Carbonate Content of Sediments in the Ashtamudy Lake, West Coast of India

K T DAMODARAN & K SAJAN
Department of Marine Sciences, University of Cochin, Cochin 682016
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Grab samples of sediments from selected stations in the lake have been studied to determine the type of sediments and the carbonate (CaCO₃) content. Striking difference in the distribution pattern of carbonate in different parts of the lake has been attributed to the type of sediments, the rate of sedimentation and the biogenic productivity in the area.

The Ashtamudy lake forms an important estuarine system in south Kerala. It extends over 19 km in length and 3.3 km in width. The major river that empties into the lake is the river Kallada, with an estimated average annual run-off of about 2140.8 x 10⁶ m³.

Prabhakara Rao¹ has made a detailed study on the sediments of the near shore regions off Neendakara-Kayamkulam coast and the Ashtamudy and Vatta estuaries. However there is no geochemical investigation either on the sediments at the tidal channel or at the river mouth for their carbonate content and/or organic matter content. In the present investigation, lake sediments have been studied to ascertain the relationships among various factors, viz. source of sediment, rate of sedimentation, carbonate content in the sediments and biogenic productivity.

Sediment samples were collected using a Van Veen grab at an interval of 150 m. Twelve samples were from the river mouth and 22 from the tidal channel and surrounding areas (Figs 1 and 2). The samples were bagged thereafter for their colour, plasticity, shell content, etc and were stored in polyethylene covers after proper labelling. In the laboratory, the samples were washed with distilled water, dried in the oven and the total calcium carbonate² and the organic matter³ content were determined. Fractions > 63 μm were separated by wet sieving and finer fractions by pipette analysis⁴. Ratios of sand, silt, and clay were calculated from the weight percentages and the texture of the sediments determined based on the proportions of sand, silt and clay⁵ (Fig. 3).

From the sediment distribution pattern (Fig. 1), it is obvious that the sediments at the Kallada river mouth area are mainly of clay and silty clay while the samples from the tidal channel and the near by areas (Fig. 2) are mainly of medium to fine sands.

The Kallada river mouth sediments (Table 1) are characterised by a low carbonate content (av. 2.92% by weight). This low value may be related to high rate of sedimentation and the nature of the substratum. High rate of sedimentation and fine nature of substratum, in

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¹ Prabhakara Rao
² Total calcium carbonate
³ Organic matter
⁴ Pipette analysis
⁵ Texture determination

Fig. 1—Station locations and sediment distribution pattern at Kallada river mouth (inset shows lake's general setting)

Fig. 2—Station locations and sediment distribution pattern in and around tidal channel in Ashtamudy lake
the normal course, adversely affect biogenic activity and hence a low carbonate value in the sediments under consideration.

The lesser biogenic activity in the river mouth is confirmed by the microscopic examination of samples that reveal only very little shell fragments, and a total absence of microfossils like foraminifera as compared to the tidal channel and the surrounding areas in the lake. The factors like sudden fluctuations in salinity, temperature, and oxygen content due to horizontal and vertical mixing of water at the river mouth also might have contributed to lowering of biogenic activity, thus bringing down the total carbonate value in the sediments.

The sediments in and around the tidal channel (Table 2) near the shore area are typically sandy and their high carbonate content (8.77% by wt) appears to be due to high amount of biogenic activity, as evidenced by the bulk proportion of molluscan shells and foraminifera in the sediments. Normally high biogenic activity is supported by a sandy nature of the substratum.

Similar types of relationships have been observed among the rate of sedimentation, grain size of the sediments and their carbonate contents. Comparatively lower values of the carbonate contents in the clays and sands of the Ashtamudy lake may be due to the absence of any carbonate contribution to the sediments by any agencies other than biogenic activity in that area. This has been confirmed by microscopic examination.

From the distribution pattern of the organic matter content in the lake sediments, a striking relation is found between the grain size and the organic matter content. Clay, silty clay and silt have higher values of organic matter content when compared to sands. Similar observations have been made by Murthy and Veerayya. Normally it is seen that high organic matter content in the sediments of an area supports high biogenic activity in that area as organic matter serves as food for the latter. But in the present investigation, in spite of high organic matter content

![Fig. 3—Percent sand, silt, and clay in sediments of Ashtamudy lake, Quilon](image-url)
(av. 8.48% by wt) found in the sediments (Table 1) at the river mouth, the other important factors such as high rate of sedimentation, the greater depth of water column compared to the other areas in the lake under consideration (av. 3m), fluctuations in salinity, prevalence of reducing environment, etc. have affected the biogenic activity in order to bring the carbonate content to the minimum (av. 2.92%). In spite of the low organic matter content (av. 1.32% by wt) in and around the tidal channel (Table 2), high biogenic activity is prevalent as evidenced by the high carbonate value (av. 8.77%). The low organic matter content may, apart from the other factors, also be due to the consumption of the same to some extent by benthic organisms that contribute to the total carbonate content. The consumption of organic matter by the benthos does not seem to be compensated by supply.

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