

CHAPTER 45

STUDY OF MUDBANKS ALONG THE SOUTHWEST COAST OF INDIA

by N.S.MONI **

ABSTRACT

The formation and behaviour of 'Mud Banks' is a phenomenon peculiar to the Southwest Coast of India. They are unique in their formation as well as functions. The paper deals with the history of mudbanks, their locations, causes of their formation, the nature of material and their sources. The behaviour of the mudbanks and their influence on the stability of the coast is also reported. The mudbanks act as storehouses of littoral material. It is also the initiator of erosion on its downdrift areas. It is noted that the material stored in the mudbanks must be advantageously utilised in stabilising the shores adjacent to it and for reclamation. Of extreme importance is the recognition that mudbanks are closely associated with the stability of the Southwest Coast of India and is a factor to be reckoned in any programme of coastal development or protection in this area.

INTRODUCTION

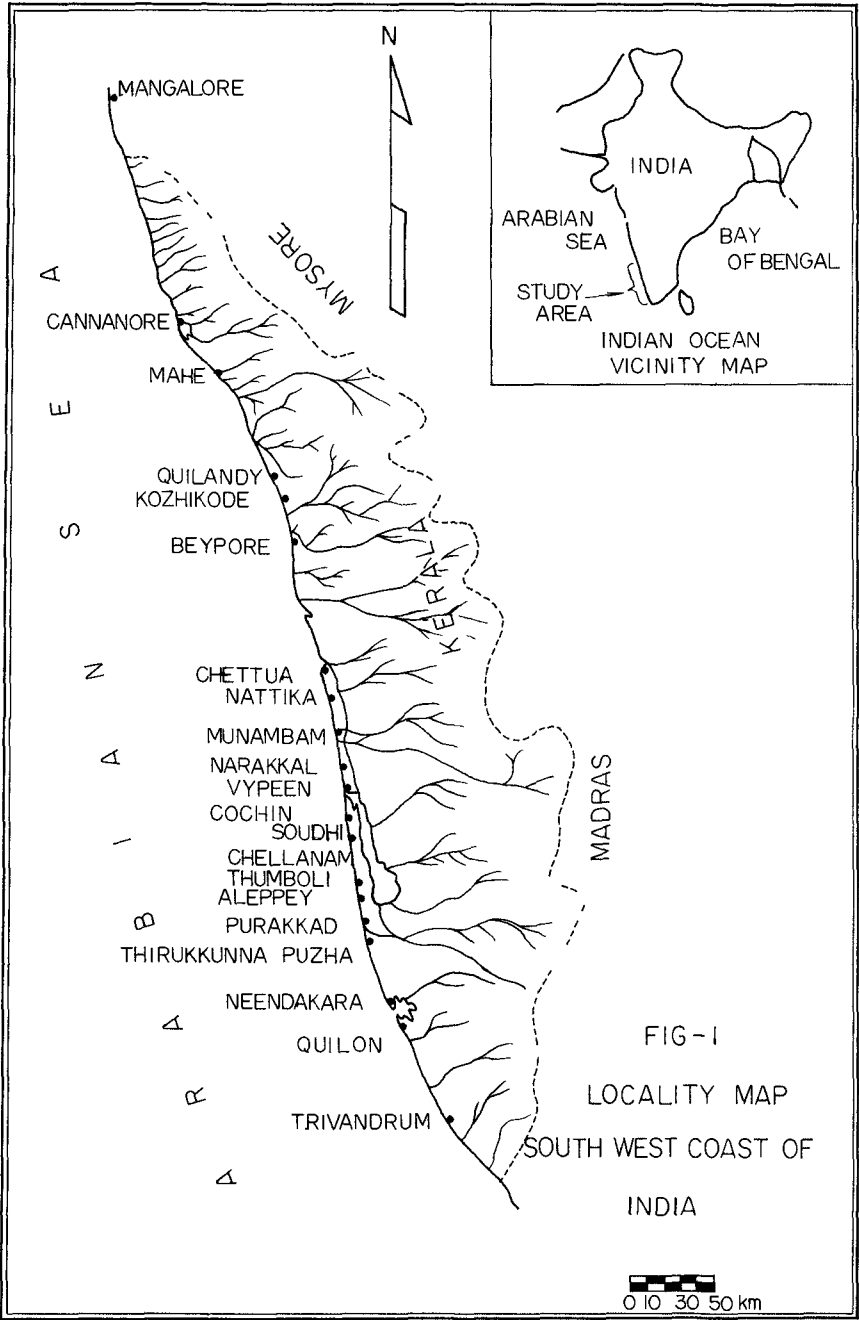
In the Southwest Coast of India, certain inshore areas have a special property of dampening wave action and producing regions of calm water even during the rough monsoon season due to the dissipation of wave energy in the large quantity of colloidal suspension in the region. These regions are generally known as the 'Mud Banks'. They are unique in their formation as well as functions. The mudbanks form part of the sediment activity along the coast. They directly influence the equilibrium conditions of shore in its vicinity. The mudbank regions are considered to be a 'boon' by the local populace as these areas which are calm during the monsoons abound in Prawns, Sardines, Mackerels and Soles.

LOCATION

There are four well known mudbanks along the Southwest Coast of India- one near Cochin, one near Alleppey and two near Kozhikode.

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Historical records relating to the mudbanks at Cochin and at Alleppey are available from 1840. Of these four, three mudbanks are either at or near the outlets of rivers and lagoons while the fourth one at Alleppey is not anywhere near an outlet. There are other mudbanks which are known to have existed during the past twenty years. They are located at:-

Mahe (South of Mahe river outlet)
 Beypore (South of Beypore river outlet)
 Nattika (South of Chettua outlet)
 Munambam (South of Periyar river outlet)
 Soudha (South of Cochin outlet)
 Thumboli (North Of Alleppey)
 Thrikkunnappuzha (South of Thottapalli Artificial Cut)

The study area of 560 km and the location of the mudbanks are given in Figure 1

HISTORY OF MUDBANKS

The earliest known record of the existence of mudbanks dates as far back as 1678, in Pinkerton's 'Collections of voyages and travels' given in the Administration Report of 1860 of Travancore (India). Dr. King, of the Geological Survey Of India in his report 'Considerations on the Smooth water anchorages or mudbanks of Narakkal (Cochin) and Alleppey on the Travancore Coast' (1881) has given an account of the migration and formation of the two mudbanks. According to his report, the range of migration of the Alleppey mudbank is twentyfour km between Alleppey and Purakkad and that of the Cochin mudbank is twenty km between Narakkal and Cochin. An organised attempt to study the mudbanks was made by Sir R.C. Bristow, and these are detailed in his books 'History of Malabar Mudbanks', 1938 Vol. I and Vol. II. This throws light on the origin, formation and other features of the mudbanks. The historical data of the Cochin and Alleppey mudbanks are given in Figures 2A and 2B.

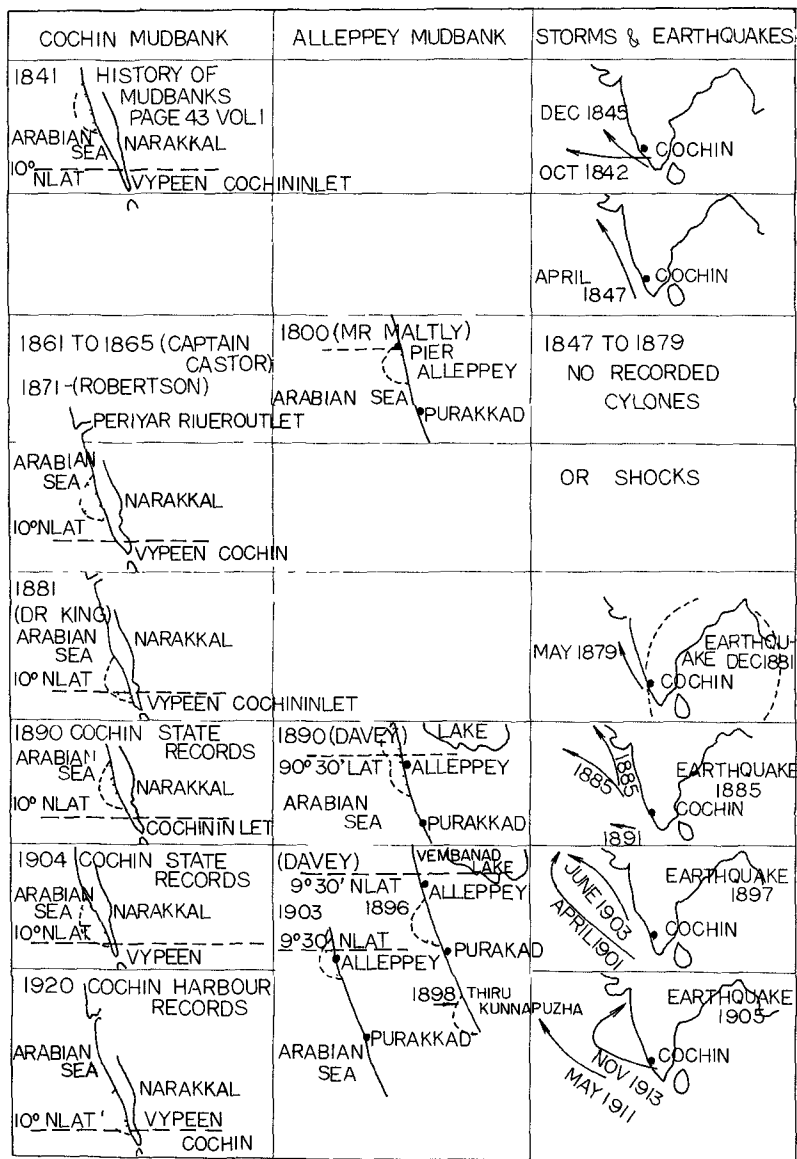
Cochin Mudbank

The record of history of this mudbank is available from 1841. No perceptible change was reported between 1841 and 1861. From 1861 to 1881 it has moved southwards for 15 km. In 1890 the mudbank was located north. Till 1924 the movement was gradual towards south. In 1937, it crossed the Cochin approach channel and caused considerable silting. It moved further south. Between 1950 and 1968 the mudbank was located both in the north and south of the Cochin outlet.

Alleppey Mudbank

This mudbank was first reported in 1678. Again it was located in the same region in 1725. In 1827 it was reported 24 km south. In 1860 and in 1890 it was located near the Alleppey Pier (northern limit). In 1896 it was 10 km south and in 1902, 25 km south. In 1924 to 1928 it was located at the Alleppey Pier. Then onwards it was moving to the south. In 1937 it was 8 km to the south of the Pier. From 1950 to 1968 it was located between 8 to 16 km south of the Alleppey Pier.

FIG- 2A
HISTORY OF MUDBANKS

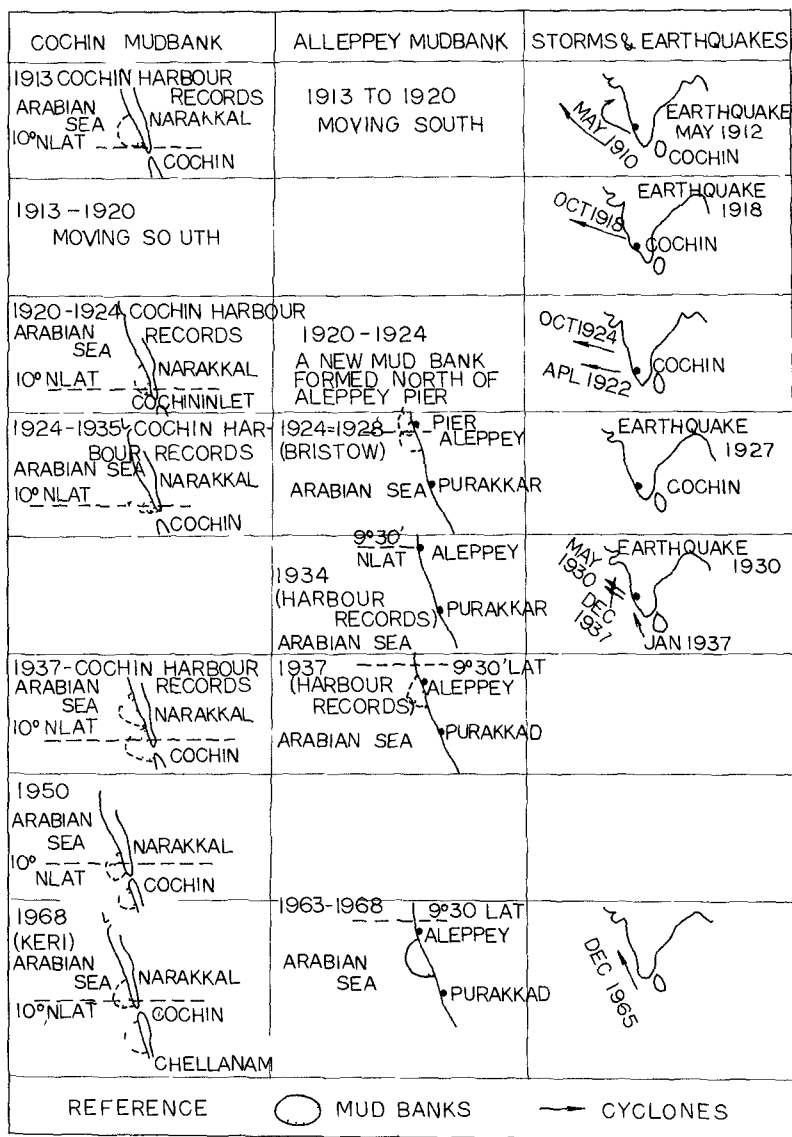


REFERENCE

○ MUD BANKS

→ CYLONES

FIG - 2B
HISTORY OF MUDBANKS



PHYSICAL FACTORS AND LITTORAL MOVEMENTS

The physical factors, shore effects and littoral drift have bearing on the mudbanks and are detailed below.

Winds, Waves and Tides

The data was developed from the daily weather charts of the Indian Meteorological Department. The predominant direction of the prevailing winds along the shore is from west and northwest during May to September (monsoon season). From the wave rose diagrams it is observed that during the monsoon season, the predominant direction of waves is from west and those from northwest are contributory factors during July, August and September. The largest computed waves were between 5m and 6m in height. The mean wave height can be taken as 1.8m with a period of 8 to 10 seconds. The tides are semidiurnal and vary with a mean range of 0.8m at the south end to 1.8m at the northern limit. Storm tides occur all along the coast during the monsoon.

Offshore and Foreshore Zones

The continental shelf of this coast has a gradual slope upto 10 fathoms after which there is a steep fall. The distance of the 100 fathom line from the shore varies from 82km at the north to 45km at the south. In general the foreshore has a slope of 1 on 5 to 1 on 10 above LW with flatter underwater slopes. The foreshore slope in the mudbank regions are flatter compared to those on the adjacent sides. A typical example is given in Figure 3.

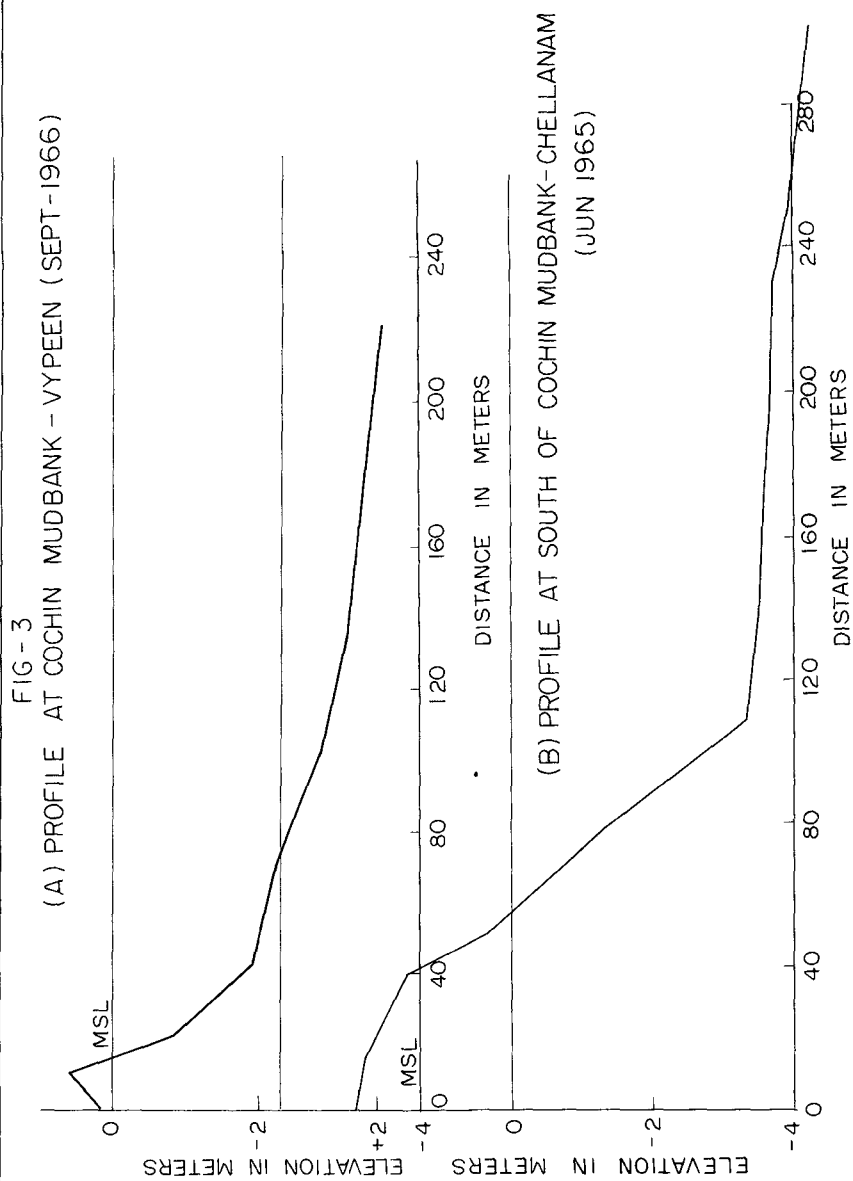
Field observations at selected reaches in the coast indicate that there are seasonal changes in the beaches. Erosion is experienced from April to September, after which the beach begins to accrete. The berm crest in certain cases fluctuates within wide limits - even upto 70m in a season.

Littoral Drift

Littoral drift varies with the seasons of the year but is predominantly from north to south. This predominance is evident from the analysis of wave data, evidence from headlands and bays, migration of spits and inlets and observations of groins and jetties.

NATURE, FORMATION AND ORIGIN OF MUDBANKS

Geologically the Southwest Coast of India is of recent age, its formation dating back to the early Tertiary period. Borings at Cochin show that there are deposits of alluvial material for 100m to 125m overlying rock. It is noticeable that the portion of the coast from Kozhikode to Trivandrum where the mudbanks are confined is coincident with the presence of alluvial belt backed by laterite deposits at no long distance from the coast. The general distribution of sediments in the continental shelf of this coast indicate that



the inner shelf (upto 20 fathoms) consists of greenish black, poorly sorted clayeys and clayey silts and the outer shelf (20 fathoms) to 100 fathoms) consists of well sorted fine and medium sand with abundant shell fragments.

Analysis of samples from the seabed in the mudbank region reveal the following. They are greenish black and deep slaty in colour and cohesive and plastic to touch. Granulometric analysis indicate that it consists predominantly of silt and clay fractions, with less than 5% of fine sand. (Figure 4) The heavy mineral fraction average 2%. The samples taken at the top of the bed reveal that the top layer of the bottom mud is in a state of liquidity.

Samples from the sea bottom upto 10m adjacent to the mudbanks and also from the inland backwaters were analysed and compared with the mudbank samples. The samples from the mudbanks and from the adjacent sea bed showed close resemblance and similar characteristics. The granulometric analysis of samples taken from inland backwaters and mudbanks also showed similar characteristics.

The mudbanks are situated near and not too distant from the river outlets except in the case of Alleppey mudbank which is separated from the Vembanad backwater by a narrow strip of alluvial belt.

The analysis suggests that the origin of the material in the mudbanks is from the deposits of laterite and alluvial formation of the interior brought by the rivers.

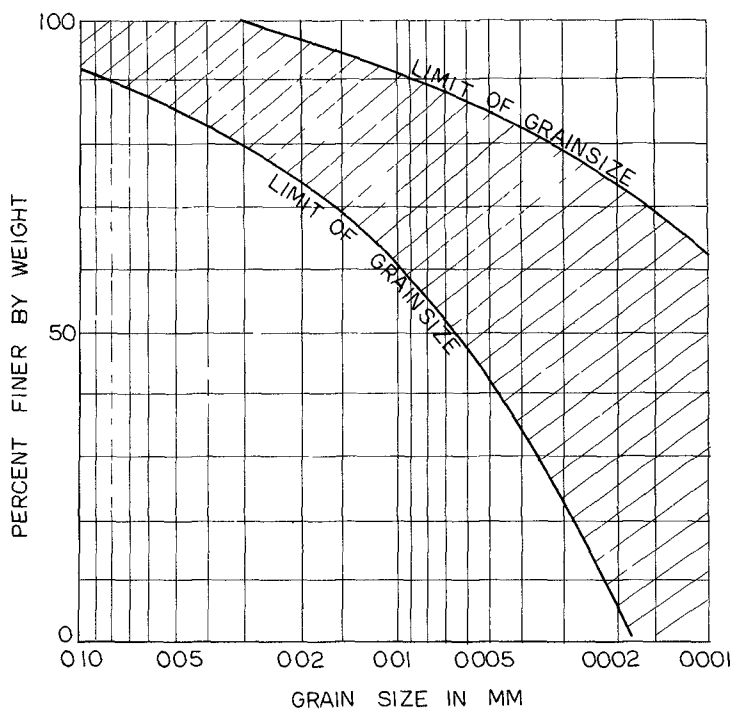
The mudbanks are formed by a single or a combination of the undermentioned causes:

- i) By the gradual deposition of clay and silt brought by the rivers during the monsoon season
- ii) By the throwing up of the already existing mud in the seabed by the waves
- iii) Their exists a waterbearing strata along the coast. The appearance of the mudbanks is coincident when the water level in the backwaters adjacent to the coast is high. When the water level rises in the backwaters during the monsoon, it is likely that silt and clay may be thrown up through the waterbearing strata connecting the backwater and sea.

It is interesting to note that the effect of the mudbanks are felt about a week after the beginning of the monsoon. The rivers and backwater systems discharge large quantities flood discharge and sediments into the sea through the numerous perennial and seasonal outlets and by seepage through barrier beaches separating the backwaters from the sea. Further the sea bed is agitated by the action of the waves and the material is thrown in suspension. The monsoon swells provide a continuous source of energy to maintain the colloidal suspension which alternately dampen the waves progressively and finally the sea becomes completely calm within the area.

BEHAVIOUR OF MUDBANKS

Observation of the Cochin and Alleppey mudbanks indicate that they change in shape and size with the seasons. The length along the coast varies from 6km to 10km and the width upto 8km. By tracking the



ENVELOPE OF GRAINSIZE CURVES
OF COCHIN MUD BANK
SAMPLES

FIG 4

mudbanks it is noted that they migrate with the seasons, but the predominant direction of movement is towards south (during June-July). These confirm the findings of the earlier observations taken in 1937-1938. It is also noted that the migration of the mudbanks conform to a cyclic pattern similar to those of the uncontrolled inlets in this coast.

MUDBANKS AND SHORE STABILITY

The effect of the mudbanks on the equilibrium conditions of the coast adjacent to it was studied with particular reference to the Cochin and Alleppey mudbanks. The shore sectors located south of the two mudbanks are subjected to progressive shore recession. An examination of historical evidence and field observations indicates that the mudbanks provide the key to the shore stability in these two sectors.

Mudbanks affect the coastal processes in the following ways

- 1) Traps the littoral material from the updrift side and thereby prevents its downcoast movement
- 11) Causes refraction of waves on its sides
- 111) Causes accretion within the mudbank area

Trapping of littoral material

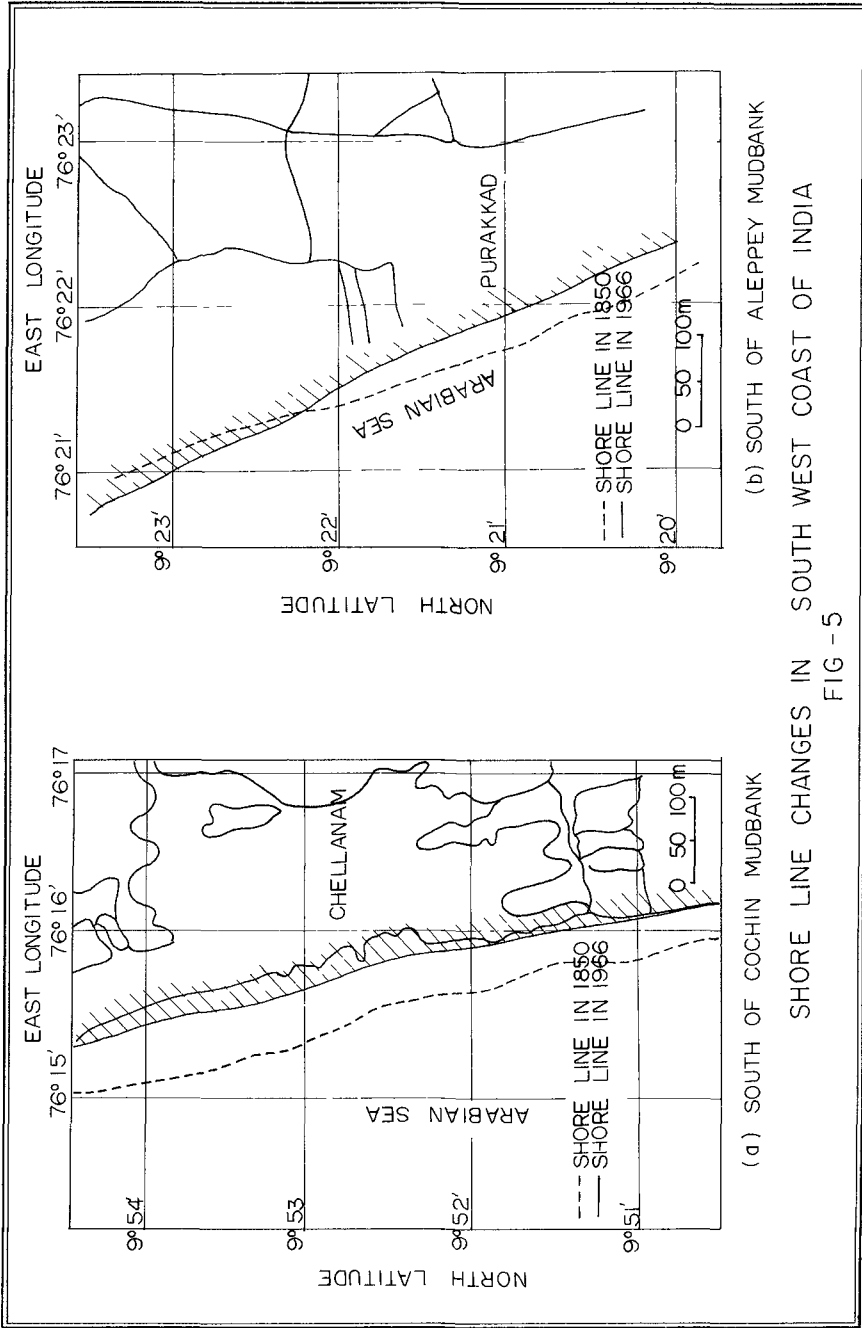
As the littoral material transported by the alongshore movement reaches the mudbank, its further movement is arrested as a result of the damping of the waves. Hence the in the immediate downdrift is starved of littoral supply and the coast is eroded to make up for the deficiency. Comparison surveys prepared from authentic maps indicate that there is consistent retrogression of shoreline, especially in the zones south of the Alleppey and Cochin mudbanks. The shorelines had receded 360m during the past 120 years south of the Alleppey mudbank and 600m during the same period south of the Cochin mudbank (Refer Figure 5).

Refraction of waves on the sides of the mudbank

The mudbank acts as a long, wide breakwater. As the waves approach the mudbank, they tend to refract. The refracted waves turn towards the mudbank on its leeside causing a reversal in the general direction of the drift from a nodal zone in the downcoast and causes movement of material towards the mudbank from its lesside. Observations confirm this phenomenon. This aggravates the eroding tendency on the downcoast sides.

Accretion within the mudbank

Within the mudbank, littoral material accumulates, thereby accreting the shore within it. Absence of waves preclude littoral movement through the mudbank and hence materials once trapped within it is prevented from moving out. The mudbank acts as a storehouse of littoral material. There is progressive growth of headland. The shoreline has advanced by 1250m during the past 50 years in the Cochin zone and by 500m during the past 15 years in the Alleppey zone.



EVALUATION

Mudbanks have the special property of dampening wave action and producing areas of calm water even during the roughest monsoon season. They decisively influence the shore processes and are effectively disturbing the equilibrium conditions of the coast adjacent to them. They are acting as storehouses of littoral material. The material stored in the mudbanks must be advantageously utilised in stabilising the eroding shores on its downdrift side and for reclamation by a coordinated programme. Of extreme importance is the recognition that mudbanks are closely associated with the stability of the southwest coast of India and is a factor to be studied further and reckoned in any programme of coastal development or protection in this area.

REFERENCES

1. Bristow, R.C., 'The History of Malabar MudBank', Vol. I, Cochin Port Trust., 1938.
2. Bristow, R.C., 'The History of Malabar Mudbank', Vol. II, Cochin Port Trust., 1938.
3. Joglekar, D.V., Gole, C.V., Mulekar, S.N., 'Studies on siltation of Cochin Port', Proceedings of XIX International Navigation Congress., 1957.
4. Kerala Engineering Research Institute, 'Annual Report', 1964.
5. Damodaran, R., Hridayanadhan, C., 'Studies of the MudBanks of the Kerala Coast', Symposium on Coastal and Nearshore Oceanography, C.S.I.R., 1966.
6. Moni, N.S., Nambiar, K.K.M., 'Study of seasonal variations in the Beaches of the Kerala State', Irrigation and Power Journal, Vol. 24 No. 2, 1966.
7. Richard T. Russel, 'Rivers, Plains, and Sea Coasts', University of California Press, Berkeley., 1967.
8. Moni, N.S., George, M.M., Nambiar, K.K.N., 'Study of Beach Profiles in & near the Surf Zone of the Kerala Coast taken using Sled', Thirtyeighth Annual Research Session of C.B.I.P., 1968.
9. Kerala Engineering Research Institute, 'Studies on Coastal Erosion', (Internal Report), 1969.