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# The Mud Banks of the West Coast of India

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The periodic formation of mud banks along the southern section of the West Coast of India between Cannanore in the north, and Neendakara near Quilon in the south is a most interesting phenomenon the like of which has not been reported from anywhere else. This takes place with cyclic regularity in the inshore areas during the South West Monsoon reducing considerably the wave action in the sea on an otherwise surf-ridden coast. The areas where such mud banks are formed provide safe anchorage for ships and facilitate fishing operations also and are therefore welcomed by the coastal people who depend on the sea for their livelihood. As the richest prawn fishing grounds in the country are located within the same region, the mud banks are of great interest from the economic as well as scientific points of view. Not much work appears to have been done on them since the extensive observations made in the thirties of this century by late R. C. Bristow, the architect of Cochin harbour whose reports are still the most important contributions on the subject.

The most important and well known mud banks are at Narakkal just north of Cochin, off Alleppy and two smaller banks at or near Calicut. The bank at Narakkal is usually situated at the mouth of the Periyar river and extends about 3 miles along the shore from south to north and 4½ miles out to the sea. The mud banks at or near Calicut as well as that at Alleppey are mobile in nature. In addition to the above four, the mud bank formation occurs at Quilandy, at Beypore, at Veliyangod, at Munambam, off Cochin south of the harbour entrance, near Chellanam and near Alleppey. These mud banks are often of an ephemeral nature appearing during some years and absent at other times.

With the commencement of the monsoon, when upwelling takes place, the bottom mud gets stirred up. During this process, there is the same surf as in other parts of the sea shore and the water becomes discoloured and dark with the churned up mud. The water has an oily look at this time and at times brings air bubbles, stems and branches of apparently submerged trees and along with them dead fish also. The Alleppey mud bank is peculiar in that at times its smooth surface is disturbed by "mud vulcanoes" or huge "cones" of mud and water bobbing up. But after this stage, the mud settles down and water becomes clear. The full characteristics of these mud banks in providing a perfectly quiet anchorage during the monsoon are not fully developed till the monsoon has sufficiently advanced to render water in the backwater on the landside quite fresh and during this period the water out to the sea is also fresh. The effects are that monsoon swell gradually subsides over the outer limits of the bank. At this stage the mud banks have the special property of giving complete quiescence to the waters in its environs even in the roughest monsoon weather. No surf breaks along the margins of the banks and the waves merely die away.

The sea bottom from about a mile from the shore out to 30 fathoms along this part of the coast is composed of soft grey mud with small dead shells. It is believed that the mud deposits are terrigeneous in character and largely derived from the laterite and alluvial belt of the coast which originated from the disintegration of gneissic rocks of the interior. The mud of both sea bed and mudbanks are thought to be brought down by the present and past rivers.

The mud banks are probably formed by the interaction of forces of a varied nature such as currents, river discharges, tides, wave action, ground swell etc. as also cyclones or exceptional storms and seismic disturbances. The investigations carried out at this Institute show the presence of upwelling and divergence near the bottom between 20 and 30 metres along the coastline north of Quilon during the South West Monsoon period. These produce vertical accelerations with the resultant lifting of the bottom waters. As the bottom is composed of fine silt, the mud is also consequently lifted up which comes almost to the surface. This mud being kept in position in the regions of convergence along the coast, we get the formation of mud banks. Thus the convergence takes place against a barrier, mud bank and thereby more mud deposited. This along with the forces mentioned above play an important role in the formation, maintenance, dissipation and movement of the mud banks.

Mud banks are known to shift from place to place. The Narakkal bank which is situated at the mouth of Periyar river sometimes moves south, not continuously, and these southward movements occasionally cease and shifting to north takes place. The mud bank at Alleppey also moves south, but something very remarkable happens here, either the bank is rapidly driven to north again and inshore, or another bank bursts up from sea bottom at or north of the Alleppey pier. Its movement to the south is generally more rapid and constant probably because the currents are from north to south during this season aiding their movement to the south.

The analysis of the offshore mud as well as the inshore mud shows that both have a common nature and origin. The mud is of a fine grained type, about three-fourth of which is composed of particles having effective diameter of 0.002 mm, or less and the remaining which is called the silt fraction composed of particles between 0.02 and 0.002 mm. in diameter. The mud itself which is peculiar and is not found elsewhere along the coast is dark green in colour, fine in texture and oily to touch. The X-ray and minerological examination of the mud particles show that the coarser particles are composed predominantly of quarts and a mineral of the kaolinitic type. From a chemical point of view, the mud has been found to contain in addition to the volatile matter, silica, aluminia, ferric oxide, ferrous oxide, lime, magnesia, sulphates and phosphates. The examination for the oil content indicates that it is about 40 parts per million of the original mud.

The investigations carried out on the bottom muds have indicated that values for interstitial phosphate were higher than the corresponding values for the inorganic phosphate in the overlying water during the pre-monsoon months and that the mud here retains

relatively large quantities of phosphate and probably other nutrients. The water expressed from the mud of the mud banks gives high figures for phosphate and silicate and these nutrients show a rise in the concentrations with falling tide possibly due to turbulence set up by the ebb tide bringing the nutrients out of the sand and mud banks. The bottom muds also contain organic matter and the extraction with organic solvent like ether gives a deposit which is composed of colourless, crystalline needles probably of a carbohydrate nature. It is shown that the mud also contains besides inorganic nutrients, important organic substances and growth promoters which are essential for the growth of phytoplankton and the absence of which could act as a limiting factor. The muds of these banks have been found to contain the diatoms belonging to several families also.

The mud banks appear to play an important part in the biology and chemistry of the sea water in these parts. During the South West Monsoon, owing to the abundant rain fall, there is a fall in the salinity of water which is considerable at times in the surface layers. At this period of lower salinity, the conditions are favourable for the growth of phytoplankton. Cells of those species of diatoms which have attained their minimum characteristic size form auxospores. Auxospores of several species as also large cells of many others indicating the occurrence of such a process, have been met with in the plankton collections at this period made by this Institute which confirms the view that the conditions are favourable for this process of rejuventation of the protoplast of the diatom cells. The mud of the mud banks which is a rich store house of various nutrients like phosphates, nitrates and silicates makes the water replenished with these nutrients during the process of the formation of mud banks when churning up of the mud with water takes place. These nutrients in the sea water act as an ideal culture medium from which phytoplankton draws its requirements and rapidly multiplies leading to its main bloom during the South West Monsoon season. Sometimes a bloom of phytoplankton appears even when the salinity is as high as 34 or 35‰. This does not, however, appear to be a result of sexual reproduction and auxospore formation of the diatom elements. Here it is due to vegetative multiplication chiefly of the diatoms. Such blooms occur during or after a period of strong winds which appear to mix up the water layers and make available certain growth promoting substances from the lower layers of the bottom sediment, for there is always a good quantity of nutrients present in the water, such a change leads to the multiplication resembling renewal of media in the cultures. Thus the process of formation of mud banks seems to play an important role in the production of phytoplankton blooms in these parts. As these microscopic organisms fluctuate in response to climatic changes, water movements, nutrient content of water and so on they form an important and convenient link in the assessment of the stock of fish.

One characteristic feature of the mud banks is that the water in their environs remains extremely calm even when the roughest weather prevails and sea is very rough in the surrounding areas. In the region of the mud banks the water surface has been found to be oily and this was believed to effect the calm conditions. However, this effect is supposed to be due to the suspension of fine matter increasing the viscosity of the water which helps to break up the force of the waves.

During the monsoon period when upwelling takes place the oxygen poor waters of the bottom layers are brought up and the fishes migrate to the near shore regions where they can get more oxygen. Due to the extreme calmness prevailing in the region of the mud banks the fishes can find an easy shelter here.

It may be pointed out that with the onset of the South West Monsoon, owing to the stormy weather, regular fishing operations are at a stand still and calmer conditions prevail in the sea about August. So the apparent paucity of fish landings during this early part of the period may not be entirely due to the fishes being not available in the waters, but fishing operations being not possible due to the weather. It may be seen that good landings can be expected even during the peak period of the monsoon as may be seen from the landings made in June 1953, when the fish mainly caught was the oil sardine, a phytoplankton feeder. Fishing operations are possible during this season at places where mud banks occur. The sea is calm in its environs and fishermen are able to take their canoes out; otherwise, the strong surf near the shore during rough weather prevents them from launching their boats. The topography and the presence or absence of the mud banks seem to influence the fishing operations here during these early South West Monsoon months.

From the fish catch data collected by the Central Marine Fisheries Research Institute, for the years 1965 and 1966, during June-August, the catch composition in the Alleppey mud bank area is found to be as given below.

| | Quantity in Tonnes | |
|---|---|---|
| | 1965 | 1966 |
| Penaeid prawns | 929.10 | 1280.88 |
| Oil Sardine | 51.05 | 1469.92 |
| Other Sardines | 21.54 | 312.81 |
| Sciaenids | 57.59 | 317.57 |
| Mackerel | 107.89 | 51.16 |
| Soles | 10.64 | 402.67 |

Average fish catch (in Kg.) per landing centre per day in the mud bank and other area in Alleppey zone during June-August is as given below.

| | 1965 | 1966 |
|---|---|---|
| Mud bank area | 2,011 | 10,907 |
| Other area | 356 | 309 |

This shows that the formation and occurrence of mud banks play an important role in the fishery, possibly because of the calmness prevailing in their regions.

The mud bauks, which are found to occur along this west coast of South India, have great influence on the fish catch which is high compared to that of the other parts of the country. Investigations are in progress now at the Central Marine Fisheries Research Institute on the various hydrographical, chemical and biological aspects of the mud banks.