



SEABED SURVEYS OF VICTORIA HARBOUR, MAHE, SEYCHELLES

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ABSTRACT

The seabed surveys in the Victoria Harbour, Mahe, Seychelles shows that the prominent feature is the navigational channel aligned in the northeast-southwest direction with a width varying from 300 to 450m. The depth in the channel ranges from 14 to 25 m. Almost whole of the channel area shows even topography however, the area adjacent to the wharf shows uneven topography with a variation ranging between 1 and 3 m.

The distribution of the sediments in the inner harbour is much diversified than the outer harbour sediments. The percentage of carbonate is higher (95%) in the outer harbour than the inner harbour (90%) which is attributed to the effects of streams. The changes in the distribution pattern of quartz and feldspars are inferred due to the effects of dredging during the construction and/or maintenance of the harbour.

1. INTRODUCTION

A study of the topography and sediments of the Victoria Harbour, Mahe, Seychelles was carried out in March, 1984 to evaluate the extent of siltation in the harbour area (fig.1) . The geological details are not available for this area though few general reports are available about the studies around the island. Before going into the details of this study it is essential to know in general the climate and geology of the island and the surrounding areas.

1.1 Climate

The climate of Mahe is a sub-equatorial marine. The mean annual temperature is 26.8 °C, the maximum and minimum temperatures being 31.5 °C and 26.8 °C respectively. Two seasons are distinguished. The period from April to October is characterised by predominantly southeasterly winds, and from November to March north-westerly monsoons reach the islands. Average annual precipitation is about 2,500 mm.

1.2 Geology

The geology of the islands of the Seychelles group has been mapped and described by Backer (1963). With the exception of two small islands (Bird and Dennis) the other islands and the islets on the bank are granitic. The petrology and the age of

the igneous rocks have also been studied in detail by Bauer (1898), Miller and Mudie (1961), Baker (1963), Baker and Miller (1963), Frankel and Kent (1964), Mathews (1965).

2. METHODS

The surveys were carried out on board "KATTI" (Length 7.5 m, width 2.85 m and draught 0.8 m) a boat belonging to the Brigade Hydrographique des Seychelles.

The positions during the surveys were obtained by horizontal angles of three fixed points, among which the central one being common, at every 30 seconds by hydrographic sextants and plotted with the help of a micrometer station pointer on a scale of 1 : 4000. Similar procedures were also adopted for taking the positions of the sample stations.

The survey tracks were selected across the channel in northwest-southeast direction spaced about 200m apart in the inner harbour and 100 m apart in the outer harbour while several other tracks were also undertaken along the channel.

A Honeywell ELAC echosounder (frequency 50/200 KHz) installed on the portside of the boat was used for the surveys. Measurements in the shallow water were recorded on a 225 mm wide paper at a scale of 1:100 in the 20 m range. In other words

1 m. of water depth is almost equal to 1 cm on the record. Everyday before the commencement and after the completion of the surveys bar checks were carried out and the zero in the records were adjusted. Thirty sounding tracks (fig.1) totaling about 25 line kilometres were covered, out of these 18 sounding tracks covering about 12 line kilometres were taken in the inner harbour only. The depth recorded on chart were digitized and reduced to chart datum using the predicted tidal data of Port Victoria (Mahe) made available by the Port authorities. The soundings reduced to chart datum were plotted on a 1 : 4000 scale map constructed on Mercator projection (CLARK 1880 spheroid). Spot soundings for checking the data were taken from a 1983 bathymetry map supplied by Brigade Hydrographique des Seychelles.

The surface sediment samples were collected with a Van Veen Grab (area 0.04 m²). Most of the sediment samples were collected from the Navigational Channel to find out the detailed sediment pattern. Based on the echosounding records 23 stations were selected for the seabed sampling. The carbonate free samples were packed in aluminium sample holders and analysed on a Philips x-ray diffractometer, using nickel filtered CuK α radiations at half degree per minute scanning speed from 26 to 30° 2 θ . The relative abundance of quartz and feldspars were determined by absolute counts per second over the background for the 26.66° 2 θ (101) of quartz and the 27.4-27.8° 2 θ (002) and 27.9-28.1° 2 θ (002) for potash and sodic feldspars respectively.

3. RESULTS AND DISCUSSION

3.1 Bathymetry and Geomorphology of seabed

A bathymetric map of the Victoria Harbour was prepared on a scale of 1:4000 with a contour interval of 1 m. The depth in the area surveyed ranged from 2 to 26 m. The depth in the channel ranges from 14 to 25 m. The width of the channel varies from 300 to 450 m. It is narrowest (300 m) at the junction of the inner and outer harbour between Navigation Beacons B-7 and B-4. Though the channel is very narrow on this track after the reefal areas another 160 m wide and about 16 m deep channel-like structure is seen. The depth of the channel varies in the inner harbour from 10 to 19 m with depth reducing to less than 4m in the north-eastern part. In the outer harbour the depth varies from 21 to 25 m.

The bottom topography studied by echograms indi-

cates that the seabed in the area is marked by even, uneven and rough topography (fig.2). The area of even topography has very little or no variations. Almost, the whole of the channel area shows the even topography. The area adjacent to the wharf shows uneven topography with a variation ranging between 1 and 3 m. Rough topography is observed outside of the channel.

3.2 Seabed Sediments

Earlier workers have studied the reef, sediments and sedimentary processes around the Mahe Island in particular and the Seychelles Islands in general (Emery et al. 1954; Munk and Sargent, 1954; Wells, 1954; Lewis and Taylor, 1966; Lewis, 1968, 1969; Ustinovsky, 1977). Sedimentation in the harbour is not only a result of natural phenomena, however, man also plays an important role in it, such as changes caused by reclamation of the area, the construction of the new port and the dredging of the channel. In this study a general distribution of the sediments in the harbour area (particularly channel) is presented to bring out the present conditions in relation to the bathymetry.

The unconsolidated sediments consisting of skeletal carbonate sediments/fragment occur in all the areas studied alongwith some fine clastics. The colour of sediments does not vary much, the most dominating colour is light olive grey 5 Y 5/2 which is due to the presence of high percentage of the carbonate material.

The distribution of the sediments in the inner harbour is much more diversified than in the outer harbour sediments. The inner harbour sediment is comparatively finer excepting the sediments just adjacent to the wharf which is coarse sand with shell and coral fragments followed by a patch of clayey silt. The eastern part of the inner harbour is carpeted with the silty clay while the western and central parts consists of the clays.

In the outer harbour the most dominating sediment is clayey silt. Coral debris is encountered near the navigation beacon B-1 and B-3, and east of Victoria Light House. The northeastern side of the Victoria Light House consists of sandy silt while northwestern side is covered by silty clay (fig.3).

The northwestern and central parts off wharf is covered by clay (fine clastic 10-12%) which might be a product of the sediment brought by the streams or the product of the dumped material for reclamation in that part. The adjacent sediments are silty clay

which must be formed along the coral reef and the surrounding area. The area covered by the outer harbour is dominantly clayey silt which is derived from the coral reef and re-distributed by the tidal currents. A coarsening of the sediment is observed along the channel in the harbour area towards the open sea with the exception near the wharf.

3.3 Calcium carbonate in the seabed Samples

To establish the contribution of the coral reefs the carbonate percentage was determined in the sediment samples by digesting in 5% HCl. The area affected by the streams shows the presence of less than 90% carbonates. In the outer harbour which is beyond the reach of stream derived sediments, they consist of more than 95% carbonate and sometimes as high as 99% (fig.4).

3.4 Quartz and feldspars in the seabed Samples

The distribution of quartz and feldspars in the carbonate free samples are shown in figs.5 and 6. Quartz increases towards the outer harbour while the feldspars show a decreasing trend. The changes in quartz distribution within such short distance are attributed to the following possibilities.

- i) Role of the dredged material used for reclaiming the surrounding areas. The dumps of these materials have provided an additional provenance besides the natural island source.
- ii) Derivation of the quartz from the relict sediments as a result of dredging the floor of the channel during the construction and/or maintenance of the harbour. The quartz grains present in the samples identified are belonging to the two different generations. The first belongs to the modern sediments where the quartz grains are transparent and angular while the grains of the second generation i.e. the relict sediments are rounded and iron stained.

4. ACKNOWLEDGEMENTS

The authors are thankful to the Government of Republic of Seychelles for hospitality during the course of survey at Mahe, Seychelles and also for the permission to publish this paper. We are also thankful to Dr.S. Genidron for his cooperation, to Mr.M.Lecerf for his help in conducting the harbour surveys and also to Mr.Sam Andrate, Captain Morgan and Captain P Grandcourt for providing facilities at harbour.

The authors are also thankful to Late Dr.H.N. Siddique, the then Director, National Institute of Oceanography and Mr.R.R. Nair, Chief Scientist of

the cruise to Seychelles, for their critical comments and suggestions on the manuscript. They are also thankful to Dr. B.N. Desai, Director for permission.

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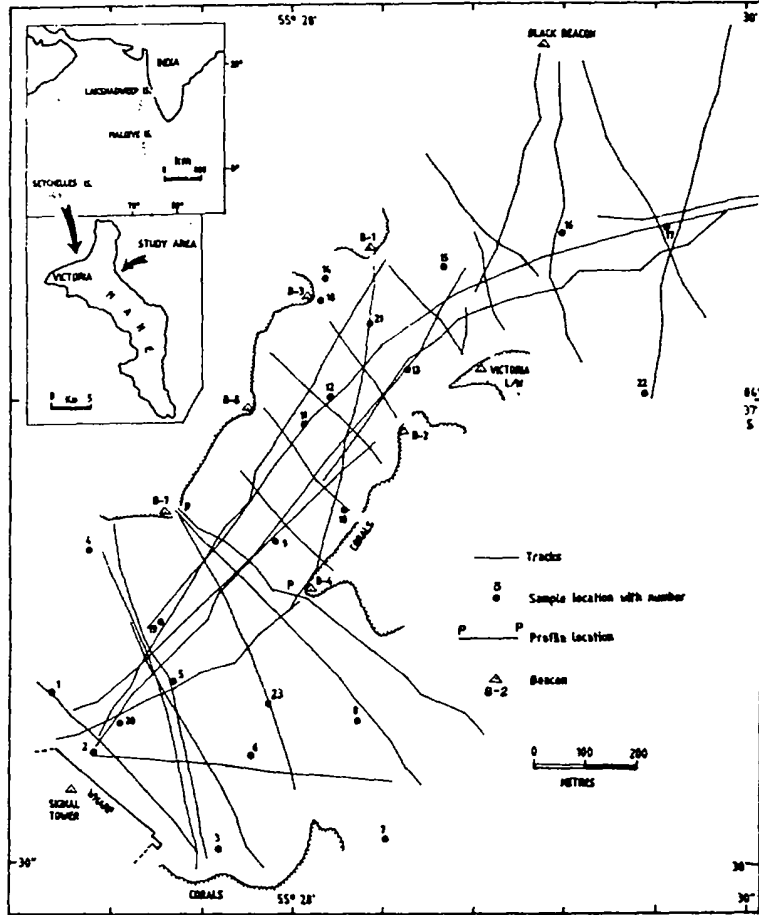


Fig.1 Survey tracks and sample locations

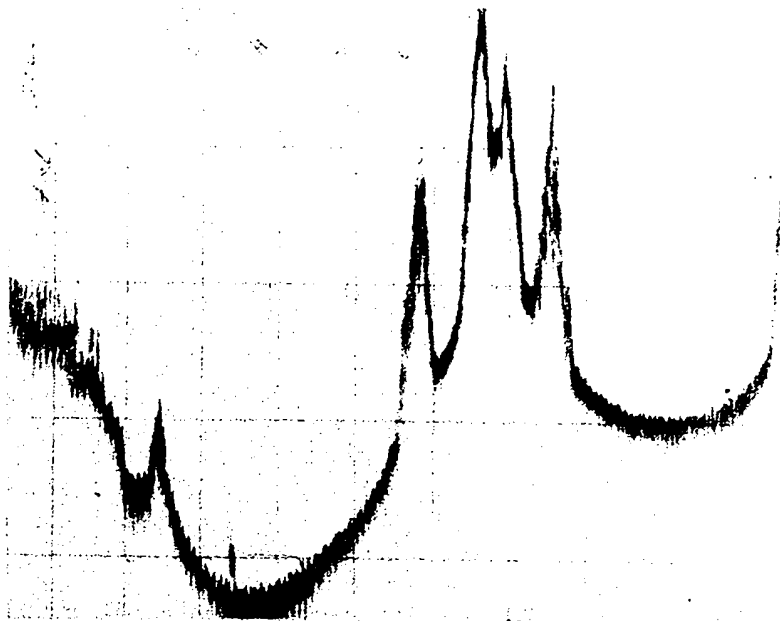


Fig.2 Bottom topography, location shown in Fig.1 (P-P)

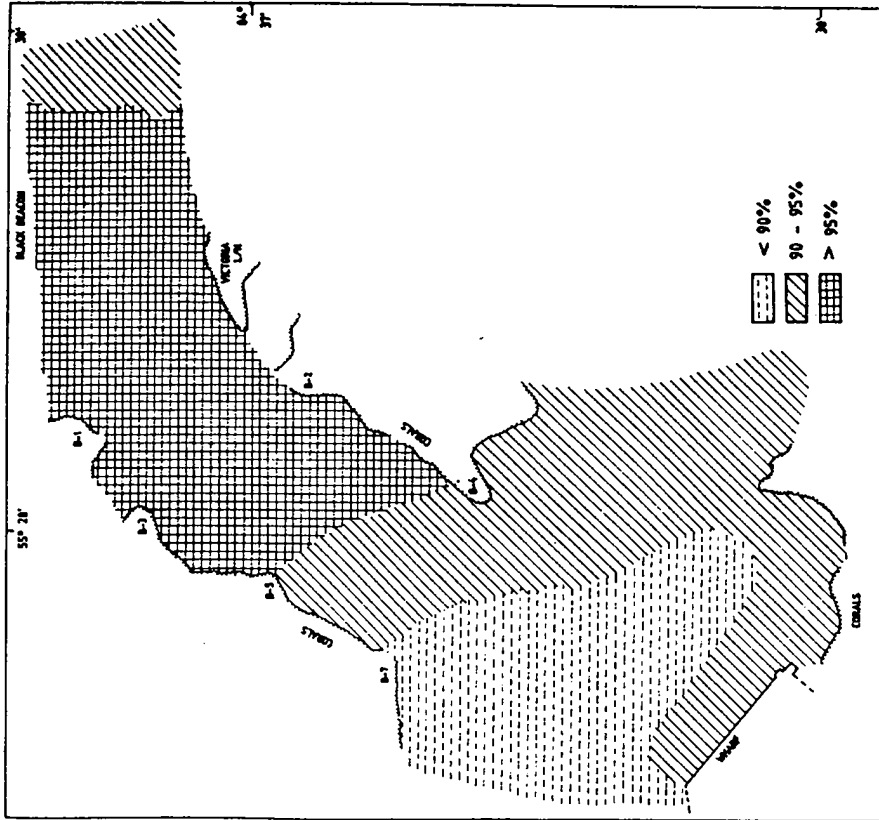


Fig. 4 Carbonate Distribution

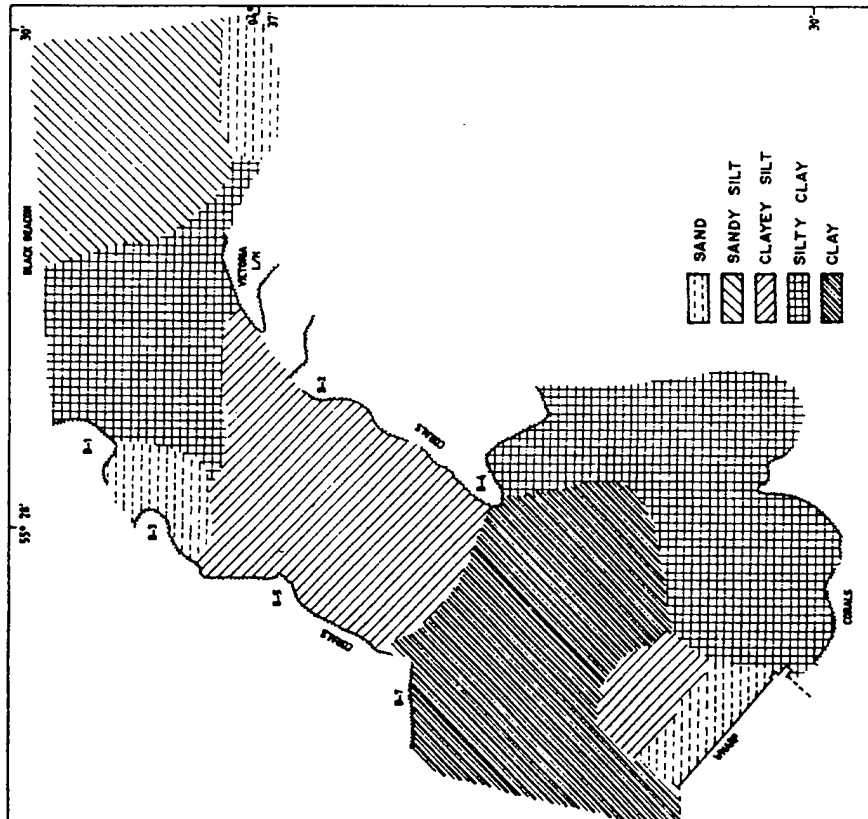


Fig. 3 Sediment Distribution

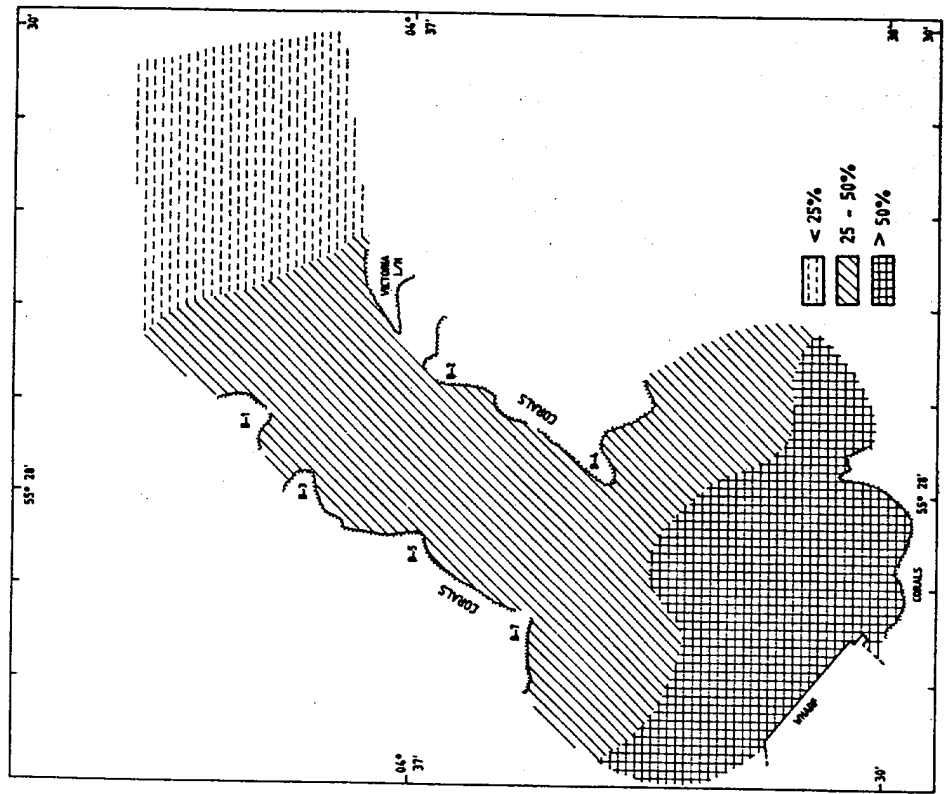


Fig. 6. Feldspar Distribution

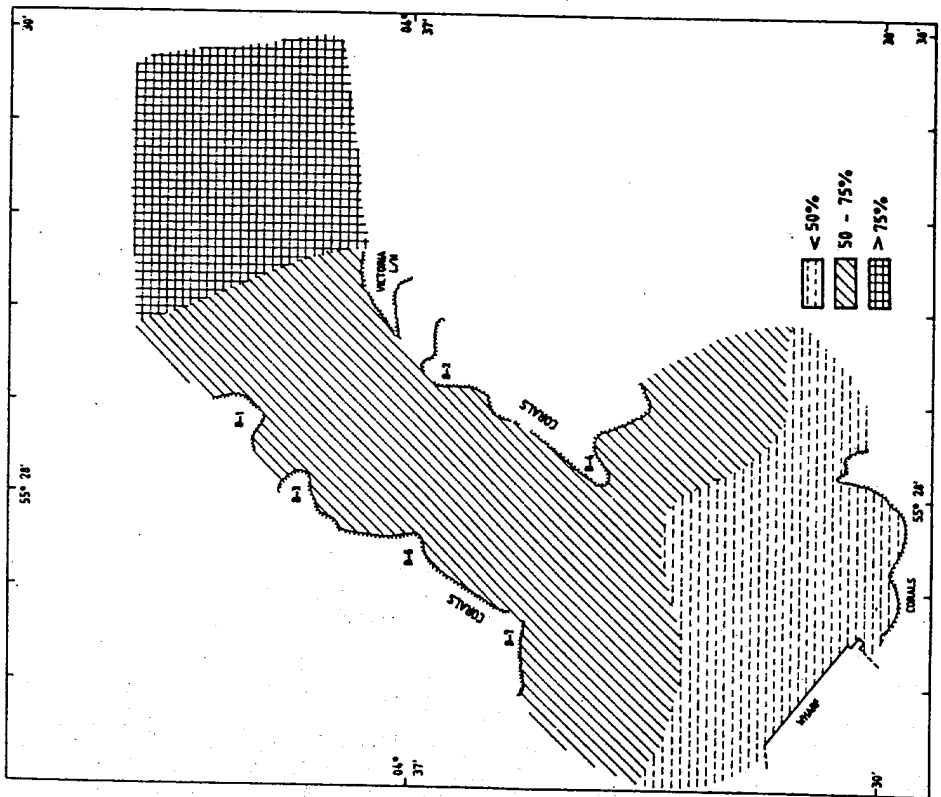


Fig. 5. Quartz Distribution