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SHALLOW SEISMIC SURVEYS AT DABHOL MINOR PORT IN MAHARASHTRA

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ABSTRACT

Detailed surveys comprising of echosounding and subbottom profiling followed by sea bed sampling were carried out in the creek off Dabhol to know the surficial and subsurface geology of the area for suggesting alignment of the approach channel route.

The bathymetric surveys have shown that the water depths in the area surveyed varies from 1.5 to 18m. The sea bed in large part of the area is even and gently sloping. The shallow seismic profiles show three prominent reflectors at depths of 5, 7 and 9 m. The surficial sediment distribution pattern indicated the presence of sands on the sand bar and on either side of the bar, while clayey sand occurs offshore of the sand bar. The isopach map shows that the sediment thickness ranges between 8 and 26m. Maximum thickness occurs at 1.5m water depth on the north eastern side of the sand bar and the minimum being at 12m water depth off Anjavel Bay.

Based on these results an area of least sediment thickness associated with deeper water has been suggested to facilitate optimum dredging for the proposed approach channel.

1. INTRODUCTION

The Konkan region of Maharashtra with a 500 km long coast line still remains a comparatively under-developed area of the state, despite its vast resources and potentials. It is rich in Iron ore, Bauxite and Placer deposits (Siddiquie et. al, 1982). The region also offers a great potential for the development of fisheries and coastal industries such as boat building and repairing yards. In view of this the Konkan developmental authority proposes to develop a few creeks along the coast into all weather ports suitable for medium draught vessels. This will provide the much needed facilities for coastal traffic and also help decongestion in the Bombay Harbour. Dabhol creek was taken up first to develop it into a harbour. In the development of ports and harbours two important approaches are: (1) geographical locations and the physical parameters such as winds, waves, currents and (2) the nature of the seabed. The instruments generally used for these investigations are echosounder to know the bathymetry and shallow seismic profiler to know the subbottom.

2. AREA OF STUDY

Dabhol creek area is located in the $73^{\circ} 77' - 73^{\circ} 11'$ latitude and $17^{\circ} 34' - 17^{\circ} 36'$ longitude on the Konkan coast. Geologically Dabhol creek and the adjoining regions are part of the Deccan traps consisting of

the hard and undulating basalt and laterite formations with scattered alluvial and laterite soil cover of varying thickness. The hilly formations around the creek are mainly laterite and attain elevations reaching over 250m. The hills are sloping steeply down to the coast and in certain places terminate into cliffs.

The river Vashisti, originating in the western ghats takes a narrow and meandering course before joining the Arabian sea at Dabhol. Many minor tributaries and rivulets join the river during the course into the sea. The river Vashisti brings lot of sediments during the S.W. monsoon.

In the area under study the direction of the surface current is towards the west i.e., offshore, while the direction of the bottom current is towards the south east during February (Josanto-1983, unpublished data).

3. SURVEY METHODS

The surveys were carried out on board F.V. Vijaya (length 17m, breadth 4.1 m and draught 2.0m). Thirty lines were surveyed in N-S and E-W directions and the lines are spaced at 35 to 40 m intervals. A total of 39 lkm of Echosounding and 20 lkm of sparker surveys were carried out.

1. Position fixing: The positions were determined by the sextant angles of shore objects.

2. Echosounding: An Atlas deso-10 (range 0-280 m) with dual frequency (30 kHz and 210 kHz) echosounder was used. The depths obtained from the echograms were corrected for tides. These corrections were made based on the predicted tidal data.

3. EG & G Sparker: An EG & G shallow seismic profiling was used. The system was operated with the power supply of 300 joules. The recorder (EPC-graphic recorder) was operated in the .125 (1/8) seconds sweep rate.

4. Sea bed Samples: Surficial sea bed sediment samples were collected with a van veen grab (area 0.04 m^2). The sampling stations were selected after an examination of the echosounding and seismic records.

4. RESULTS AND DISCUSSION

The salient features obtained from the study are described below:

I. Bathymetry and Geomorphology:

The corrected water depth in the area surveyed varies from 1.5 to 18 m. The seabed in large part of the area is even and gently sloping (fig.2).

A sand bar was observed in the centre of the creek and it extends offshore in the direction N70° E. The bar is about 2.7 km long and 0.9 km wide with water depth ranging from 1.5 to 4m.

The higher water depths were noticed on the eastern side (14m) and western side (18m) of Gopalgarh light-house (fig.1a).

An examination of the echogram reveals an interesting step like feature on the western edge of the sand bar (fig.3) between 4 to 6 m water depth. This feature has been observed in all the lines surveyed crossing the sand bar towards offshore. This feature might have been formed due to breaking of waves during low tidal period.

II. Subsurface geology:

Seismic profiles were prepared based on the shallow seismic data collected during the surveys. Based on the seismic profiles isopachs were prepared. In general the seismic records show three prominent reflectors below the seabed (fig.7) at about 5,7 and 9m depth. The seabed in the area surveyed is mainly covered by sands as evidenced by seabed sampling and from the shallow seismic records. It is presumed that the first reflector (seabed) is composed of sand. In the absence of bore hole data it is difficult to indicate the composition of the other two reflectors. These reflectors occur

at a depth of 7 and 9m. from the seabed. Where the acoustic basement shows characteristic high relief, exceptionally strong reflections, it is assumed to represent the bed rock (fig.5 and 6). The bed rock reflector can be traced 3 to 4 kms. Offshore and about 8-26 m. below seabed. Generally the acoustic basement is rugged and the depressions were filled with sediments. The seismic signature of this acoustic basement resembles that of the Jaigarh, Vijaydurg and Devgarh bays and further confirms the extension of onshore basalts to offshore as suggested by Siddiquie et al.(1982).

The Isopach maps drawn from seismic profiles indicate that the sediment thickness varies from 8 to 26 m. The minimum thickness of sediments (8m) was noticed at the NW side of Tolkeswara light house at water depth of 4m, while the maximum thickness of sediments (26 m) occurred further west ward at a water depth of 3.5m over the sand bar the sediment thickness varies from 14 to 26 m. Along the proposed channel the sediment thickness ranges between 11 and 18 m.

III. Surficial sediments

40 surface sediment samples collected in the area surveyed are mainly composed of sands and sandy clays. Sands mainly occur on the sand bar and on either side of the bar whereas sandy clays occurs offshore of the sand bars. The step like feature noticed in the echograms (fig.3) is the transition zone between sands of the bar and sandy clays of the offshore.

For the development of Dabhol creek into a harbour it is essential to have appreciable deeper water and minimum sediment thickness which will minimise the dredging cost. From the present studies of bathymetric and shallow seismic surveys of the Dabhol creek an area of least sediment thickness associated with deep water has been identified for the proposed approach channel as shown in fig.1a.

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REFERENCES

N.L.O. Technical Report; Shallow Seismic Surveys in Dabhol Creek, Maharashtra (1984); pp.1-12.
 N.L.O. Technical Report; Oceanographic studies at Dabhol Creek (1983); pp.1-21.
 Siddiqule H.N., Rajamanickam,G.V. and A.R.Gujar, and Ramana,M.V.

Geological and Geophysical Exploration for Offshore illmentite placers off the Konkan coast, Maharashtra, India. 14th Annual OTC Conference in Houston-Texas 1982 pp.749-755.
 Krishanana,M.S. Geoloty of India and Burma (1968) Higginbothams,Madras 536 pp.
 Anonimus: West Coast of India Pilot (1970) pp.219-220. Hydrography Department Admiralty, London.

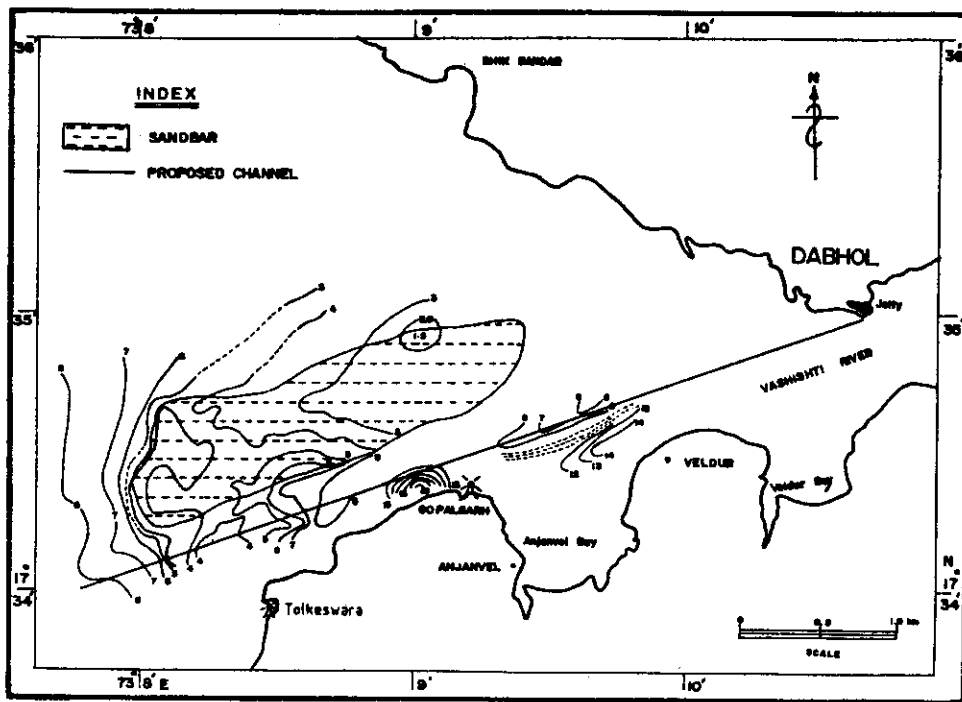


Fig. 1a. Map showing the area surveyed.

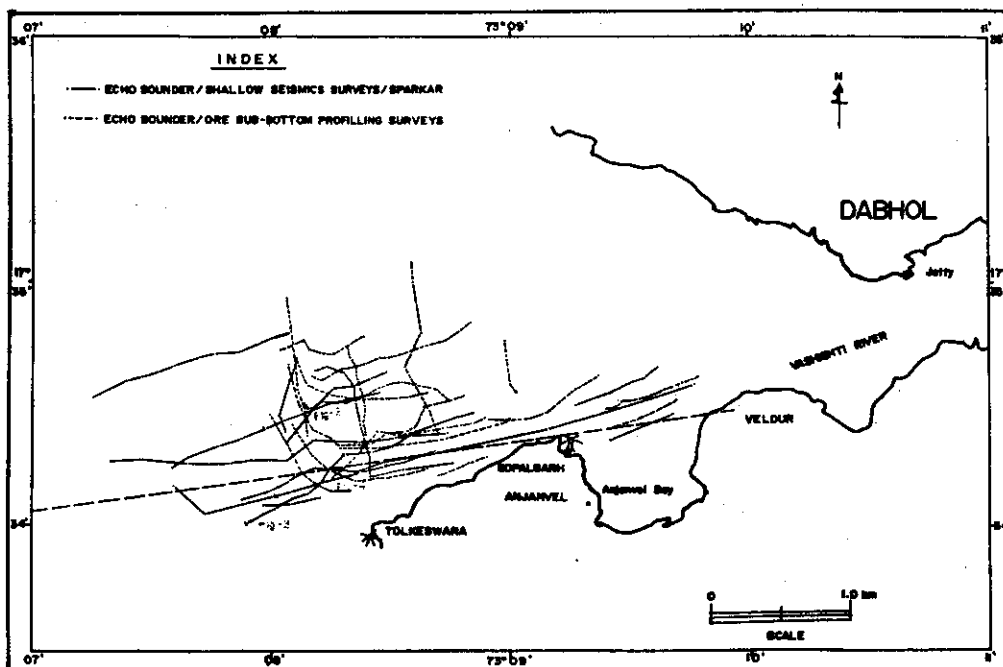


FIG. 1b. MAP SHOWING THE SURVEYED TRACKS

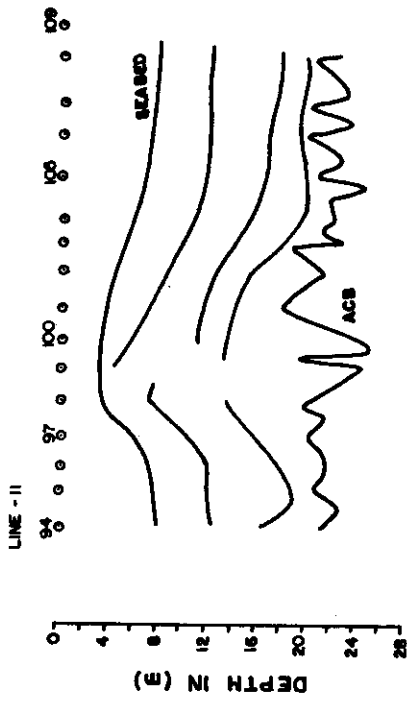


FIG. 5 SEISMIC PROFILE SHOWING A TYPICAL VARIATION IN ACOUSTIC BASEMENT (ACB) IS SEEN AROUND 18m DEPTH BELOW THE SEABED

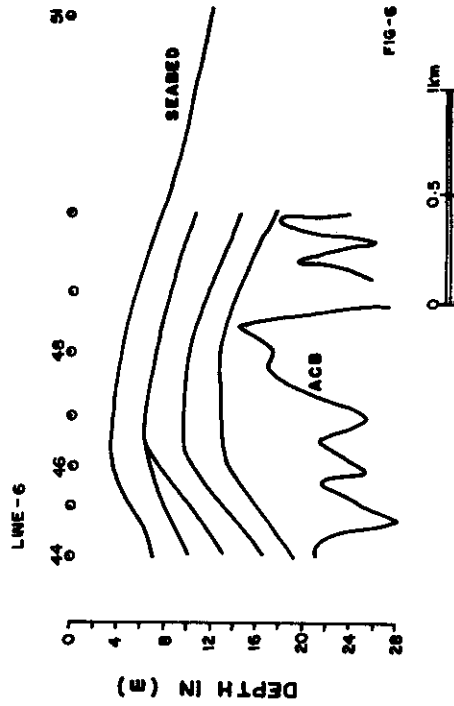


FIG. 6 SEISMIC PROFILE REPRESENTING SUBBOTTOM LAYERS FOLLOW THE TOPOGRAPHY OF THE SEABED. A MAXIMUM VARIATION OF 14 M IS OBSERVED IN THE SUBBOTTOM TOPOGRAPHY OF THE BASEMENT.

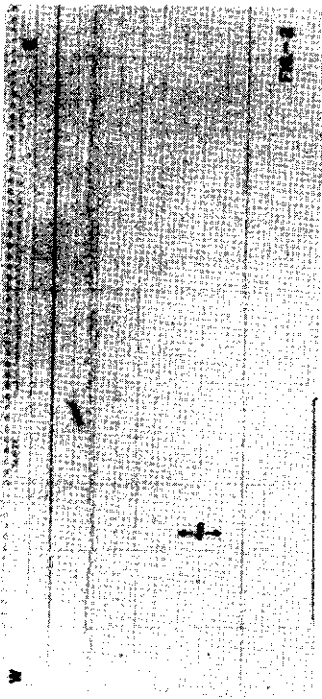


FIG. 2 ECHOGRAM SHOWING EVEN TOPOGRAPHY ON THE SEA BED.

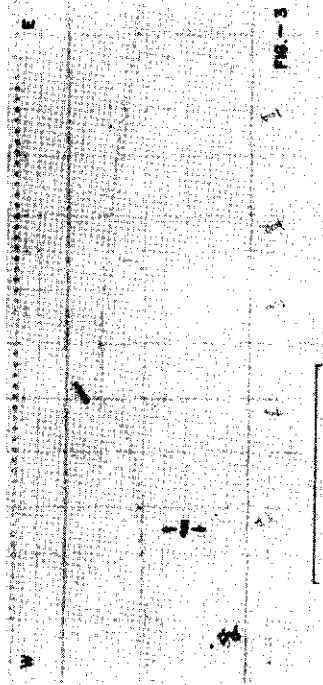


FIG. 3 ECHOGRAM SHOWING STEP LIKE FEATURE ON THE WESTERN EDGE OF THE SAND BAR.

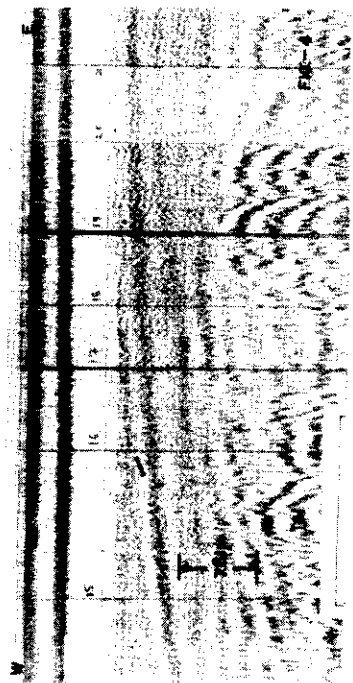


FIG. 4 SHALLOW SEISMIC I.e., SPARKER RECORD SHOWING ROCKS AT 8m DEPTH

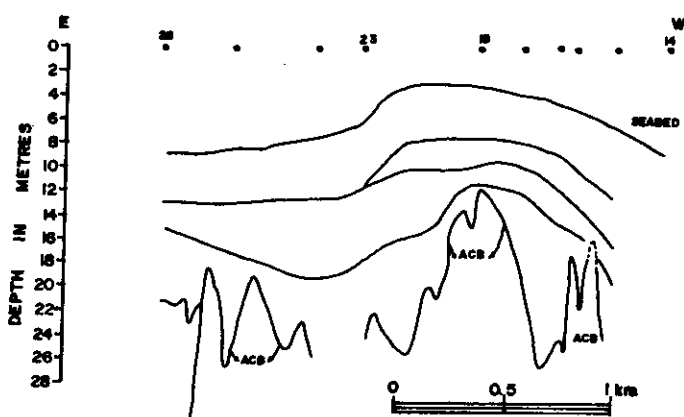


FIG. 7 SHALLOW SEISMIC PROFILE REPRESENTING PROMINENT SEISMIC REFLECTORS AND INTERPRETED ACOUSTIC BASEMENT (ACB)