

SUBMARINE CANYONS OFF THE COROMANDEL COAST

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During the 26th Cruise of I.N.S. 'KISTNA', a bathymetric survey was carried out in some detail off the Pondicherry coast. This survey has revealed the existence of three sets of distinctly separate canyons between Cuddalore and Palar River. The morphological features of these canyons are briefly described in this paper on the basis of a few traverses taken across each of these canyons.

INTRODUCTION

Before the International Indian Ocean Expedition, practically no Submarine Canyons were investigated off the East Coast of India except the trough like valley off the Ganges delta (Killerich 1958; Hayter 1960). But the detailed surveys conducted during the expedition period have brought to light the presence of a number of valleys off the East Coast of India (LaFond 1964; Varadachari 1964; Subba Rao 1964; Balaramamurty 1965). These studies reveal that their occurrence may be considered a rule rather than exception.

The hundred fathom curve on the British Admiralty chart number 71, bends near to the coast at a number of places near Pondicherry suggesting the possibility of the presence of some canyons. But the existence of canyons in the area was established only during the 15th cruise of I.N.S. 'KISTNA' and on the basis of a single traverse taken on this cruise the presence of some canyons was reported earlier (Setty 1964; Rao 1964). The shelf and slope regions of this coast were surveyed in some detail during the 26th cruise of I.N.S. 'KISTNA' when the existence of three sets of distinctly different canyons could be established in the area and more details collected about the canyons. The object of this paper is to present briefly the results of this survey based on a few traverses taken across each of these canyons

DESCRIPTION OF THE CANYONS

The location of the canyons and the traverses taken across them are shown in figure 1. The depths as obtained from an Edo Echo Sounder have been transferred on to the chart and using these depths and those available on the British admiralty chart, an approximate contouring has been done as shown in figure 1. The transverse profiles of these canyons as obtained on the echograms are presented in figures 2, 3 and 4. The longitudinal profiles for these canyons are shown in figure 5. The canyons have been given different identifying names making use of the names of the towns in the vicinity or rivers where prominent towns are not available.

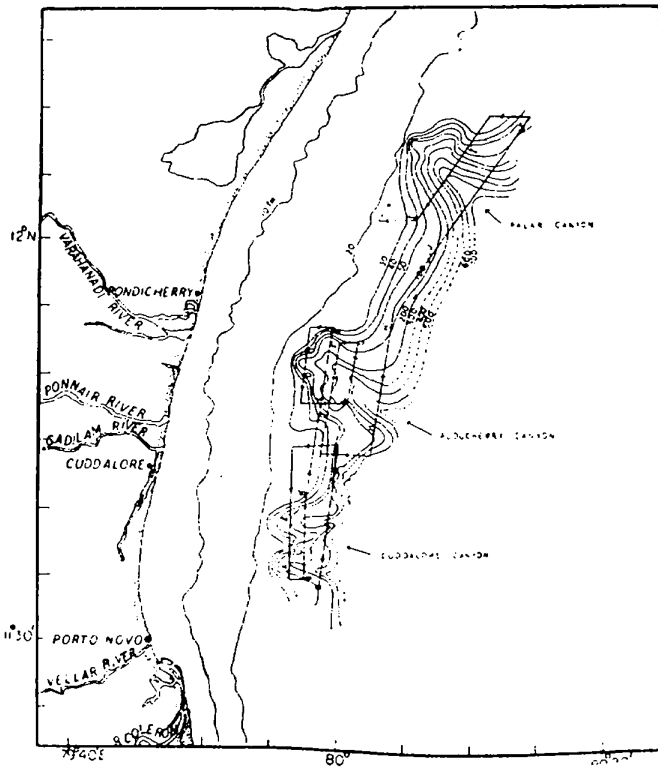


FIG. 1. Map showing location, bathymetry of canyons and cruise tracks.

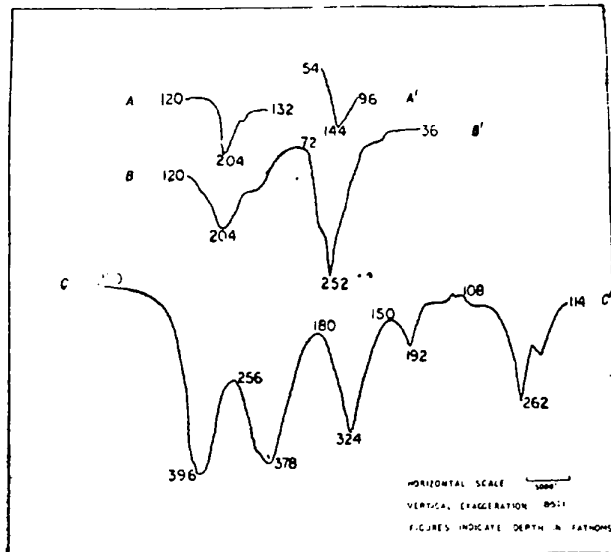


FIG. 2. Transverse profile of Cuddalore canyon,

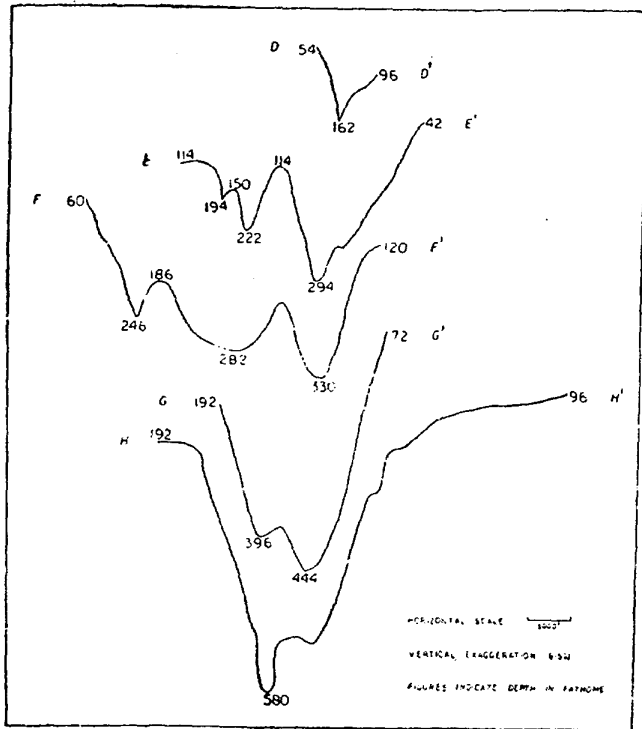


FIG. 3. Transverse profile of Puducherry canyon.

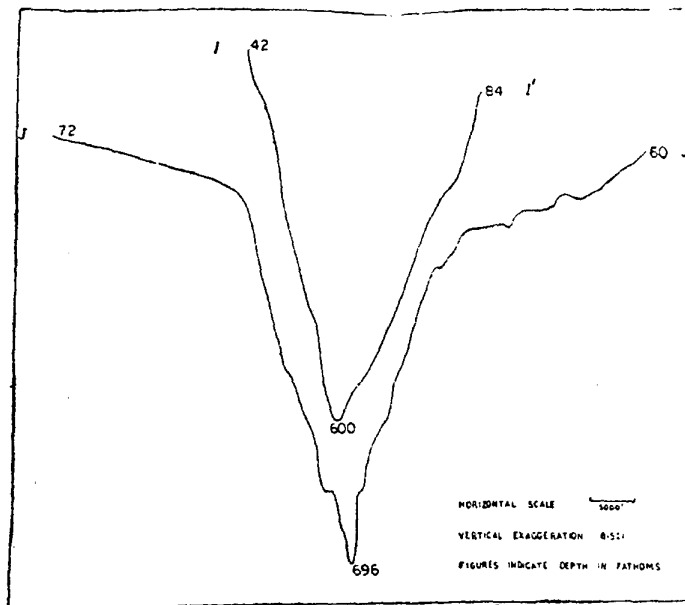


FIG. 4. Transverse profile of Palar canyon.

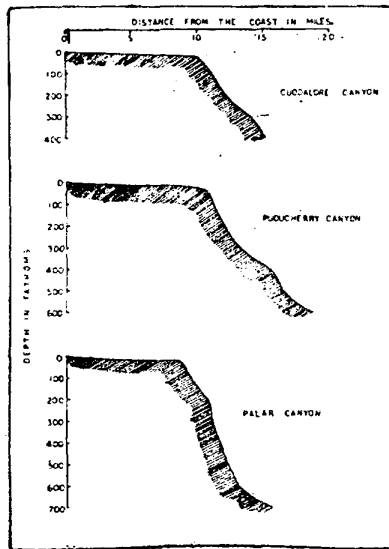


FIG. 5. Longitudinal profiles of the canyons.

CUDDALORE CANYON

This canyon has two major valleys with their heads located between 20 and 30 fathoms. Three traverses were taken across this canyon. In the landward traverse (A-A') two valleys were encountered (Fig. 2). They are fairly symmetrically V-shaped and steep walled. They have crossing depths of 204 and 144 fathoms. In the middle traverse, while the southern valley becomes broader and shows the same depth as in the first traverse, the northern valley becomes steeper. The inter valley crest between these two valleys has a sill depth of 72 fathoms. Both these valleys have small depressions on their northern walls. The seaward traverse has revealed the presence of five valleys and have crossing depths of 396, 378, 324, 192 and 262 fathoms. These valleys are separated by ridges having sill depths of 256, 180, 150 and 108 fathoms. While the three crests in the southern side are sharp the northern ridge is flat topped and has a few pinnacles. The depressions in the northern walls of the valleys in the middle traverse show up as prominent valleys in this traverse. While the two southern valleys on this traverse are more U-shaped, the other valleys are V-shaped and steep walled. From the shape of these valleys it could be said that they extend further seaward.

PUDUCHERRY CANYON

The canyon heads in around 30 fathoms. The landward traverse (D-D') shows one valley with a crossing depth of 162 fathoms (Fig. 3). The second traverse (E-E') shows three valleys with crossing depths of 194, 222 and 294 fathoms while

the inter valley crests have sill depths of 150 and 114 fathoms. The third traverse also shows three valleys with crossing depths of 246, 282 and 330 fathoms and the inter valley crests have sill depths of 186 and 222 fathoms. The valleys show a tendency to become broad. The fourth traverse (G-G') shows two valleys with crossing depths of 396 and 444 fathoms. The seaward traverse (H-H') shows more or less one valley with a crossing depth of 580 fathoms. Thus the valleys of the middle traverses show a tendency to merge together to form one valley with a V-shape on the seaward side.

PALAR CANYON

This canyon was named after Palar river which joins the sea at lat. $12^{\circ}28'N$ long. $80^{\circ}10'E$. The two traverses (Fig. 4) show that the canyon is symmetrically V-shaped and steep walled with the steepness increasing seaward. They have crossing depths of 600 and 696 fathoms in the two traverses I-I' and J-J' respectively. On the rim of northern wall in the seaward traverse hummocky type of topography is found with numerous mounds separated by intervening depressions. From the shape of the canyon it can be said that the canyon extends seaward.

An examination of the longitudinal profiles for these three canyons (Fig. 5) shows that the Palar canyon has the steepest longitudinal profile (average slope angle $6^{\circ}07'$). While the Cuddalore canyon has a more flat profile (average slope angle $4^{\circ}17'$) with the slope of the Puducherry canyon (slope angle $4^{\circ}42'$) coming in between.

DISCUSSION

According to Shepard (1963) the shelf edge off the East Coast of India is around 50 to 70 fathoms except off the deltas where it shoals to 20 fathoms. Off Pondicherry coast the shelf break occurs around 80 fathoms. The shelf is narrow where the canyons are present and this coast is characterised by the presence of a number of rivers (Coleroon, Vellar, Gadilam, Ponnir, Varahanadi and Palar) that empty into the sea. The heads of the canyons are a few miles away from the coast. They occur around 30 fathoms depth and do not seem to lead into the river channels. This may perhaps be because the seaward ends of the river channels and the headward portion of the submarine valleys are obscured since the end of the pleistocene glacial period; or the canyon heads did not cut across the shelf because they lacked sediment necessary for submarine erosion since the rapid rise of the sea level during the pleistocene period or the slope of the shelf between the coast and the present day heads of the canyons is not sufficient to create a submarine erosion.

Most of the hypotheses on the origin of the submarine canyons have been discarded in recent years, leaving only the turbidity current hypothesis and another which combines subaerial erosion with drowning and maintenance of the canyons by turbidity currents, submarine slides and sand flows (Shepard 1963). The conspicuous presence of these canyons off the Pondicherry coast where a number of rivers empty into the sea may lead one to think that these canyons might have been formed by subaerial erosion by rivers during the pleistocene glaciation period or even earlier, as the East Coast of India is believed to have taken its present shape as

early as in the upper Jurassic (Krishnan 1960). But this would require lowering of sea level to about 1000 fathoms and further it cannot explain the sharp break in longitudinal profile of the submarine canyon at the shelf break. No doubt, the sediment distribution gives indications of lowered stand lines of the Bay of Bengal (Rao and Mahadevan 1957). But it is no more than 100 fathoms. Hence it is quite possible that these canyons might have been formed as a result of submarine erosion. An examination of the storm tracks in the Bay of Bengal show that the Pondicherry coast is frequently crossed by severe storms which may perhaps supply the triggering mechanism for the turbidity currents necessary for the maintenance of these canyons.

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