

Reprinted from the
Recent Researches in Geology (Volume 7)
"A COLLECTION OF PAPERS IN MEMORY OF
PROFESSOR A. G. JHINGRAN"

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CONTINENTAL SHELF SEDIMENTS OF MADRAS,
BAY OF BENGAL

by

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PUBLISHED BY
HINDUSTAN PUBLISHING CORPORATION (INDIA), DELHI-110007
(1978)

RECENT FORAMINIFERAL ASSEMBLAGES FROM THE CONTINENTAL SHELF SEDIMENTS OFF MADRAS, BAY OF BENGAL

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Introduction

During the 15th Cruise of INS Kistna, as part of the International Indian Ocean Expedition, several sub-surface samples were collected, (using LaFond-Dietz snapper), from the continental shelf region of the Bay of Bengal. Samples from two locations, one of which is from the near middle shelf (sta. no. 381, at Lat. 13°05'N 80°24'E) at 46 m depth, and the other from the edge of the continental shelf (sta. no. 353 at Lat. 13°06'N 80°34'E) at a depth of 183 m, are considered here. They represent two distinct sedimentological environments (i.e., augite-rich and augite-poor zones) (Setty and Rajamanickam, 1972).

The purpose of this study is to evaluate the foraminiferal fauna, its content, its diversity, relationships of species in the environment, their zoogeographical provenance and also some of the major characteristics of a few species encountered.

(Earlier, Bhalla (1970) reported the foraminiferal content of the Marina beach of Madras.

T-S and Oxygen Relationships

The surface water temperature (28.10 and 30.80°C) in these two stations (Nos. 381 and 353) is not very much variable but it becomes gradational and low with depth (25.41°C at sta. no. 381 at 46 m depth;—no data available for sta. no. 353). This indicates that water becomes cooler with depth. However, the salinity variation of the surface waters (34.243 and 34.455 per mille) at these two stations appears to be very negligible.

The dissolved oxygen in the surface waters and that of the water mass at depth of sta. no. 381 indicates a remarkable degradation (i.e., 5.41 ml/l at the surface to 2.85 ml/l at 46 m depth). This depletion may be due to various factors including increased organic matter on the subsurface which gives rise to reducing conditions. This results in the destruction of the fauna. Comparatively sta.

no. 381 is low in the richness of the fauna, but it does not indicate any reducing condition as prevailing there.

Such a variation in temperature, salinity, and oxygen content from the surface to deeper waters exercises a profound effect as limiting factors of environment on the biocoenosis of the foraminiferal fauna (the standing crop of the region) and in turn their contribution to the thanatacoenosis in the sediment, permitting least transport and disturbance in the environment. This is reflected in the relative degree of species abundance, and also the diversity in that region.

Discussion

The freshly collected samples (at the time of collection), before washing and also after concentration, showed the richness of the fauna. Foraminiferal productivity, therefore, can be stated to be high in the shelf region (off the Madras Coast) in its number and diversity.

The planktonic species and their populations are found to be comparatively low at sta. no. 381 at 46 m depth but their number is increasingly manifested towards the outer shelf and edge of the continental shelf (sta. no. 353 at 183 m depth). This is a common and well-known phenomenon as noted by Phlegar (1960) in Gulf of Mexico; Murray (1976) in Vineyard Sound and Central Texas shelf; and Uchio (1960) in San Diego area. The planktonics are represented by a dozen species, of which *Globigerina bulloides*, *Globigerinella aequilateralis*, *Globoquadrina dutertrei*, *Pulleniatina obliqueloculata*, and *Globigerinoides conglobatus* are common, while *Globorotalia menardii* and *Orbilina universa* are rare. All these are typical warm water species.

However, the benthonic populations abound the substrate with a variety of calcareous and several species of agglutinated forms. Most of the species encountered here are cosmopolitan in nature. The miliolids, *Ammonias*, *Cibicides* sp. and *Elphidium* sp. dominate the entire population; while *Bolivina* sp. *Amphistegina* sp. and *Lagena* sp. are very rare. The dominance of thick-shelled, robust forms of *Ammonia* sp. *Elphidium* sp. and some miliolids may be due to their ability for survival and preservation over long periods of time than to the delicate, and the thin-walled forms.

Textularia candeiana, *Bolivina folia* and *B. lowmani* are widespread, while *Poreponides cribroropandus* and *Buliminella elegantissima* are very rare in our samples. *Cancris sagra* is abundantly found here as it ranges from 37-1000 m depth. *Bolivina lowmanii*, *Triloculina tricarinata*, and *Ammonia beccarii* are characteristic bay fauna and found in the middle shelf (sta. no. 381 at 46 m depth). Similarly, the typical Gulf fauna (Phlegar 1960) like *Cibicides depremus*, *C. floridanus*, *C.*

umbonatus, *Eponides repandus*, *Gaudrina flintii* and *Quinqueloculina bicostata* are also found here.

Fissurina scmiopaca, *Lenticulina gibbus*, *Lagena striata*, *Trifarina bradyi*, *Pyrgo depressa* are common in the muddy sediment (Murry 1973) and are found in both the sampled localities. Though *Quinqueloculina bicostata*, *Gaudrina flintii*, *Triloculina tricarinata*, *Textularia agglutinata* are characteristic of sandy substrate, they are also encountered here.

Elphidium morenoi, *E. crispum* and *Milliolinella subrotunda* can withstand hyposaline to hypersaline as well as cold to temperate conditions; they are found to occur only as rare in this region.

Bolivina albatrossi which is a widespread, offshore, outer slope and deep water (175-1500 m) species preferring muddy substrate, and normal marine (32-36‰ S) conditions appears only in the offshore material (sta. no. 353, at 183 m depth). It is known to occur as rare even at 100 m in the Gulf of Mexico (Phlegar, 1951), but it is for the first time recorded from this region.

Textularia mayeriana is an agglutinated species which is typical of shallow water neritic, subtropical, open ocean environment. The living specimens range at 20-60 m depth whereas the dead populations can be traced upto 250 m depth (Phlegar, 1956). It is found to be associated with *Ammonia tepida*, *Trifarina bradyi*, and *Triloculina tricarinata*. It occurs in the middle shelf region here with the equivalent fauna. It is for the first time that its occurrence is recorded from the east coast faunal assemblage. *T. mayeriana* is found in the chinen sands of Pliocene of Okinawa (LeRoy 1964). Its occurrence faunistically supports the earlier observation (Setty and Rajamanickam, 1972) that the heavy mineral suite indicated a fluctuation of sea level and also the possible existence of a relict structure. However, more supporting evidence in additional faunal populations may be helpful to confirm this observation further. *Ammonia beccarii* is found at sta. no. 381 only. It is restricted to 0-50 m depth zone whose temperature range is 15-30°C and characteristic of hyposaline to hypersaline waters including normal marine nearshore conditions. Station no. 381 is a nearshore region where the temperature is 28.10°C, salinity—34.243 per mille and dissolved oxygen content (2.85 ml/l) at the substrata-water interface. Therefore, the conditions appear to be favourable for their prolific growth and development. *Ammonia* sp. is found to be one of the dominant species (*A. beccarii*, *A. dentata* and *A. tepida*) in this sample along with *Elphidium* sp. (*E. crispum*, *E. clavatum* and *E. gunteri*) which has similar habitat, temperature and salinity ranges. These two species become very good indicators of a 'modified' environment in coastal waters as a result of pollution (Setty 1976b, in press).

Comparison Between Areas

Several species of this region are common to those earlier described by Ganapathi and Satyavati (1958) and Bhalla (1968) from Vishakapatnam coast; and a few to those of Vedantam and Rao (1970) off Pentacota. Some species are also similar to those described by Setty (1976a, in press) off Pondicherry. Thus, many species of this region are common to those found in areas both north and south of this region.

Cancris sagra, *Triloculina tricarinata*, *Poreponides cribroripandus*, *Ammonia beccari* and variants and *Spiroloculina communis* are common to those earlier reported off Kerala on the west coast of India (Setty, 1974).

It is also interesting to note that a few species found in this region are also reported from a similar environment in the Leeward bays of St. Lucia, West Indies (Sen Gupta and Scafer, 1973). The species are, *Cancris Sagra*, *Cibicides lowmanii*, *Quinqueloculina aglutinata*, *Textularia candeiana* and *Triloculina tricarinata*. Some species which are typical of Gulf fauna are reported from the Gulf of Mexico (Bandy, 1956). Thus, these species exhibit a wide geographic distribution.

Heron and Earland (1915) have reported the occurrence of *Spiroloculina communis*, and *Triloculina tricarinata* from the Kerimba archipelago; Braga (1967) from southern Mozambique, and Albani (1965) from the Durban bay. Many of the species found here like *Quinqueloculina subcuneata* and *Q. parkeri* are also reported from the Neogene and Holocene deposits of South Pacific, thus showing an affinity to the Indo-Pacific faunal realm. Thus, many of the species present in the study area are common with the East African coastal foraminiferal assemblage on the one hand, and the Indo-Pacific assemblage on the other. Hence, this fauna also, as referred to earlier (Bhalla, 1968, 1970; Setty, 1976a, in press) represents a mixed environment and appears to be influenced by tropical conditions.

Acknowledgements

The author is thankful to Dr. S. Z. Qasim, Director, National Institute of Oceanography for his interest, and to the Captain and shipmates of INS Kistna for assistance in collecting the samples.

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