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MUD OF THE MUDBANK; ITS DISTRIBUTION AND PHYSICAL AND CHEMICAL CHARACTERISTICS

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ABSTRACT

Description of the texture, grain size, thickness and chemical properties, including minerological-studies, of the mud in the mudbanks is given. An echosurvey conducted in the mudbank revealed the pattern of distribution of mud and the extent of the area of the mudbank, which would provide answers to problems connected with the formation of the mudbank and the associated calmness.

INTRODUCTION

The mud being the chief component of the mudbank, a through study on the texture, the thickness of the deposit, the grain size and chemical properties of the mud would provide answers to many problems concerning the mudbanks, which, therefore, formed a major part of study during the present investigations. The earlier authors who attempted to study the physico-chemical aspects of the sediments of the mudbanks are Ducane et al (1938), Dora et al (1968), Gopinathan and Qasim (1974), Jacob and Qasim (1974), Kurup (1977) and McPherson and Kurup (1981).

MATERIAL AND METHODS

Mud samples were collected regularly from June 1971 to September 1972 from 4 stations between Kakkazham and Purakkad. The stations fixed were at Kakkazham (Station 1, near to the coast, and Station 2, away from the coast), Ambalapuzha (Station 3) and Karoor, near Purakkad, (Station 4). The Stations 2-4 were parallel to the cost, about 1 km away and were separated from each other by about 1.0 km each (Fig. 1). A Van veen type grab of 0.03 m² was used for sampling the mud. The highly unconsolidated nature of the mud did not permit the grab at times to close. These samples were studied for their texture, grain size and chemical properties.

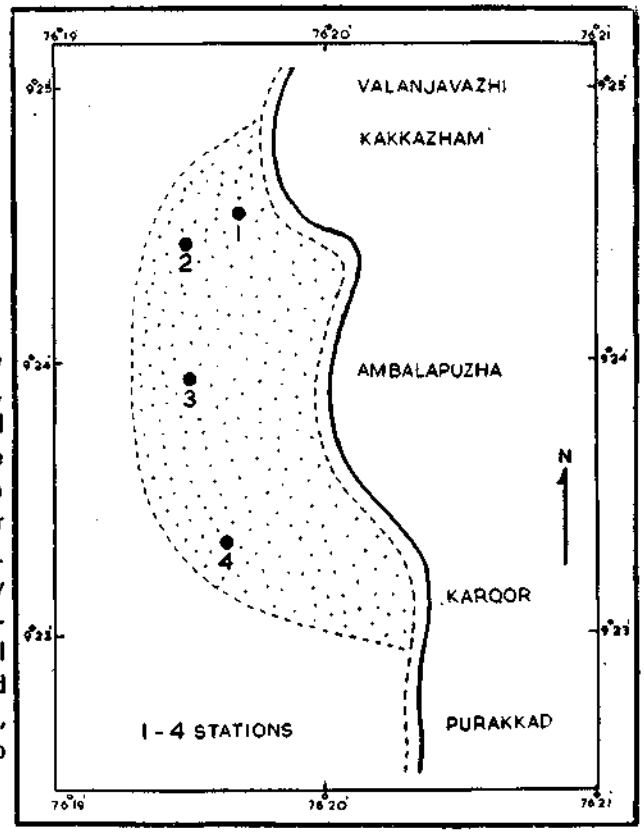

Fig. 1. Station positions, where seasonal observations were made at Alleppey mudbank.

An echo survey at the mudbank area was carried out on 18th May 1975, to study the distribution and thickness of the mud deposit and also to understand the actual extent of the mud deposit in the mudbank. A Simrad Echo sounder of model EX 38 with a transducer 10 x 20 cm of model 65 R was used for this survey. The survey was carried out in two directions, one parallel to the coast along the 3-metre depthline covering a distance of 5 km from Thottappally in the south to Kakkazham in the north and another perpendicular to the coast at Purakkad from 2 m depth to 12.5 m

depth off the shore for a distance of 3.5 km. During the survey, mud samples were collected from 8 stations (Plate 1). All the samples were subjected to grain-size analysis by sieving. Measured quantities of the oven-dried sediments were dispersed overnight in 0.025 N solution of sodium-hexa-meta phosphate. The silt and clay fractions were separated by washing the dispersed sediments using a 63μ sieve. The coarse fractions retained in the sieve were dried and examined under the microscope.

The mudbank sediments were compared with samples collected from Elathur (Calicut) mudbank and Vembanad Lake. The mud samples I and II were from the Elathur mudbank (Table 3), sample III from the mouth of the Korapuzha river and sample IV from a station near the railway bridge across Korapuzha. The sediments were analysed according to the methods mentioned by Sankaram (1966).

OBSERVATIONS AND RESULTS

the mud of the mudbank is mostly silty-clay in its nature (Table 1). Relatively a higher percentage of sand was observed at station 1 than at the other stations. The sandy nature of the mud at this station may be attributed to the proximity of the station to the shore and to the wave action at the periphery close to this station. While stations 2 and 3 show less sand in the samples, station 4 showed a high percentage of clay-silt fraction. This may be due to its position in the highest depth contour where the nearshore activities have less impact on the sediments.

The sandy nature of the bottom at station 1 during the non-mudbank season clearly shows the infleuce of anchoring and other activities of the mechanised boats on the otherwise surf-ridden bottom. The present

TABLE 1. *Monthwise sand and silt-clay contents of sediments (%) in the area of Alleppey mudbank.*

	St. 1		St. 2		St. 3		St. 4	
	sand	silt-clay	sand	silt-clay	sand	silt-clay	sand	silt-clay
Jun.	15.71	84.29	2.30	97.70	2.20	97.80	1.00	99.00
Jul.	0.28	99.72	0.80	99.20	0.78	99.22	—	100.00
Aug.	0.82	99.18	0.72	99.28	0.70	99.30	—	100.00
Sept.	3.02	96.98	2.80	97.20	1.70	98.30	0.27	99.73
Oct.	5.04	94.96	3.00	97.00	2.80	97.20	0.30	99.70
Nov.	8.72	94.28	4.25	95.75	4.00	96.00	0.72	99.28
Dec.	13.40	86.60	6.30	93.70	6.00	94.00	1.20	98.80
Jan.	15.28	84.72	8.00	92.00	6.70	93.30	1.72	98.28
Feb.	27.30	72.70	8.20	91.80	6.90	93.10	2.78	97.22
Mar.	32.10	67.90	9.00	91.00	8.92	91.08	2.78	97.22
Apr.	100.00	—	9.50	90.50	8.71	91.29	2.78	97.22
May	100.00	—	8.10	91.90	8.00	92.00	2.00	98.00

investigation showed that the mudbank sediments are predominantly of clay and silt fractions and the sand fraction is negligible.

Extent of mudbank and distribution of mud

The echo survey conducted off Ambalapuzha (remnants of 1974 mudbank) and Purakkad (the active mudbank in 1975) gave some very interesting results with regard to the extent and nature of the mud deposits. Samples collected during the echo survey were analysed for particle size and the details of the analysis are given in the following table:

TABLE 2. *Details of mud analysis.*

St. Nos.	Depth (m)	Silt-Clay fraction	Sand fraction	Grain size (mm)	Average grain(mm)
Thottappally					
1	2.5	99.40	0.56	0.08 -0.220	0.136
2	4.0	96.64	3.36	0.086-0.300	0.143
3	6.0	99.12	0.88	0.066-0.283	0.140
4	8.0	98.72	1.28	0.066-0.250	0.140
5	11.0	95.84	4.16	0.050-0.266	0.133
6	12.5	98.60	1.40	0.050-0.250	0.131
Kakkazham					
7	4.5	90.26	9.84	0.050-0.400	0.150
8	4.0	nil	sand only	–	–

Analysis of the sediments showed a high percentage of silt-clay fraction (99.4%) and only a negligible percentage of sand. The composition of the sediment at Thottappally was in the order of 90% silt-clay and 10% sand, but the sediment at Kakkazham did not show any trace of silt-clay indicating the northern limit of mudbank. Ducane et al (1938) recorded a high percentage of clay content in the mudbank sediments. A high silt-clay fraction ranging from 85.9% to 99.7%, with values clustering around 98.2%, was observed by Dora et al (1968).

The echogram (Fig 2) revealed that the mud of the mudbank was in a heap with a vertical thickness of about 2 m at the centre situated around 2 m bathymetric line off Purakkad. The thickness of the mud gradually decreased from this point until it reached a thin layer on all sides except perhaps towards the shore (draft of the vessel did not permit the vessel to move closer to the shore). The investigations showed that the mudbank extended for about 3 km in the north-south direction along the coast off Purakkad while the remnants of the previous years mudbank off Ambalapuzha occupied a length of about

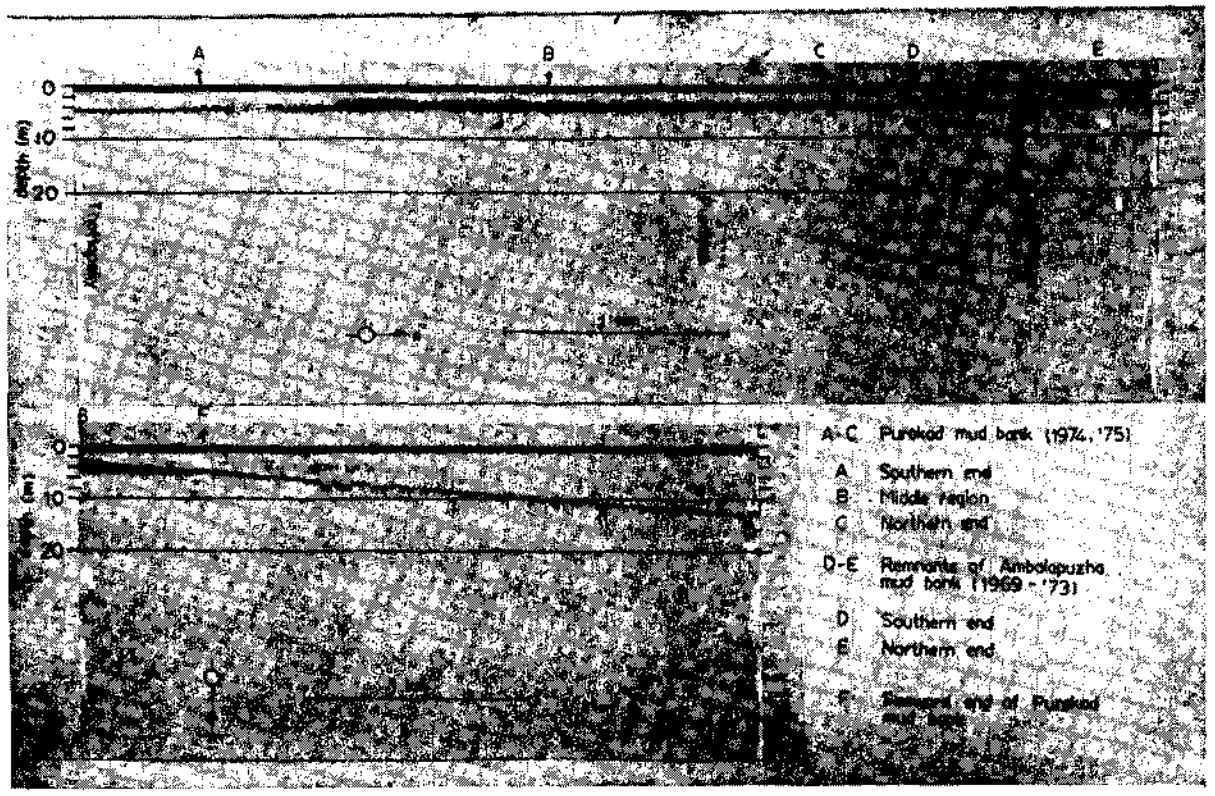

Fig. 2. Echogram showiug the old mud in the mudbank area at Alleppey.

1 km along the coast north of Purakkad. The mudbank extended roughly about 1.5 km out into the sea, but, the thin layer of the spread-out mud extended even beyond 3.5 km. While there was perfect calmness at Purakkad, the sea off Ambalapuzha was somewhat disturbed.

MINEROLOGICAL STUDIES OF THE MUD

The results of the chemical and mineralogical analysis of the mud are given in table 3. The silica concentration of the mudbank sediments of Purakkad and Elathur and of the sediments of Vembanad lake were in general comparable with each other. The iron contents of the sediments, estimated as ferric oxide, did not show any appreciable variation. The same was the case with the concentrations of calcium, magnesium, alumina, sulphate and phosphate in the sediments.

There were no significant variations during the mudbank season and non-mud bank season.

DISCUSSION

The composition of the mud at Thottappally (10% sand) and Kakkazham (100% sand) suggests these places as the possible southern and northern periphery of the mudbank, respectively, in the year 1975 (Fig. 2 and Table 2) The grain size was observed to be of an average of 0.14 mm but the minimum limit of its range showed gradual reduction in size

TABLE 3. *Minerological analysis of mudbank sediments.*

Sample	Volatile matter %	Acid insoluble SiO_2 %	Iron* %	Calcium as CAO %	Magnesium as MgO %	Alumina %	Sulphate %	Phosphate %	Acid soluble SiO_2 %	Total %
Aug. 71	1.82	42.92	8.91	7.05	5.28	20.35	3.11	9.45	9.68	99.57
Sept.	1.23	42.88	8.91	7.02	5.21	20.92	2.88	0.44	10.11	99.60
Oct.	1.52	42.91	8.80	7.04	5.08	20.81	2.90	0.40	10.20	99.66
Nov.	1.38	43.15	8.77	6.73	5.52	20.63	2.93	0.45	10.31	99.42
Dec.	1.14	42.87	8.92	6.88	5.43	19.98	3.04	0.58	9.82	99.66
Jan. 72	1.61	42.03	8.73	6.92	5.01	20.19	2.97	0.61	10.18	99.24
Feb.	1.30	42.57	8.49	6.98	5.23	21.23	2.93	0.58	10.21	99.52
Mar.	1.12	43.01	8.81	7.81	5.18	20.78	3.01	0.63	9.32	99.67
Apr.	1.82	43.04	8.52	6.63	5.15	20.77	3.41	0.61	9.84	99.69
May	1.43	42.80	8.01	6.81	5.71	20.73	2.88	0.60	10.28	99.25
Jun.	2.05	43.12	8.11	6.77	5.35	20.28	2.95	0.59	10.23	99.45
Jul.	2.21	42.53	8.89	7.12	5.18	20.44	2.98	0.42	9.58	99.35
Aug.	2.13	42.79	8.63	7.17	5.17	21.18	2.89	0.41	9.01	93·38
Vembanad	1.41	43.71	8.12	7.14	5.08	21.08	2.95	0.68	9.13	99.56
Elathur I	1.62	43.42	8.57	7.09	5.27	19.64	3.12	0.43	10.21	99.37
II	1.81	43.38	8.53	7.15	5.19	19.83	3.08	0.41	10.16	99.54
III	1.32	43.41	8.87	7.31	5.31	20.12	2.92	0.48	9.74	99.48
IV	1.92	43.50	8.99	7.04	5.23	19.93	2.99	0.47	9.53	99.60

* Iron as ferrous and ferric oxide (total)

towards west. The sediments at the Kakkazham area did not show any trace of silt-clay fraction. It is interesting to recall here that the active mud supply zone in 1972 was at Kakkazham, where the mud cones were observed to be very active at the inter-tidal zone and on the beach. It may be mentioned that no mud cones were observed to be very active at the inter-tidal zone and on the beach. Further no mud cones were observed in later years and Purakkad became the seat of the mudbank in 1974–75.

From the minerological analysis, it is clear that the mineral composition af the sediments off Purakkad, Elathur and at Vembanad backwater region are almost the same, suggesting that they are all of the same laterite origin as found by Brown et al (1938). The composition of the mineral components compared very well with that observed by Brown.

Further, the presence of ferric oxide, silica and alumina in fine clayey from in the sediments imparts the thixotropic character to it. Thus when the mud cones are in contact with electrolyte lipoids, they form a colloidal solution by thixotropy with the seawater and increases the viscosity of the medium and keeps it in a colloidal form for a longer period.