

GRAPHIC PATTERN OF FORAMINIFERAL DOMINANCE IN NEARSHORE REGION OF CENTRAL WEST COAST OF INDIA

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ABSTRACT

Within the inner neritic zone (0-55 m depth) along the central west coast of India, some foraminiferal groups such as *Ammonia*, *Elphidium*, *Trochammina*, *Bulimina*, *Bolivina*, *Nonion*, *Nonionella* and *Florilus* individually (total foraminiferal number) and collectively (total species number) are dominant. Their distribution pattern is shown graphically. The living/dead foraminiferal test ratio was found to be anomalous but the richness of foraminiferal number probably reflects the high organic productivity of the region.

The distribution pattern of benthic foraminiferal species generally varies from one region to the other particularly when variation in temperature gradient, bottom sediment character and salinity fluctuation due to run-off are considerable. Bathymetric ranges of species and their groups show a trend within a given region and these may have a correlation with those which occur under similar conditions. Therefore, such a record of events and conditions may be necessary to establish their distribution sequence and the existence of such depositional environments for future record. This study is an attempt in this direction.

Within the inner nearshore zone (0-55 m depth) of Dabhol-Ratnagiri-Vengurla sector along the western Indian continental shelf (Fig. 1), exists a high species diversity of foraminiferal fauna and this zone also contributes a large foraminiferal number (populations) (Nigam, Setty and Ambre, 1979). The material which formed the basis of the present study was collected during the 17th cruise of R.V. *Gaveshani* using grab, snapper and core (see Fig 1). The fauna described here occurs abundantly and is typically characteristic of such marginal marine features as bays, estuaries and intertidal marshes where dilution of sea water takes place and salinity cannot remain constant. Further, the region is continuously influenced by seasonal changes in river discharge, temperature variation, organic productivity, terrestrial sediment input and organic matter deposition. The microenvironments or milieus produced locally and the possible parameter/s directly responsible for them, have already been carefully delineated (Setty and Nigam, 1979). The area under consideration includes fresh and brackish (estuarine) environment along the shoreward side, and 55 m depth contour on the seaward side. The faunal distribution of the dominant species studied is represented graphically in Fig. 2 (A to H).

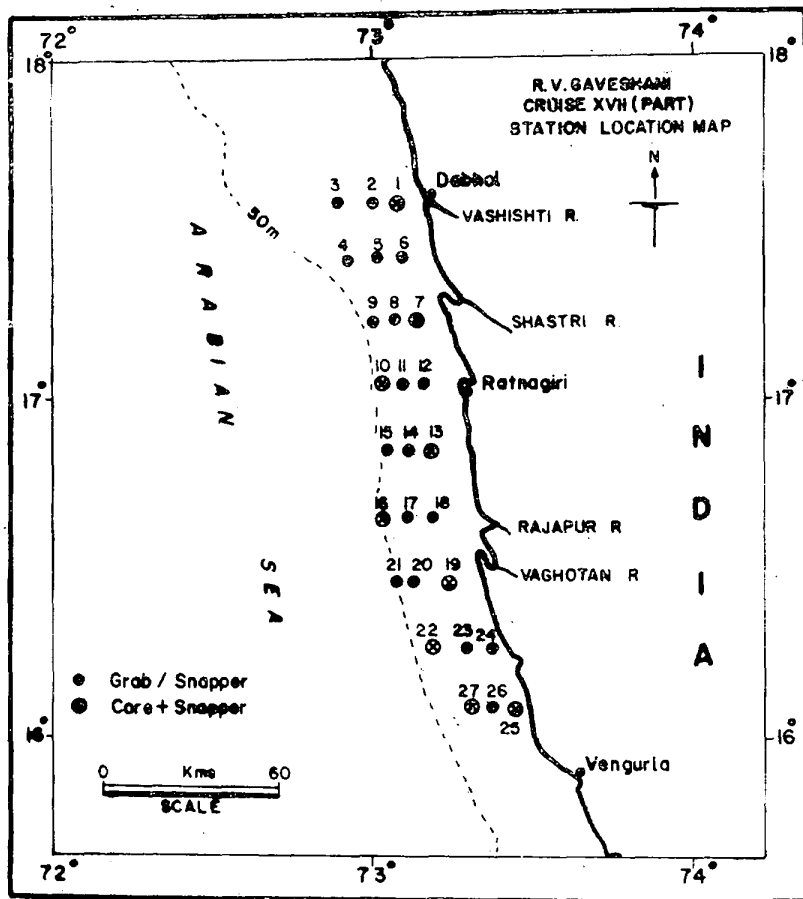


Fig. 1. Map showing the location of stations and methods of sampling.

Ammonia fauna (Fig 2 A): *Ammonia* spp. are noticeably very dominant and most numerous in the entire study area, the depth range of which is 0-50 m. It is the transition fauna between the marginal marine and open marine faunal groups (Walton, 1964). Its dominance gets reduced in areas off the river mouths but beyond 50 m depth it thins out considerably (Setty and Nigam, 1979). Its faunal association is more with *Elphidium* which has a similar range in distribution. On the seaward side, it is bound by *Bulimina* dominant zone and grades into subdominant *Bolivina* fauna. The characteristic abundant species are *Ammonia annectans*, *A. beccarii*, followed by *A. dentata*, *A. papillosus* and *A. sp.*

Elphidium fauna (Fig 2 B): *Elphidium* has a depth range of 0-50 m. It is less abundant off the river mouths but sometimes tends to be low or absent if fresh water influx and terrigenous material deposition becomes very high. It increases gradually

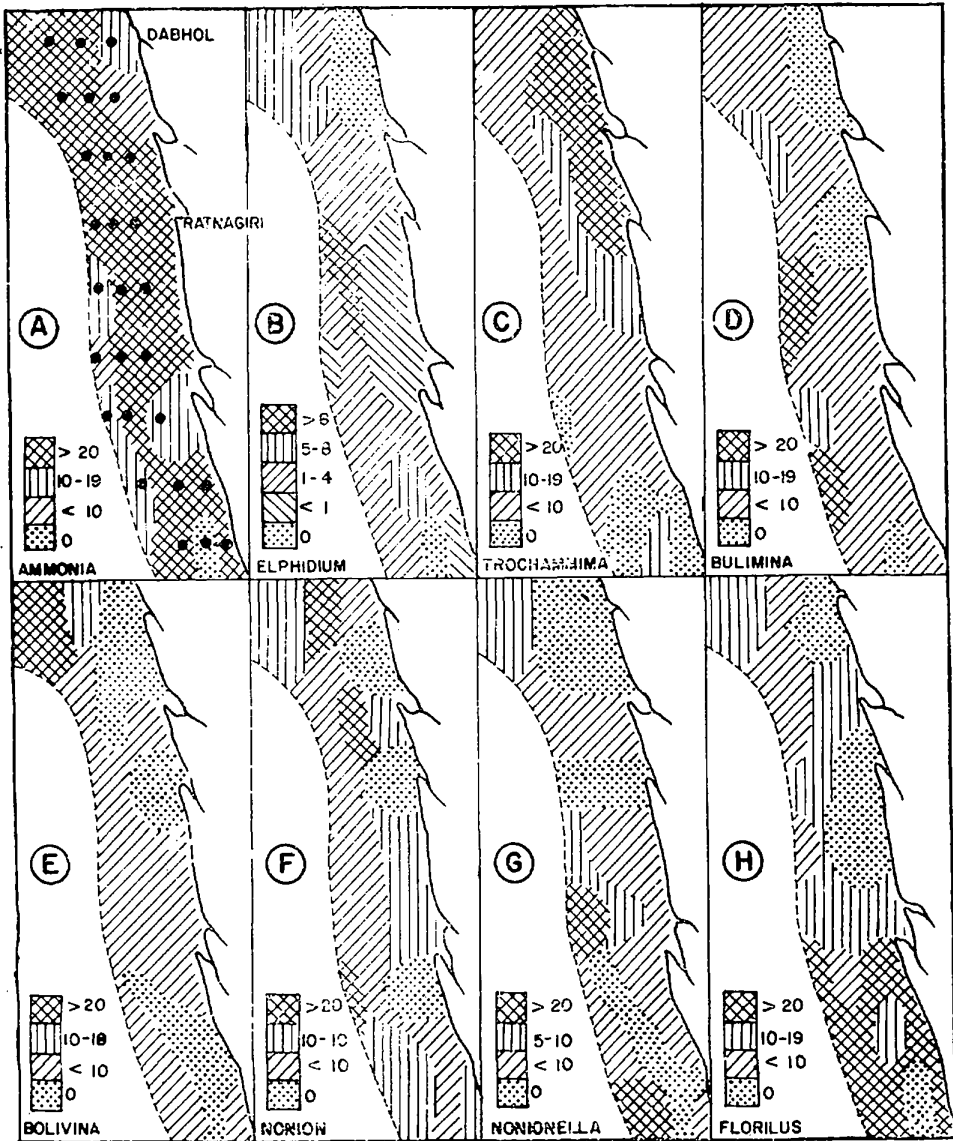


Fig. 2. (A-H) : Distribution patterns of foraminifera in the inner neritic zone (0-55 m depth) along central west coast of India.

(A) *Ammonia* (B) *Elphidium* (C) *Trochammina* (D) *Bolimina* (E) *Bolivina* (F) *Nonion* (G) *Nonionella* and (H) *Florilus*.

in waters towards the open sea. However, its density in the region is very low. *Elphidium* is represented here by 7 species: *Elphidium advena*, *E. craticulata*, *E. crispum*,

E. falunicum, *E. indicum*, *E. minutum* and *E. simplex*. At stations where organic matter is high (4.86 to 5.15%), *E. falunicum*, *E. minutum* and *E. simplex* dominate.

Trochammina fauna (Fig 2C): *Trochammina* is common in hyposaline to hypersaline waters (33–37‰), muddy substrate and typical tidal marsh, intertidal and nearshore environment (0–30m depth) though a very few species are known in bathyal conditions upto 2000m depth (Murray, 1973). It is maximum at stations where fresh water influx is high such as in off-the river mouths. Bhatia and Kumar (1976) also noticed similar distribution at Binge Bay near Karwar. Its frequency diminished seaward side. In this region *Trochammina* is represented by two species: *Trochammina inflata* and *T. pacifica*. These species are invariably associated with *Ammonia agglutinans*. Thus *Trochammina* is characteristic of low salinity, estuarine condition and sediments with low organic matter.

Bulimina fauna (Fig 2D): The depth range of *Bulimina* according to Murray (1973) is between 40–1000m and according to Walton (1964), it is typically an open-marine fauna but in this region *Bulimina* is found to be present all along the shore together with *Ammonia*, *Elphidium*, *Bolivina*, *Florilus* and *Trochammina*. *Bulimina* sp. is absent at the river mouths as it cannot tolerate low salinity but in the low estuarine conditions where salinity range improves it is poorly represented. Towards the seaward side its abundance increases. The fauna is represented by *Bulimina exilis* and *B. marginata* which seem to prefer sandy clay and silty clay substrate for their prolific growth.

Bolivina fauna (Fig. 2E): *Bolivina*, according to Walton (1964) and Murray (1973) is typically a deep water (150–1000 m depth range) species, hence it occurs as a common, outer neritic, bathyal fauna; but it is also present in the nearshore areas of this region. However, it is absent off the river mouths as in the case of *Elphidium*, *Bulimina*, *Nonion*, *Nonionella* and *Florilus*. Also, it is very sparsely distributed in the entire region. It is represented by 7 species: *Bolivina attica*, *B. goesii*, *B. lanceolata*, *B. punctata*, *B. striatula*, *B. subaenariensis* and *B. translucens* but the dominating ones are *B. striatula*, *B. subaenariensis* and *B. lanceolata*. Towards the seaward side this fauna grades into *Bulimina* and *Nonionella* faunal zone.

Nonion fauna (Fig 2F): *Nonion* is an open continental shelf fauna occurring from 0–180 m and it is characteristically absent off the river mouths. It is quite abundant all along the shallow sea and dominant in patches upto 25 m depth. It becomes less abundant between 25–55 m depth throughout the study area. *Nonion* is represented here by 5 species: *Nonion elongatum*, *N. granosum*, *N. perforatum*, *N. sp. 'A'* and *'N' sp. 'B'* but *N. elongatum* is the most predominant species in the area. Fluctuation in organic matter content appears to have no effect on this species.

Nonionella fauna (Fig 2G): *Nonionella* has a distribution range of 10–1000 m depth. It is more common in deeper parts and in the regions of coarser sediment than in near shore areas or in clayey substrate. The fauna is represented by *Nonionella basispinatus*, *N. auris*, *N. turgida* and *N. translucens*. The first two species are predominant.

Florilus fauna (Fig 2H): Except for the mouths of relatively large rivers in the northern part of the study area, *Florilus* is very abundant in the rest of the region. It is represented by 3 species: *F. boeuanum*, *F. scaphus* and *F. grateloupi* in the order of

predominance. They show a positive correlation with organic matter present in the sediment.

The dominant genera described above are common, regional and characteristic of the ecosystem, hence correlatable. Though the number of species are many; as a general rule, only two or three species show generic dominance over all others. Other species included in the total species counts are rare, but they are restricted often to certain stations only, hence unreliable as environmental indicators but become specific to signify a habitat (Setty and Nigam, 1979).

Further it is also observed that: (i) living/total foraminiferal test ratio is anomalous (0-55.6%) which reflects on the rate of sedimentation (being high at some and low at other stations), (ii) richness of foraminiferal tests indicating high organic productivity, (iii) the rate of destruction of foraminiferal tests is low except for *A. annectans* which may be transported from a relict sand zone present off Ratnagiri, and (iv) some morphological abnormalities noticed (accelerated growth in the last 3-4 chambers) in *Nonion*, *Florilus*, *Ammonia*, *Bulimina exilis* and *Virgulina*.

The percentage distribution and faunal dominance observed in the study area clearly demonstrates that: (a) high *Trochammina* population at stations near the river mouths in the northern part is indicative of relatively high influx of fresh water and comparatively less run-off in the southern part of the area, (b) high populations of *Bolivina*, *Bulimina* and *Nonionella* at the outer stations indicating their preference to normal marine conditions and intolerance to fluctuating environment nearer shore, (c) *Ammonia* sp. being dominant at mid-stations shows its high tolerance in the overlapping environment, (d) the regions, where *Florilus* is predominant, are characterised by low run off and high organic matter and (e) *Nonion* and *Elphidium* are absent or rare in regions where there is high influx of fresh water since they are intolerant to hypersaline conditions.

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REFERENCES

- Bhatia, S.B. and S. Kumar, 1976. Recent benthonic foraminifera from the inner shelf area around Anjidiv Island, off Binge, West Coast of India. 1st International Symposium on Benthonic foraminifera of continental margins, *Part A: Ecology & Biology, Maritime Sediments*, Sp. Publ, 1: 239-249.
- Murray, J.W., 1973. Distribution and ecology of living benthic foraminiferids. *Heinemann Educational Books*, 248-251.
- Nigam, R., M.G. Anantha P. Setty and N.V. Ambre, 1979. A checklist of benthic foraminiferids from the inner shelf of Dabhol-Vengurla region, Arabian Sea. *Journal of the Geological Society of India*, 20: 244-247.
- Setty, M.G. Anantha P. and R. Nigam, (1979). Microenvironments and anomalous benthic foraminiferal distribution within the neritic regime of Dabhol-Vengurla sector of Arabian Sea. *Seventh Colloquia, Indian Micropaleontology & Stratigraphy*, (Abst) p. 1 (in press).
- Walton, W.R., 1964. Recent foraminiferal ecology and paleoecology. In: *Approaches to Paleocology*, edited by J. Embrie and D. Newell, John Wiley, New York, 151-237.