

STRUCTURE OF WESTERN INDIAN CONTINENTAL SHELF BETWEEN BOMBAY AND GOA

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Introduction: This study is a part of an extensive project undertaken by the Indian National Science Academy on Arabian Sea Islands, to know in detail about the relationship of Indian continental shelf with that of Arabian Sea Islands.

The unconformities and the NW-SE trend of folds and faults of the northern Indian ocean floor near Ceylon give evidences of reactivation of fracture zones. The movement occurred in early and middle Miocene time (Eittem and Ewing, 1972). Here an attempt is made to know the nature and the off-shore extent of coastal structure.

The data of echo-sounding profiles was collected on INS DHARSHAK in the Arabian Sea on cruise No. 7 during 7th May, 1971 and 14th May, 1971.

Geological Setting: The West Coast of India between Bombay and Goa is known as the Konkan coast (Fig. 1). The coastal area up to Ratnagiri is made up of

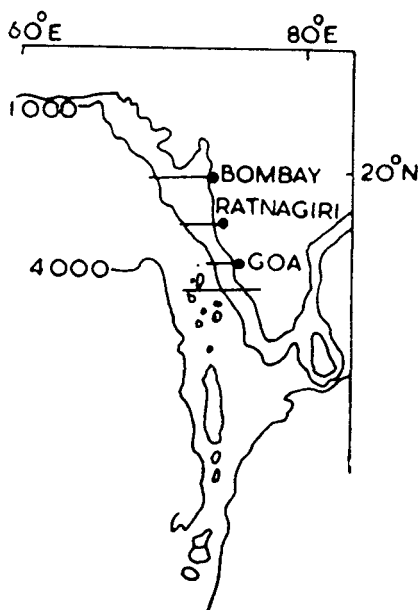


Figure 1. Map showing the locations of profile taken.

Deccan Traps and between Ratnagiri and Goa of Dharwarian rocks of Western Ghats. The continental shelf between Bombay and Goa is covered by lower to middle Eocene cherts followed by Pelagic sediments which are thick in the northern than in the southern part. Structurally and stratigraphically the region can be divided into three parts—nearshore islands, middle part of the continental shelf and the Chagos-Laccadive Ridge.

The survey by DSDP (Leg 23) revealed that the middle part up to Chagos-Laccadive Ridge is penetrated by N-S normal faults which were active even after

middle Eocene. The middle Eocene chert to the west of Chagos-Laccadive Ridge wedges out against younger ocean basement and shows the presence of several normal fracture zones. The nearshore islands are either faulted blocks of the mainland or made up of igneous basic or acidic rocks.

Interpretation of data: The echo-sounder profiles revealed that off Bombay the shelf area is almost completely uniform in tone (Fig. 2a) whose relief is, at most gentle and rolling, in keeping with the presumed existence of a thick blanket of sediments. On the other hand, a record along the continental slope off Ratnagiri and Goa showed the presence of sharply defined portions indicating floors of different roughness but to some extent covered with sediments having definite slope than the profile off Bombay (Fig. 2b & c). The rough surfaces, represented by the profile, may indicate that these portions of slope have been scoured by the passage of slumps and turbidity currents. Such profile as off Goa (Fig. 2c) originate from the down-slope movement of the sediment due to high currents.

In Fig. 2b the steep walled deepening in the cross-section shows a canyon type feature. An upbulge, near the base of the steep wall of the canyon, shows some slumped portion. This canyon and the gullies are prominent in Ratnagiri cross section.

The records taken off Bombay and Ratnagiri show 1° – 3° gradient of continental slope, while off Goa the gradient is 10° – 15° . These echo-sounder profiles reveal striking presence of step like features on the continental portion. These steps are narrow, flat and almost horizontal surfaces separated by steeper slopes as in Fig. 2b & c. Nair (1972) also suspected the possibility of three narrow almost horizontal features as submerged beaches. The small raised portions on the steep walls of the possible fault planes or on the walls of canyon are the pinnacles which are restricted to a depth of 95-100 m.

In comparison with the relatively complex structural pattern of the continental margin—Western Ghats, the rock units and faults and folds on the shelf are discarded on account of their lack of sufficient data helpful in their interpretation. However, the faults are always associated with bending fold. This is due to the lateral compressional forces. Sykes (1970) and Eitteim and Ewing (1972) pointed to the most seismically active zone in the northern Indian ocean south of Ceylon. The sediments in this zone are folded and faulted and the strike of these folds and faults is parallel to the strike of Himalayas and normal to the shear zones observed by Abdel-Gawad (1971) on the western end of the Himalayas. Faults almost certainly dissect the continental slope in the terrace like features and cliffs. Accordingly, it seems most likely that the beaches, described as submerged beaches by Nair (1972) were cut at the edge of the sea during pauses in the general sinking of the land from a much higher level than at the present time. Krishnan (1968) said that the West Coast fault line was formed sometime in late Pliocene. This subsidence took place possibly in middle Miocene times, marking stages in the crustal collapse of this region. Keeping in view that West Coast of India is formed due to a main fault running NW-SE (Krishnan, 1968) and these subsidences probably are the series of parallel normal faults as shown by Eremenko and Datta (1968) in a section (Fig. 3) taken from Calicut to Laccadive which seem to be the rejuvenation of tectonically weak fractures already present in the basement. The opening up of the fracture zones with the left-lateral oblique slip movements and formation of near shore islands show an anti-clockwise movement of the Indian subcontinent.

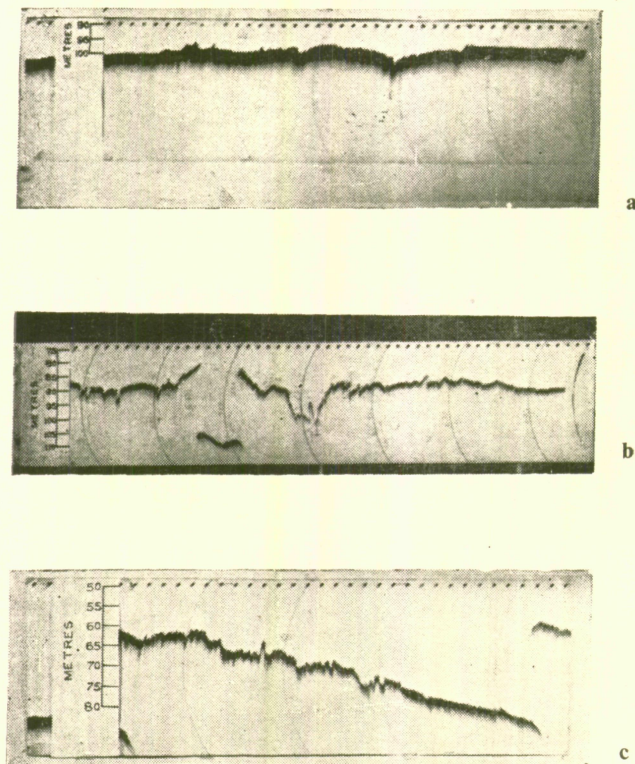


Figure 2. Comparative Echo-Sounder Profiles of the Continental Slope obtained by INS DHARSHAK while on cruise No. 7 off a. Bombay, b. Ratnagiri and c. Goa. Note the breaks in the echo-sounding lines and a considerable deepening of the profile off Ratnagiri.

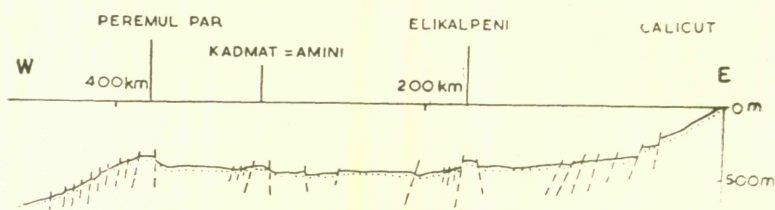


Figure 3. Geological cross section from Calicut to Peremul Par Islands (Based on Seismic Profile R-7 from Gagelgantz, Voevodina and Party), (Eremenko and Datta, 1968).

Discussion: The western Indian continental shelf shows activity along three major tectonic lineaments which are produced by

1. NNW-SSE coastal down-faulting during Mesozoic and Tertiary times.
2. Formation of the compressional ridge – the Western Ghats, and
3. the strike of folded and faulted sediments south of Ceylon parallel to the strike of Himalayas.

The West Coast fault zones extend NW all along the West Coast of India as are clear from the echo-sound profiles and run parallel to the NNW-SSE trending compressional ridge—the Western Ghats. These parallel fault zones on the continental shelf represent a zone of weakness created by the vertical movements during the northward and anticlockwise movement of Indian subcontinent due to plate tectonics.

From the DSDP (Leg 23) survey, it is clear that the marine deposition occurred during Lower Eocene in a gradually deepening environment on a faulted continental shelf. The vertical movement and unconformities give evidences of normal fracture zones. The main sinking movement occurred in early and middle Miocene times which incidentally coincide with the paraoxymal phase of the Tertiary Orogenic and Epeirogenic revolution in the Himalayan region (Pande and Kumar, 1974). The deformation of sea-floor south of Ceylon points to the nascent-arc trends system showing a still active zone.

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OSTREA IN THE MIOCENE BEDS OF MAYURBHANJ, ORISSA

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Introduction: The Miocene beds of the district Mayurbhanj in the state of Orissa, are fairly well-exposed along the banks of the river Burhabalanga, especially to the south of Baripada town ($21^{\circ}56' : 86^{\circ}44'$). They are commonly known as Baripada beds and have yielded a rich and varied assemblage of both mega and microfossils. The megafossils from the Baripada area were given a cursory treatment by palaeontologists in the form of abstracts and brief notes. The present assemblage of megafauna comprises species of *Ostrea*, *Leda*, gastropods (molds only), and a few