Pakistan J.Sci. Ind. Res., Vol. 26, No. 2, April 1983

DISTRIBUTION OF SEA BED MATERIAL ALONG THE COASTAL AREA OF KARACHI DURING THE SOUTH-WEST MONSOON

S.M.A. Tirmizi and Ziauddin Ahmed

Department of Physics, University of Karachi, Karachi

(Received March 27, 1982)

Waves breaking at an angle with the shoreline set up a longshore current, which is capable of carrying large amounts of sediment. If the flow of sediment is impeded, the equilibrium of the beach is disturbed and silting or eroding will follow. The distribution of sea-bed material during south-west monsoon (April to September) have been studied by collecting weekly samples at six stations along the belt from cape Monze to Manora Break Water. The study reveals that wave energy is enough to erode and move the sand along the coast.

INTRODUCTION

It is an immediate experience that wind, blowing on a flat, calm sea produces waves. The most significant change in surface waves takes place as waves enter shallow water and approach the coast. If a long crested wave approaches obliquely a beach, different points of the crest will experience different depths and hence difference phase velocity. The wave is therefore forced to turn from its original direction, moving usually almost perpendicularly to the shore. During the approach the kinematics of a wave varies, but the overall energy must remain the same. The result is first a decrease, then an increase of its height, that ends up as surf on the beach [1]. In the process of wave breaking littoral drift or a longshore current is induced which moves between breakers and the shore line and is capable of carrying large amounts of sediment. The velocity is a direct function of breaker height and wave angle [2].

Shore erosion arises when more material is eroded than deposited. Usually there are two types of erosion, natural erosion due to storm, tides and rise in the sea level and man made erosion resulting from improperly designed and incorrectly located coastal structures. Natrual erosion is usually a very slow process mainly due to littoral currents. Sometimes this process may be accelerated by sudden storms. Man made erosion is caused by man's interference such as dredging or construction of jetties and coastal protection which blocks the natural movement of sediments along the shore.

Predominent waves in Karachi and vicinity during south-west monsoon (April to September) are from south-west having a long fetch over the Arabian Sea. Consequently waves are built to a height of 2-3 metres. They generally approach the coast at an angle that gives a large component of longshore currnet in the direction of Manora Break Water.

Photographs of sea state during monsoon and pre-monsoon periods indicate greater waves activity during the former period.

DATA COLLECTION AND ANALYSIS

Present study has been confined to a belt stretching over 25 k.m. from Cape Monze to Manora Breaks Waters (Fig. 1). Six stations have been established along the belt and they serve as reference points for repeated oceanographic observations. The area of sampling is rocky at some places but the greater part is sandy coast. Near station 2 & 3 the coast is rocky with sporadic sandy beaches, while at the remaining stations viz 4,5,6 & 7 it is predominantly sandy. The depth contours indicate a comparatively sharp slope at stations 2 & 3 in comparison to the other stations. The breaking zone may be larger at Sandspit resulting in a greater transport of bed material. The distribution of sea bed material under the action of intense monsoon waves and associated currents have been studied by collecting weekly samples from area of Back Shore, Intertidal and Off Shore, at all the stations. The observations also include wind speed, air temperature, height and location of monsoon berms etc and the analysis of this data will appear in a subsequent paper.

The laboratory analysis was carried out by seiving these samples and quantity of suspended load and its variations were determined. The results of seiving were grouped into fine sand (diameter < 0.125 mm), medium sand (diameter 0.125 to 1.00 mm) and coarse sand diameter > 1 m.m.). Multiplie bar diagrams were then constructed for all the

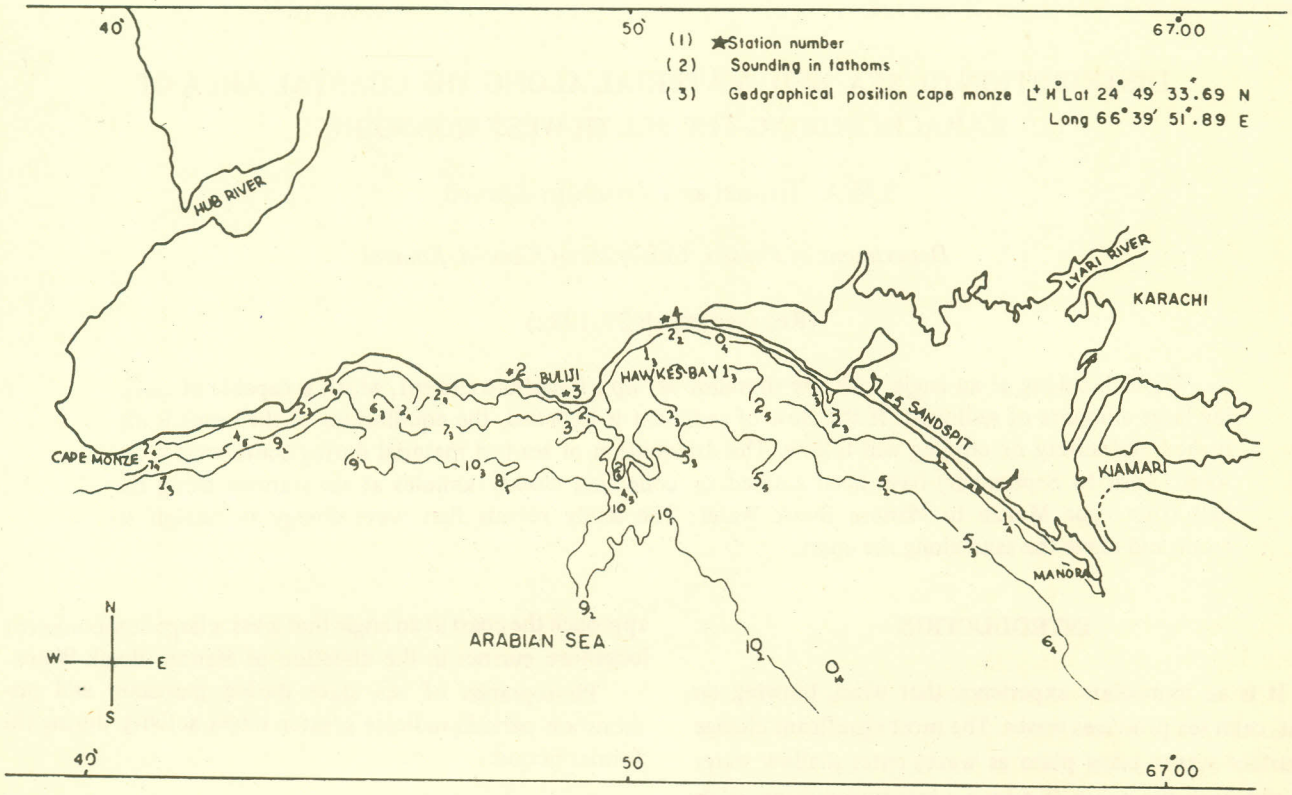

Fig. 1. Sea belt from Cape Monze to Manora Breaks Water.

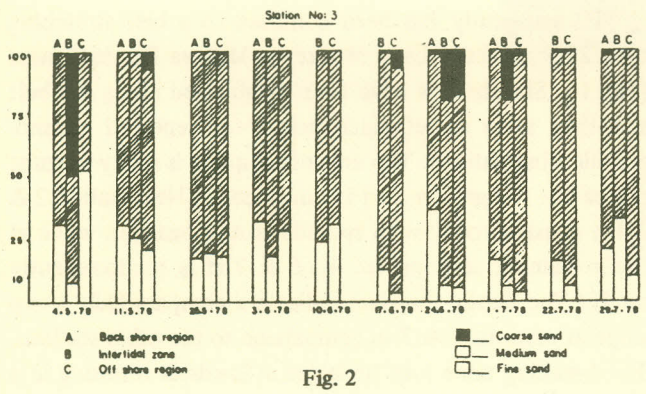

Fig. 2

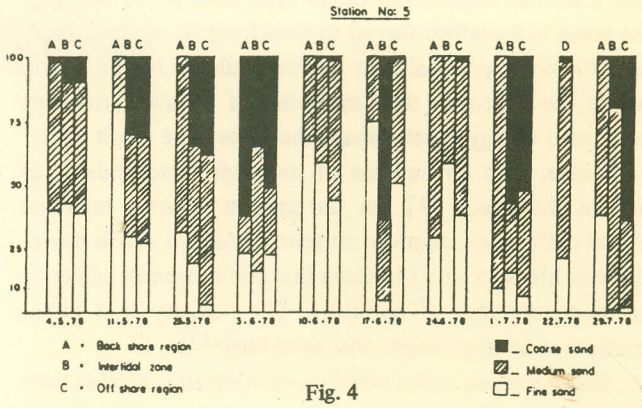

Fig. 4

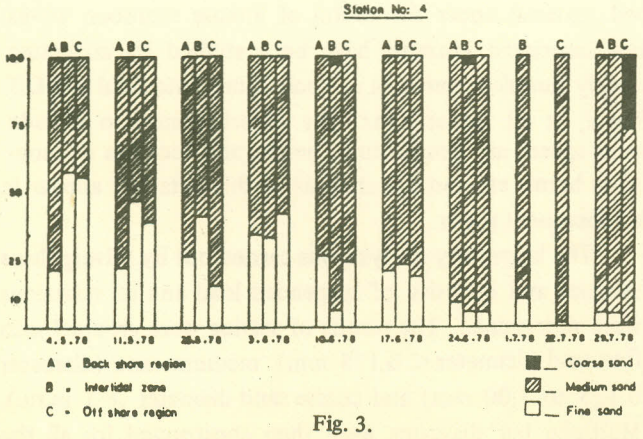

Fig. 3.

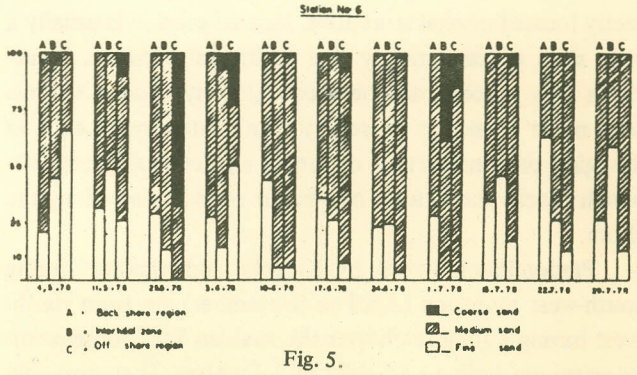

Fig. 5.

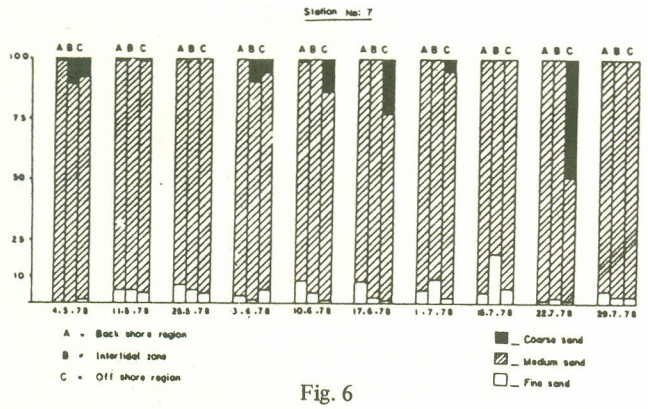

Fig. 6

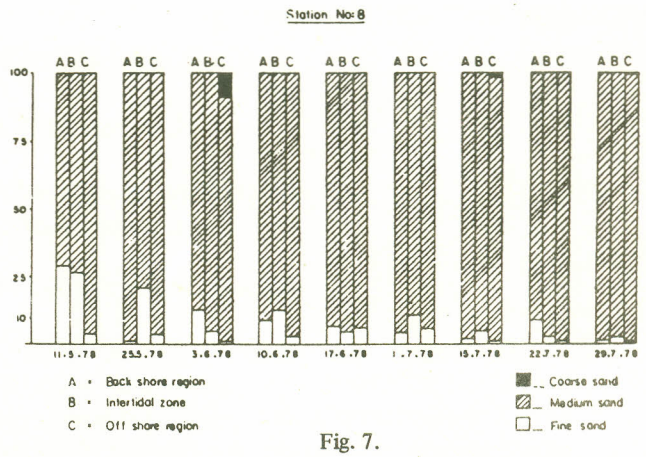

Fig. 7.

stations and are shown in Figs. 3 to 8. From the bar diagrams it is clear that the quantity of fine sand is comparatively higher in all regions at stations 4 & 5. This higher percentage of fine sand may be indicative of the fact that these station are situated in a sheltered area at the centre of Hawks Bay and the wave energy is spread along the arc of the Bay, providing a settling time for fine sand.

Medium sand is the most predominent grain size along this belt. The percentage of medium sand is observed to be higher at backshore, intertidal and off shore regions at station 6 & 7.

As the medium sand increases with the progress of monsoon, it appears that the wave energy during this period is enough to move the medium sand and deposit along the coast.

the percentage of coarse sand is found to be low except at station 4. However there are certain anomalies. The higher percentage of coarse sand at this station may be due to erosion of sand stone at Buleji.

CONCLUSION

The study shows that medium sand is the predominant grant size in this area. The medium sand increases with the progress of monsoon indicating that wave energy during this period is enough to move it along the shore.

The percentage of the sand is h igher at station 4 & 5. This is because of the fact that these stations are in a sheltered region and the wave energy is spread along the arc of the Bay, providing a settling time for the fine sand.

Acknowledgements: This research was sponsored by the Pakistan Science Foundation under project S-KU/Ocean (4). We wish to thank Dr. FAzal Ahmed, Chairman of Applied Physics Department, University of Karachi for reviewing the manuscript and making many useful suggestions and also to Comd. (Redt). Dr. G.S. Quraishee for useful advices throughout this study.

REFERENCES

1. J.W. Johnson, *Dynamics of the Near Shore Sediment Movement;* Am.Assoc.Petroleum Geologists, Bull **40**, 2211 (1956).
2. J.A. Puntnam and M.A. Traylor, *The Prediction of Long Shore Currents;* Am.Geophysics, Union Trans., **30**, 337 (1945).