stationary, change the shorelines in a specific way. The rising and falling stages are the one of massive sediment release and transport while, stationary stage allows time for adjustment toward equilibrium (Carter R.W.G. 1988). The coastal forms changes in accordance with sediment availability and sea level fluctuations.

Sea level rise leads to coastal erosion, beach migration, in situ drawing and infilling of estuaries and embayments. Each morphological elements responds in a particular way according to its resistance to change and the rate of sea level rise. Falling sea level is responsible for general abandonment of coastal features. Raised coastal landforms dominate each coast. Such landforms are used extensively to reconstruct chronomorphological sequence. The most common result of falling sea level is the development of shore parallel, constant width beach ridge sets. These may be of gravels, sands or shells. Orientation of these ridges may alter through time, reflecting different wave refraction, diffraction patterns due to changing bathymetry as sea level lowers. The progradational shoreline, thus formed is characterized by regressive shoreline sediment sequences, while the essential coastal form is the beach ridge its composition and morphology may vary considerably. It can also give rise to sub ordinate features like aeolian dunes. A dune field pattern may reflect underlying ridge layout or it may form chaotic veneer of sand.

Field Survey, exploration and sediment analysis were done to find the indicators for assessing the impact of sea level regression on small Barshiv beach along the western coast of Maharashtra. Levelling is done with the help of instrument like Dumpy Level that indicates uneven distribution of sediment along the beach during pre-monsoon and post monsoon season. Exposed beach fossil rocks were analyzed to understand the past sedimentary environment, provides some clues of the fluctuation of sea level during geological past. Seasonal variation in proportion of calcium carbonate and clay in sedimentary sequence suggests variations in past waves and tidal environment. Occurrences of lithified dunes and exposure of beach rocks are an important evidences of local regression of sea level along the Konkan coast of Maharashtra.

It has been confirmed (Jelgersma et. al 1970) that thick dune suggests low rates of sea level fall and vice versa. A succession of regressive sand / gravel / shell ridges gives clue to the sequence of falling sea levels. Younger ridges are normally the ridges of fine sands and the older of gravels. In such a regressive sequence, sand overlies the transgressive deposits of holocene or pre-holocene period therefore in a study of any regressive sand body, it is necessary to know its relationship to underlying and overlying sediments and the mechanism of deposition and regression at work on the coast (Curry and Moire). Regressive sand bodies of limited extent are seen at a few places on Maharashtra coast. Although infrequent, their occurrence assumes greater importance especially when Konkan coast is being recently classified as a coast of rising sea level.

This work tries to study the regressive sands and sandy, shelly ridges backing a small stretch of sandy beach at Barshiv and assess its significance in the sea level variations on the said coast. During the recent past, the shoreline has regressed by exposing beach rock and basal rock between high tide and low tide and very small amount of sediment near the beach rock. This area consists of sediment beach rock dune, the sand in turn partially covered.

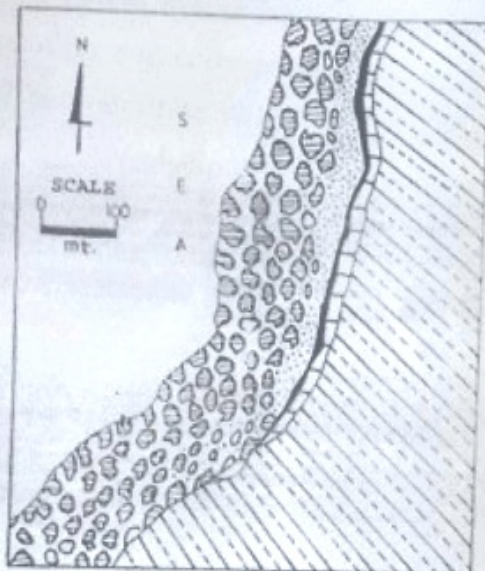
Keywords : Regression, Beach rock, Dune facies, Transgressive deposits, Beach morphodynamics, Wave energy.






Study Area

Beach at Barshiv located in Raigad district on coast of Maharashtra. It is easily approachable from Alibag to the north and Murud to the South. Barshiv is located at $18^{\circ}26'00''$ north latitude and $72^{\circ}55'$ east longitude. The shoreline of Barshiv is look like a platform with small cliff on the southern side of area. The sediment has a patchy appearance and is

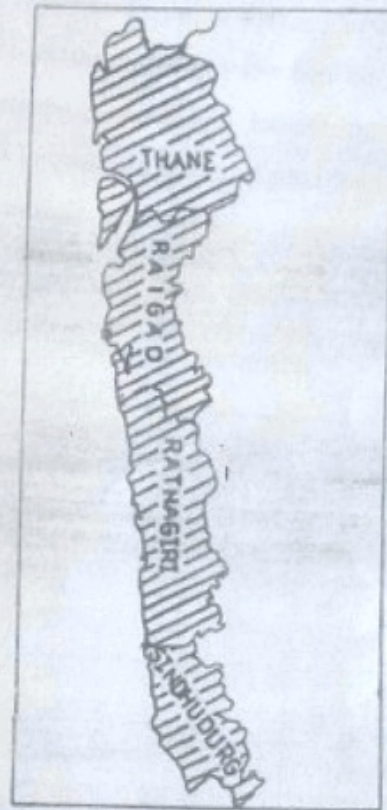
distributed on a limit of the high water mark. This sediment area appears to be narrow beach, where sea-ward side is exposed by basal rock and hence this area not only to be a platform but also a beach. It shows boulders, gravels, coarse sand, calcareous shells are scattered everywhere on the beach or platform. Behind the narrow sediment of fossil beach rock is not likely to be exposed on a prograding shore but also exposed by sub-areal processes. Behind beach rock, old lithified vegetative dune ridge, connected with steep slopes of low coastal ranges. A small seasonal stream that originate from this coastal range and join the beach or platform.

GEOMORPHIC MAP OF STUDY AREA
 (Barshiv Beach)



- | | | | |
|---|-------------------|---|-------------------|
|  | Rocky Platform |  | Sand (Regressive) |
|  | Fossil Beach Rock |  | Dune |
|  | Hill Slope | | |

KONKAN REGION



Methodology

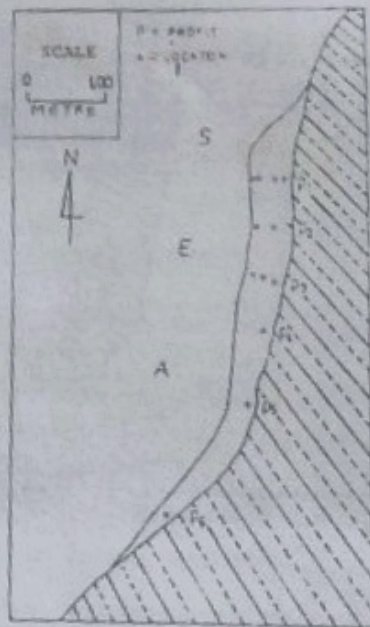
To understand regression of sea level at Barshiv beach the field survey was carried out in September and February, The September observations were treated as representative of monsoon and February observation is representative of post monsoon season in that area. About 13 samples (monsoon) and 22 samples (post monsoon) were collected from this area to study the textural properties of sediment. Sample of beach fossil rocks were taken to understand sedimentology of old beach. To understand the stratigraphy of beach / dune facies six samples

taken at various depth up to a present beach level. To study the nature of sediments of deposits on the beach. This sort of study therefore, requires actual levelling of beach by using a leveling instrument like a dumpy level in at least two different seasons. Finally identify the sedimentary sequence on level of fluctuation through geomorphological sedimentological clues. Geomorphologic were prepared for the Barshiv beach.

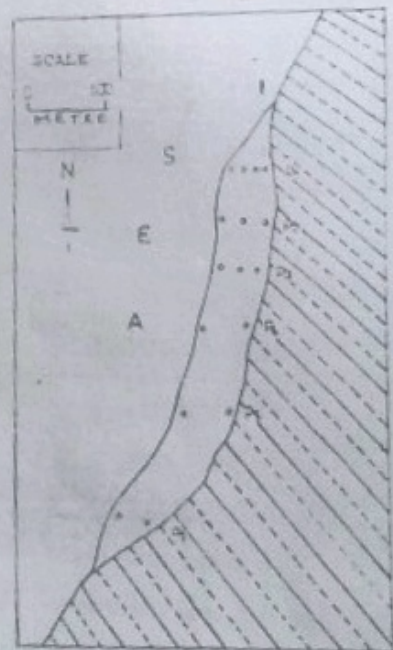
Beach Profile : The study of beach morpho- dynamics is mainly a study of changing beach profile in storm and fair weather seasons. The transportation and deposition of sediment on the beach is an important process to determine the overall morphology of beach. The force which moves sediment on beach is provided by water depends on two factors namely velocity and viscosity of moving water. Thus, morphology of any specific beach is basically a result of any factors including its sedimentology. A clear understanding of coastal processes in nearshore areas and the study of sediment is an important aspect of morphodynamics of beach.

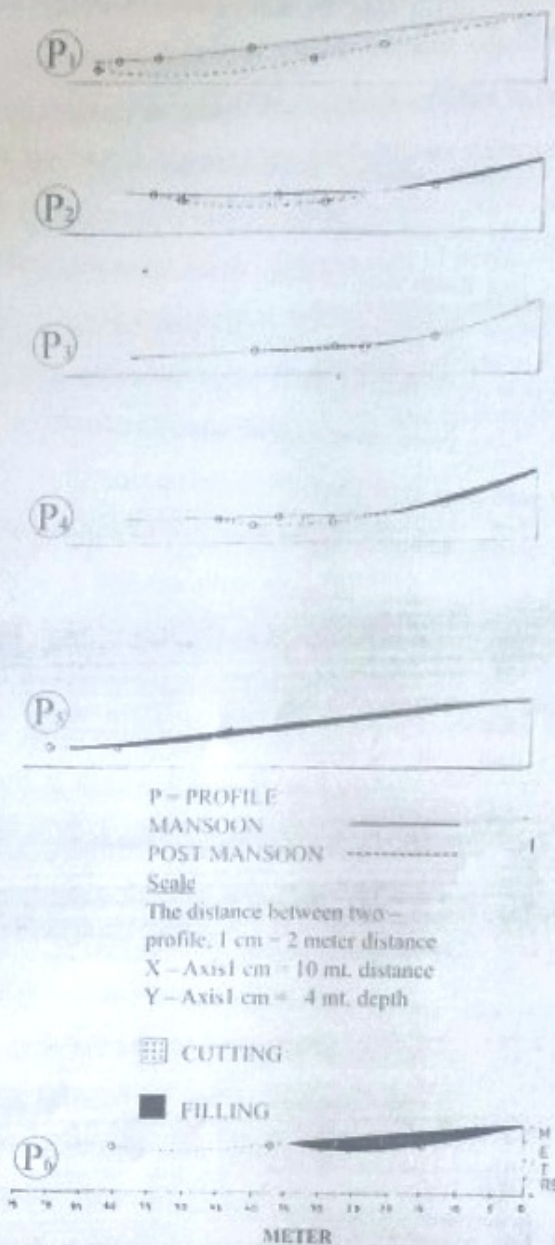
Seasonal Variation in Beach Morphology

MAP SHOWING SAMPLES IN MONSOON SEASON



MAP SHOWING SAMPLES IN POST MONSOON SEASON





On Barshiv beach, there is no seasonal variation in amount of sediment only redistribution of sediment takes place in post monsoon season. Cutting activity is dominant towards northern side of beach. The slope of beach is slightly increases toward north but no change towards the southern side. A comparison between monsoon and post monsoon season, the sediment on P₁ is completely removed in post monsoon season. On P₂ seaward side is cut and small patch of deposition is seen. The P₃ is more or less similar in both seasons. On P₄ deposition

place on landward side and erosion on seaward side. P_5 and P_6 are completely filled by silt and clay.

Sedimentary Environment on Beach

On the Barshiv beach, sediment samples collected in both season (monsoon and post monsoon). These samples were mechanically sieved to get proportion of particles in different size groups. From this major parameters like mean size, Sorting index, skewness and kurtosis were determined.

The sedimentology of any beach is governed by tidal range and wave energy. Other factors like topography, slope of beach, long shore currents and swash / backwash effect. The values of median shows energy level in particular area. Deposition and transportation of particles depends on wave energy. Higher wave energy transport larger grain size particle and lower wave energy transport small grain size particle. The values of mean sediment size give better result about seasonal variation in grain size distribution.

In monsoon season northern side of beach (P_1, P_2, P_3, P_4) indicates low wave energy near landward side and high wave energy near seaward side. Because of this coarser to medium sediment locates at the landward side and very coarser to granule deposited at seaward side. Southern side of beach (P_5 & P_6) indicates high wave energy landward as well as seaward side and distributed very coarse to granule material on both sides.

In post monsoon season, northern side of beach (P_1, P_2, P_3, P_4) granule to very coarser sediment toward land, because of high wave energy and coarser to medium size material toward sea, due to low wave energy. Toward southern side of beach (P_5 & P_6) indicates very coarser sediment toward landward as well as seaward sides, because of high wave energy.

- **Seasonal Change in Grain Size :** The change in grain size only on the northern side of the beach. Landward side shows low wave energy in monsoon and high wave energy in post monsoon season. Seaward side shows high wave energy in monsoon and low wave energy in post monsoon season. In both seasons southern area indicates high wave energy. There is clear cut sequence about skewness, most of the sample near seaward side negatively skewed and near landward side positively skewed. The wave approach in both season from south-west due to coarseness increases toward northern side of beach. The supply of very coarser to coarser size particle has dominated on the beach.

Very coarser material is deposited near southern side of beach near landward and coarser to medium size deposited toward northern side of beach.

- **Seasonal Variations in Clay:** The amount of clay is separated by wet sieving and filtration methods. The percentage of clay shows variation in proportion and unevenly distributed through the beach in both season. Amount of clay increases in post monsoon. In both season on the northern side of beach clay is maximum. The trend of clay decreases toward sea in both season, but in post monsoon season, profile number one and two shows increasing trend. In monsoon season, the maximum 8% near P_1 and minimum below one percent near P_3 & P_2 . And in post monsoon season, the maximum 9% near & 7% near P_2 and minimum below one percent near P_3 .
- **Seasonal Variation in Calcium Carbonate :** The amount of Calcium Carbonate also shows variation in proportion and unevenly distributed through the beach in both season. Monsoon season shows more amount of Calcium Carbonate towards northern side of beach. This trend of Calcium Carbonate shows decreasing seaward. But no southern side profile number shows seaward increasing trend. In monsoon season, the maximum Calcium Carbonate present near P_1 (seaward) and minimum is 30% near P_3 (landward). In post monsoon season, the maximum Calcium Carbonate 75% on P_1 and minimum 25% on P_6 . The Calcium Carbonate is main constitute sediment on beach profile.

Thus, the sequence is representative of different episodes of deposition of fine to coarse shelly, sandy material. Increase in Clay depth wise mean that the lower section material was deposited in the ancient tidal and wave environment. Middle section of coarse to medium sand suggests the environment of swash / back wash deposition. The material on the top seems to have a complex origin. It is mixture of wave and wind depositions and probably suggests a fluctuation in sea level in the study area.

Conclusions

Sediments over the beach are not well graded. The wave approach in area in both seasons is Southwesterly. Near southern side (headland area) shows coarse sediment. The mean size of sediment indicates coarser to medium sediment locates at the landward side and very coarser to granule deposited at seaward side. The pattern of sediment deposition is complex and creates a lot of problems to interpret sorting index, skewness and kurtosis. There is seasonal variation in

amount of sediment only and redistribution take place. There is no definite relationship between Calcium Carbonate and Clay on the beach. The dune on the back of beach is lithified with high amount of Calcium Carbonate. Both Clay and Calcium carbonate increases at depth-wise. The tal sand on younger and regressive the beach is coarse indicating that it is.

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