

Morphology of a Coral Bank, Western Continental Shelf of India : A Multibeam Study

P. S. RAO, V. N. KODAGALI, T. RAMPRASAD AND R. R. NAIR
National Institute of Oceanography, Dona Paula, Goa-403 004, India

Abstract: Morphology of a living coral bank (Gaveshani Bank) is described using multibeam swath bathymetric survey system Hydrosweep. The bank has a height of 42 m, length of 2 km and a maximum width of 1.66 km, with steep flanks and flat top. It has a north-south orientation and occupies an area of about 3 sq km. A 100% coverage obtained in the present study enables us to determine the exact morphology of the bank. A comparison with the single beam echosounding data reveals that the dimensions (length and breadth) and areal extension of the bank are much larger than previously known.

Keywords: Coral bank, Morphology, Multibeam bathymetry, Western continental shelf of India.

INTRODUCTION

The physiography and sediment facies distribution of the central western continental shelf of India have been studied (Nair *et al.* 1978; Rao, 1989). Nair and Qasim (1978) discovered a living coral bank at 80 m water depth, about 100 km from the coast, off Malpe, west coast of India and named it as Gaveshani Bank. Based on echosounding data, the outline of the bank was drawn (Qasim, 1979). The present study deals with the morphology of the Gaveshani Bank as observed by the multibeam bathymetric survey system and compares the results with those obtained by the single beam echosounder (Nair and Qasim, 1978; Qasim, 1979).

DATA COLLECTION AND PROCESSING

Detailed morphological study has been carried out on the central western continental shelf of India between 11° 55' N and 14° 20' N using a multibeam swath bathymetric survey system (Hydrosweep - manufacturers: M/s Krupp Atlas Elektronik, Germany) onboard ORV Sagar Kanya in June 1991. Technical

details of the multibeam system and operational procedure are available elsewhere (Gutberlet and Shenke, 1989; Grant and Schreiber, 1990). Global positioning system was used with integrated navigation system for accurate position fixing (± 30 m). Six lines across and two lines along the bank (13° 24' N; 72° 43' E) were run to obtain complete coverage (Fig. 1). The swath coverage across the track in each line is twice the water depth. The depth data from all the lines was used to generate a grid of depth values. The depth contour map (Fig. 2a, contour interval 5 m.), isometric view of the bank (Fig. 3) and the cross section profiles (Fig. 4) were drawn from this grid.

RESULTS

The continental shelf in the study area is nearly flat with extremely low angle of slopes from shoreline to the break in slope. The topography on the outer shelf reveals the presence of two to three meters undulations that are produced by the reef exposures. The bank is situated on the outer shelf which is covered with sand and silty sand, predominantly carbonate, consisting of shells of foraminifera and

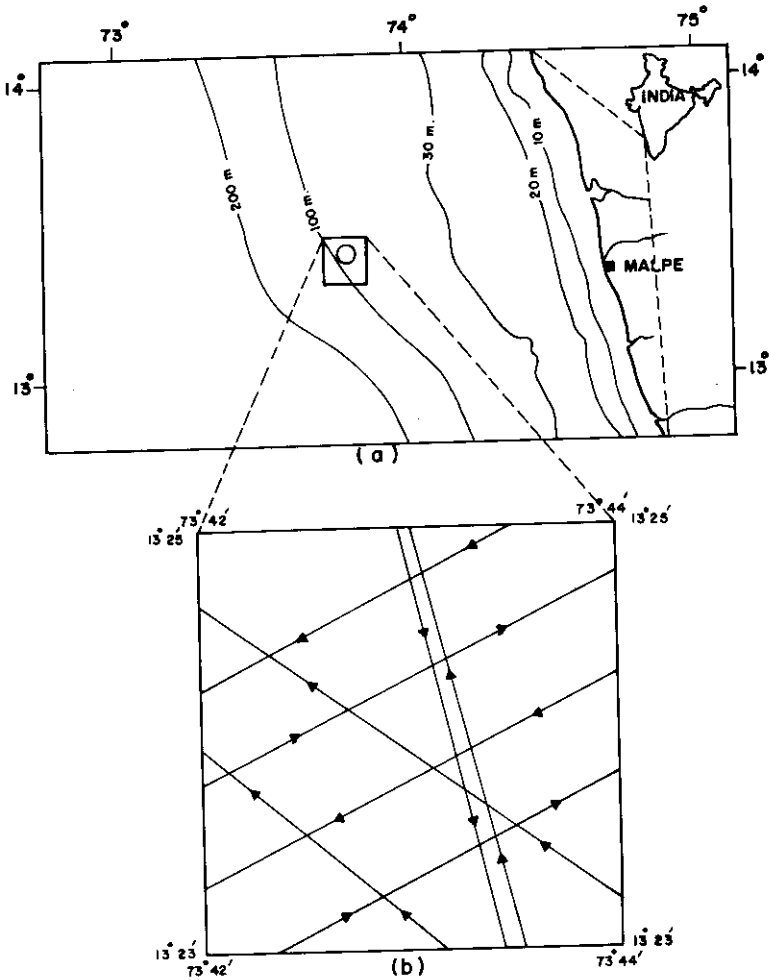


Fig. 1 : (a) Map of the central western continental shelf of India, showing the location of the Gaveshani Bank and (b) cruise tracks run over the bank.

fragments of molluscs and reefs (Nair *et al.* 1978). The bank has a distinct north-south orientation and is 2 km long and has a maximum width of 1.66 km. The width (0.9 km) is less at the southern end (Fig. 2a). Total area occupied by the bank is about 3 sq. km. Depth on the bank top is 38 m with a 3 m depression in the middle of the southern part (depth 41 m). Average depth at the base of the bank is 80 m. Walls of the bank rise steeply from the seafloor

(Fig. 3), steepness being maximum along $13^{\circ} 23.75' N$ latitude. (note the contours running extremely close at this latitude in Fig. 2a). Cross section profiles across the bank (Fig. 4) show that the top of the bank is flat profile WE-2 and profile WE-3 have steeper western flanks and gentler eastern flanks, whereas profile WE-4 has steeper flanks on either side (Fig. 4). The north-south profile NS-1 shows gentle northern flank and steep southern flank. A

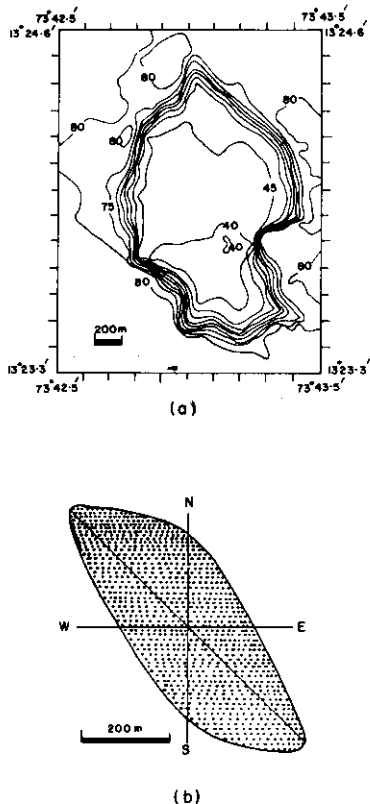


Fig. 2: (a) Depth contour map of the Gaveshani Bank (Contour interval 5 m) obtained from multibeam system showing the shape of the bank. (b) Shape of the Gaveshani Bank as outlined from the single beam echosounding data (after Qasim, 1979).

small step-like feature is observed on the southern flank on this profile, which appeared as a small depression (2 m) on profile WE-2.

The Gaveshani Bank has been mapped by single beam echosounder earlier (Nair and Qasim, 1978; Qasim, 1979) and now by multi-beam swath bathymetric system. The shape of the bank observed in both the studies vary considerably (Fig. 2a, 2b). A comparison of various parameters from each study is shown in Table I. The area occupied by the bank as per the calculations from the single beam survey (~ 0.23 sq km) is much less than the area from the multibeam data (~ 3.00 sq km). The length of the bank (2 km) is nearly 3 fold more than the earlier reported one (0.77 km), whereas the width in the middle of the bank (1.66 km) is 5 fold more than previously known (0.33 km). Shallowest point of 32 m on the apex reported to be present on the periphery of the bank is not confirmed in this study. Also the valley-like depression adjoining the base of the bank, noted earlier appears to be a minor undulation and present in one profile (WE-4) only.

The location of the bank (Lat. 13° 24' N; Long. 73° 43'E) is 3.2 km. away from the previously reported position (Lat. 13° 24'N; Long. 73° 45'E). The Global Positioning System used for this survey is more accurate compared to the single channel satellite navigation system used in the previous survey.

TABLE I

Morphology of the Gaveshani Bank: Comparison between single beam echosounding data (Nair and Qasim, 1978; Qasim, 1979) and multibeam swath bathymetric data.

Parameter	Single beam data	Multibeam data
Position	13° 24' N 73° 45' E	13° 24' N 73° 43' E
Orientation	NW-SE	N-S
Shape	Oblong	Irregular
Depth at the top	32 m	38 m
Height of the bank	48 m	42 m
Maximum length	0.77 km	2.00 km
Maximum width	0.33 km	1.66 km
Area	~ 0.23 sq. km	~ 3.00 sq. km

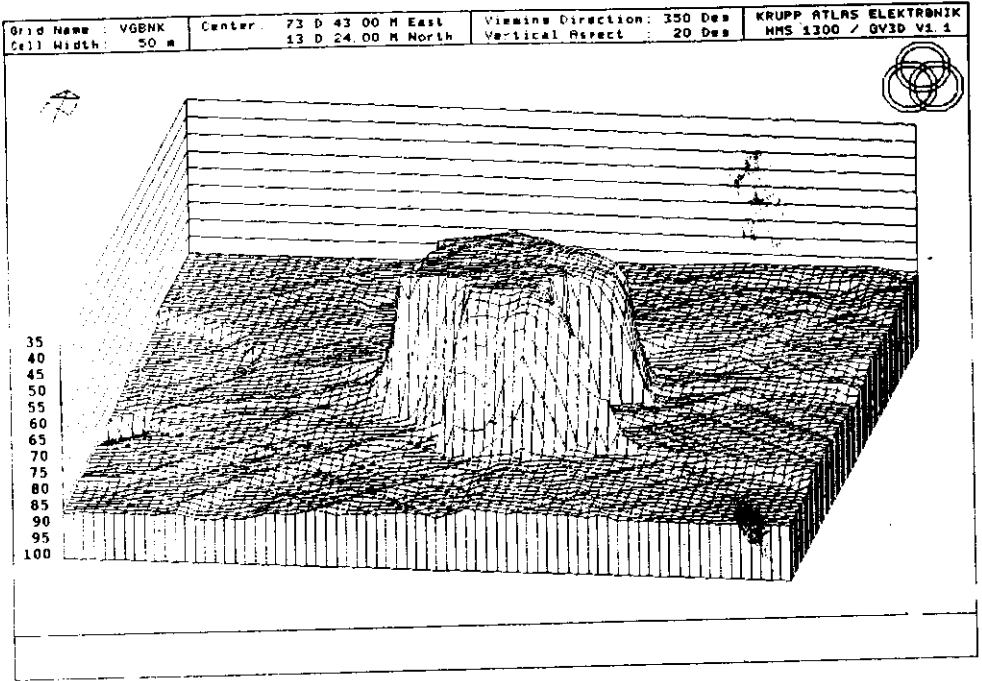


Fig. 3 : Isometric view of the Gaveshani Bank.

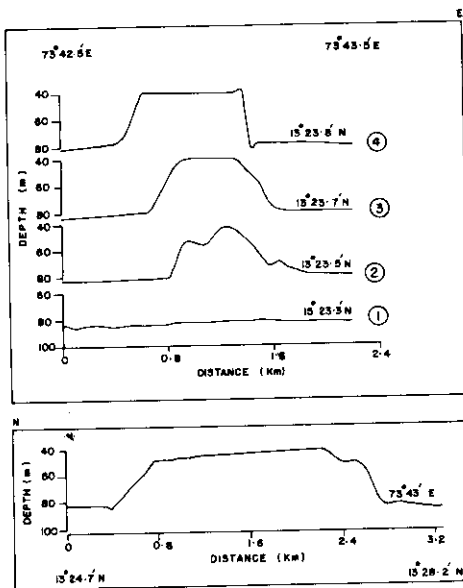


Fig. 4 : Cross-section profiles over Gaveshani Bank, constructed from depth grid generated from multibeam data.

The present study shows that topographic highs such as banks and seamounts can be recorded with single beam echosounder, when the trackline is placed over the feature of interest, but the exact extension and detailed morphology can only be obtained from the multibeam data. Therefore multibeam mapping of various features reported earlier need to be carried out to know their true morphology. From the bathymetric data obtained from 280 km long shelf between Kasargod and Karwar, no bank or high similar to the Gaveshani Bank is observed. Hence this feature appears to be an isolated occurrence.

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