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Taxonomy and Distribution of Recent Benthic Foraminifera from the Inner Shelf of Gulf of Mannar, off Tuticorin, South East Coast of India

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Abstract
Foraminifera have been successful inhabitants of every aquatic environment from deep oceans to brackish water lagoons, estuaries and even rarely in fresh water streams, lakes, etc. In order to know their distribution in different offshore habitates, the present study has been undertaken 9 stations starting from Thirayshapuram to Vanthivu in two transects with necessary precautions from Gulf of Mannar, Tuticorin. Twenty five bottom sediments and water samples were collected. Benthic foraminiferal taxa belonging to four sub orders (Textularina, Milolina, Lagenina and Rotalina), 5 super families, 10 families, 11 sub families, 14 genera and 29 species have been identified. Among the 29 species, five species Ammonia beccarii, A. dentate, Spiroloculina communis, Quinquloculina seminulam and Pararotalina nipponica are considered to be abundant species of the present study. Higher diversity and population of foraminifera is noticed in the samples collected in the stations 2 to 8, because of their favorable niche. In the stations 1 and 9 the lower diversity and population may be due to the winnowing action of the waves. The substrate of present study area is seen to consist of Silty clay, Sand, Silty sand and Sand. The most accommodative substrate for higher population is Silty sand. The main ecological parameters, which govern the distribution of foraminifera of the present study area, are organic matter content and nature of the substrate. The other water parameters like temperature, salinity, pH and dissolved oxygen do not show any appreciable spatial variation among different stations and hence they do not have any ecological significance in the distribution of foraminifera.
Keywords: Benthic foraminifera, Gulf of Mannar, South East coast of India.

1. Introduction

Foraminifera are single-celled organisms with shells. Their shells are also referred to as tests because in some forms the protoplasm covers the exterior of the shell. The study of foraminifera assemblage variations, preserved within coastal and marine sediments, offers manifold opportunities for investigating the responses of coastal zones to changes during the Quaternary period. The first record of fossil foraminifera was reported by Herodotus (5th Century B.C.) from limestone blocks used by Egyptians during construction of the pyramids at Gizeh. In Indian waters Chapman (1985), Hofker (1927, 1930) and Stubbings (1939) initiated foraminiferal studies. Subsequently, foraminiferal distribution has been reported by many workers off Visakapatnam (Vedantam and Rao 1970;Kaladhar et.al., 1990), off Pondicharry (Setty, 1978), off Portonovo (Ragothaman, 1974; Rasheed and Ragothaman 1978), off Rameswaram (Ragothaman and Kumar, 1985, 1988), off Palk Bay (Kumar, 1988; Kumar et.al., 1996, 1998), and off Karikattukupam (Rao, 1988) offDhabol – Vengurla (Setty and Nigam, 1978) off Trivandrum (Rao etal. 1985), off Karwar (Nigam and Khare, 1992 1994, 1995) off Vengurla Mangalore (Henrirues, 1993), off Mangalore-Cochin (Mayenkar, 1994), off Karwar (Khare, 1992). A case study between Mandapam to Tuticorin (SureshGhandhi and Solai 2010), Hamsa (1973) has reported 34 species from the beach sands of Palk Bay and Gulf of Mannar. Kumar (1988) have studied ecology and distribution of foraminifera at Rameswaram, Palk Bay. Kumar et al. (1966) have explained the spatial and temporal variations in foraminiferal abundences and their relation to substrate characteristics in the Palk Bay, off Rameswaram, Tamilnadu. However few workers are seen in the Gulf of Mannar region. But, no systematic study has so far been undertaken in this region. In this paper, an attempt has been made to identify the foraminiferal distribution and their systematic in Thirayshapuram to Vanthivu region.

2. STUDY AREA AND METHODS

The present work deals with the study of some Recent foraminifera in the sediments collected from the shelf sediments of Gulf of Mannar, off Tuticorin, southeast of India (Fig.1). The area of study forms a part of toposheet 58 L/1, 58 L/5 (N 8° 46' – N 8°50'and E 78° 10' – E 78° 14') of the survey of India. Van Island the local fishermen call this island by the name Vaan Theevu. This island is located 6 km away from Tuticorin. It has a circumference of 2,015 meters.

The square area of the island is 16 hectares. The island soil is sandy with sparse vegetation of low bushes, mostly of grasses and xerophytic plants. The study area enjoys a tropical climate. The maximum temperature in summer is often as high as 40C and the minimum temperature in winter is around 20C. The

district has two distinct rainfall seasons, namely the southwest and northeast monsoon which is closely associated with the seasonal depression in Bay of Bengal.

Twenty sediment samples were collected in the nine stations between Thirayshapuram to Vanthivu in two transects with necessary precautions. A unit of 50ml wet sediment was taken from the top 1cm, layer of sediment in all the sample locations (making use of a plastic tube). The sediment samples were preserved in polythene bags for laboratory investigations. All of them were indexed. The respective depths of the water column above the sample sites were also recorded.

At each station, samples of water from the sediment water interface were collected. The temperature of the bottom water samples was recorded from the built- in thermometer. The dissolved Oxygen was determined by Portal Digital Dissolved Oxygen meter Model 831E. The pH was calculated using a portable pH meter.

The samples were preserved with 10% neutralized formalin. Simultaneously, rose Bengal solution (1gm/lit) was applied to stain the tests (Walton, 1952) in the field itself. In the laboratory,the wased samples were passed through an 0.063mm sieve and then dried. From the dried residues, one gram sediment is taken out by cone and quatering. From that, foraminifera are hand picked using 'OO' Windsor Newton sable hairbrush, the remaining residues were again separated by CCl_4 method (Nigam, 1984). The picked out specimens were mounted and then counted. Selected specimens from each species were mounted on micropalaeontological slides, according to the family, genus and species, over a thin layer of tragacanth gum. Before the gum gets dried up each specimen was oriented to the desired position for further study

3. DISTRIBUTION

From the present study, 29 benthic foraminiferal species belonging to 14 genera, 11 families, 5 super families and 4 sub orders have been identified (Table.1). The 29 identified species are listed in table.2.

Table 1. Species composition of foraminiferal Suborders.

SUB ORDER	SUPERFAMILY	FAMILY	GENUS	SPECIES (in%)
Textularina	2	3	3	13.79
Miliolina	1	1	2	37.93
Lagenina	1	3	3	13.79
Rotalina	2	3	5	34.48
	6	10	13	

Table 2. List of Species in Inner shelf of Gulf of Mannar.

1. Ammobaculites exigus
2. Textilaria foliacea
3. T. candeiana
4. Spiroloculina communis
5. S. carinate
6. S. costifera
7. Quinqulenoculina agglutinans
8. Q. bicostata
9. Q. lamarckiana
10. Q. parkari
11. Q. seminulam
12. Q. tenagos
13. Trilloculina oblonga
14. T. trigonula
15. Lagena setigera
16. L. striata
17. Globulina gibba
18. Fissurina marginata
19. Bolivina doniezi
20. B. nobilis
21. Pararotalia nipponica
22. Ammonia beccarii
23. A. dentate
24. A. tepida
25. Asterorotalia inflate
26. A. multispinonsa
27. Elphidium advenum
28. E. crispum
29. Eggrella advena

In the study area the following 9 species are present rarely distributed (in 2 or 3 stations only). They are Bolivina doniezi, B.nobillis, Globulina gibba, Lagena setigera, Quinqueloculina bicostata, Q.parkari, q.tenagos, Triloculina trigonula and Textularia candeiana. Remaining twenty species are found present commonly in shelf sediments of Gulf of Mannar. When the station wise distribution is consider it is found that in the station 5, of the species 26 species are present. In the stations 1, 9 and 10 species only found to be present. That is the species diversity is found to more in the station 5. There are 5 species of Quinqueloculina in the study area and hence Quinqueloculina is considering as the well-represented genus of the study area. The distribution at nine different stations is given in table 3. The identification is supported by illustrations (plates 1 and 2) and systematic inventory of species given below.

3.1 SYSTEMATIC PALAEONTOLOGY

Order Foraminifera Eichwald, 1830
Suborder Textularina Delage & Herouard, 1896
Superfamily Astrorhizacea Reuss, 1862
Family Lituolodae De Blainville, 1827
Subfamily Ammomarginulininae de Blainville, 1825
Genus Ammobaculites Cushman, 1910

Ammobaculites exigus (Cushman & Bronnimann, 1948)
(Pl.1.Fig.1)

Description: Test small with tightly coiled early portion followed by uniserial rectilinear portion with 4-5 drum-shaped, inflated chambers. Sutures are less distinct in the early portion and distinct in the later portion. Broadly rounded periphery is oblate in the later portion. Terminal aperture is small and rounded.

Table 3. Distribution of foraminiferal species in different stations
A= Abundant (>20 specimens) M= Moderate (20-5 specimens)
R= Rare (<5 specimens)

S.No	Species Name	Stations								
		1	2	3	4	5	6	7	8	9
1	Ammonia beccarri	A	A	A	A	A	A	A	A	M
2	A.dentate	R	R	M	M	A	M	M	R	R
3	A.tepida	R	R	M	M	A	M	R	R	--
4	Ammobaculites exiguus	M	R	R	--	--	--	R	R	M
5	Asterorotalia inflata	--	--	R	R	M	R	R	--	--
6	A.multispinosa	--	--	R	R	A	R	--	--	--
7	Bolivina doniezi	--	--	--	R	M	R	--	--	--
8	A.nobilis	--	--	R	--	M	--	--	--	--
9	Elphidium advenum	--	R	R	R	M	R	--	R	--
10	E. crispum	--	--	R	R	M	R	--	--	--
11	Eggrella advena	M	R	--	--	R	--	--	--	M
12	Fissurina marginata	--	R	M	--	R	--	M	--	--
13	Globulina gibba	--	R	--	--	R	R	--	--	--
14	Lagena setigera	--	--	--	R	M	R	--	--	--
15	L. striata	--	--	R	--	M	R	R	--	--
16	Pararotalia nippanica	M	A	A	A	A	A	A	A	M
17	Quinqueloculina agglutians	--	--	--	R	R	R	R	--	--
18	Q. biscostata	--	--	--	--	M	R	--	--	--
19	Q. lamarkina	--	R	R	M	A	M	M	M	R
20	Q. parkeri	--	--	R	--	R	--	--	R	--
21	Q. seminulum	M	A	A	A	A	A	A	A	M
22	Q. tenagos	--	--	R	--	R	--	R	--	--
23	Spiroloculina communis	M	M	A	A	A	A	A	A	M
24	S. carinate	--	--	--	R	M	R	M	R	--
25	S. costifera	--	--	R	M	M	M	R	--	--
26	Textularia candiana	M	R	--	--	--	--	R	--	M
27	T. foliacea	M	R	--	--	--	--	--	--	R
28	Trilloculina oblonga	--	--	R	R	M	R	--	--	--
29	T. trigonula	--	--	--	R	M	R	--	--	--

Super family Tectulariacea Ehernberg, 1839
Family Eggereillidae Cushman, 1937
Sub family Eggereillinae Cushman, 1937
Genus Eggerella Cushman, 1935

Eggrella advena (Cushman)
(Pl.2.Fig.29)

Description: Test is small, elongated and gradually tapers towards the blunty rounded initial end. Sublobular chambers are arranged 3 to a whorl and increase in size gradually. Arenaceous agglutinated wall is roughly finished. Narrow silt-like aperture occurs near the base of the inner margin of the end- chamber.

Family Tectulariacea Ehernberg, 1838
Sub family Textulariaiinae Ehrenberg, 1838
Genus Textularia Defrance, 1824

Textularia foliaceous (Heron- Allen & Earland, 1915)
(Pl.1. Fig.2)

Description: Small, compressed test is sub triangular in later view. Biserially arranged 16-18 rapidly increasing chambers is indistinct near the initial end but distinct in the later portion. Distinct sutures are depressed and make an angle of 45 degree with the periphery. Subquadrate periphery is lobulate. Arenaceous wall consists of roughly cemented coarse, angular sand grains. Narrow silt like aperture occurs at the base of the end-chamber.

Sub order Miliolina Delage and Herouard, 1896
Superfamily Milolacea Ehernberg, 1839
Superfamily Spiroculininea Wisener, 1920
Genus Spiroloculina d'orbigny, 1823

Spiroloculina carinata Fornasini, 1905
(Pl.1. Fig.5)

Description: Test ovate to broadly ovate sometimes with raised shoulders, flat to biconcave. Periphery broad truncates with sharp angles. Spiroloculine chambers elongate square to rectangular in cross section. Sutures smooth to slightly depressed. Calcareous porcelaneous wall is opaque and rather rough due to the presence of minute pits. Rounded to subrectangular aperture is terminal on a short neck with a bifid tooth.

Spiroloculina costifera (Cushman, 1917)
(Pl.1. Fig.6)

Description: Large, sub circular planispiral test is laterally compressed wsith about 6-8 arcuate chambers. Spiroloculine chambers are rounded in cross section. Distally, in most of the specimen the end chamber does not come in to contact with the previous one, thus leaving a gap in between, which shows a tendency for uncoiling. Distinct sutures are slightly depressed. Calcareous porcelaneous wall is polished but for the ornamentation in the form of a few longitudinal costae which are pronounced in the peripheral margin. Last chamber is produced to form a distinct short cylindrical neck having a small rounded aperture with a bifid tooth.

Subfamily Quinqueloculininae Cushman, 1917
Genus Quinqueloculina d' Orbigny, 1826

Quinqueloculina agglutinans d' Orbigny, 1839
(Pl.1. Fig.7)

Description: Small oval test is nearly one and half times as long as bredth. Five extremely visible quinqueloculine chambers are arcuate, tubular and half-a-coil in length. Distinct sutures are slightly depressed. Peripherly is broadly rounded. Porcelaneous wall is rough and agglutinated with fine to rather coarse sand grains. Last-formed chamber is extended beyond outline of the test at eighter end. Rounded aperture at the distal end of the end chamber has a small simple tooth.

Quinqueloculina bicostata d' orbiny, 1839
(Pl.1.Fig.8)

Description: Test is stoutly built, suboval Ana triangular in apertural view five externally visible Quinqueloculina chambers are arcuate and tubular. Distinct sutures to truncate. Ornamentation occurs in the form of 2 or 3 longitudinal striations in the margin of the chambers. The thick calcareous porcelaneous wall is shining at the distal end of last formed, chamber, the larger suboval aperture has a prominent simple tooth.

Quinqueloculina lamarckiana d'Orbigny, 1839
(Pl.1.Fig.9)

Description: Large, suboval to subrounded test is triangular in apertural view and is about 11/2 times as long as broad. Externally visible five quinqueloculine chambers are broad and arcuate. Sutures are arcuate, distinct and depressed. Wall is smooth calcareous porcelaneous and polished. At the distal end of the last-formed chamber, the large suboval aperture has a distinct simple but large tooth.

Quinqueloculina parkari (Brady, 1884)
(Pl.1. Fig.10)

Description: Small suboval test is nearly as long as broad. Externally visible five quinqueloculine chambers are arcuate and tabular. Sutures are distinct and depressed. Periphery is subacute. Calcareous porcelaneous wall is dull and rough. Chambers are ornamented with about 7 to 10 tranverse slightly arcuate ridges. Distal end of the last formed chamber opens out into an elongate narrow oval aperture with a distinct elongates simple tooth.

Qinqueloculina seminulum (Linne, 1767)
(Pl.1. Fig.11)

Description: Small elongate suboval test is about 11/2 times as long as broad. Externally visible five quinqueloculine chambers are tubular, arcuate, broader near the proximal end and almost rounded in cross-section. Thin distinct sutures are depressed. Periphery is broadly rounded. Smooth calcareous porcelaneous wall is thin and subtransparent. Suboval apertures occurs with a simple short tooth at the distal end of the last chamber.

Quinqueloculina tenagos (Parkar, 1962)
(Pl.1. Fig.12)

Description: Small, robust test is nearly as long as broad. Externally visible five quinqueloculine chambers are arcuate and tubular. Arcuate sutures are distinct but depressed. Periphery is broadly rounded. Thick calcareous wall is ornamented with numerous, almost evenly spaced longtitudal costae that run to the entire length of the test. Large rounded aperture at the distal end of the end-chamber has a thick lip and a prominent'T'shaped tooth.

Genus Triloculina d' Orbigny, 1826

Triloculina oblonga (Monagu, 1803)

(Pl.1. Fig.13)

Description: Small elongate test is almost oblong in shape about 21/2-3 times as long as broad and slightly compressedlaterally. Externally visible three triloculine chambers are tubular and arcuate near the proximal end. Sutures are distinct and depressed. Periphery is subrounded. Calcareous porcelaneous wall is smooth and polished. At the distal end, the end chamber opens out into an oval aperture having a simple tooth.

Triloculina trigonula (Lamarck, 1804)

(P1.14.Fig.14)

Description: Longer than broad, the test is subtriangular in apertural view. Specimens are short and as long as broad. Sutures are distinct and depressed. Periphery is sub rounded calcareous porcelaneous wall is smooth, polished and shining. Large elongate aperture at the distal and of the chamber has a prominent tooth, which shows bifid tendency at the free end.

Suborder Lagenina Delage and Heroward, 1896
Superfamily Nodosariacea Ehrenberg, 1839
Family Lagenidae Reuss, 1862
Genus Lagena Walker & Jacob, 1798

Lagena setigera Millett, 1901

(Pl.1.Fig.15)

Description: The small test is unilocular, rather fusiform, widest near the middle portion of the test and circular in transverse section. Distal end of the chamber produced to form an elongate narrow cylindrical neck. Wall is thin, calcareous hyaline, finely perforate and smooth. Periphery is rounded. Initial end of the chamber is slightly depressed and has a few small, short and blunt spines. Small rounded aperture occurs at the distal end of the neck.

Lagena striata (d' Orbigny, 1839)

(Pl.2.Fig.16)

Description: Small test is unilocular and flask-shaped with a single subglobular chamber, which produced abruptly to form an elongate neck towards the apertural end and has an almost flat proximal end. Wall is thin, calcareous hyaline, finely perforate and ornamented with 12-14 distinct striae strating from the proximal end of the test and extending upto the base of the neck. Terminal aperture is rounded.

Family Pormorhinidae d'orbigny 1839
Subfamily Polymorphininae d'orbigny 1839
Genus Globulina d'orbigny 1839

Globulina gibba (Montagu, 1803)

(Pl.2.Fig.17)

Description: The test is small globular with circular cross. Aboral end is well rounded and tapering slightly towards apertural end. Apertural is radiate. Wall is calcareous hyaline and smooth.

Subfamily Ellipsolageninnae Silverstri 1928
Genus Fissurina Reuss, 1850

Fissurina marginata (Montagu, 1803)

(Pl.2.Fig.18)

Description: The test is circular, slightly compressed with a sharp marginal keel. The keel continues upto the aperture and merges with it. Aboral end is rounded while it tapers towards apertural end. Aperture is long and fissurine. Wall is calcareous hyaline, surface smooth.

Suborder Rotalina Delage and Heroward 1839
Superfamily Rotaliacea Ehrenberg, 1839
Superfamily Bolivinacea Glassener, 1937
Family Bolivinidae Glassener, 1937
Genus Bolivina d' Orbigny, 1839

Bolivina doniezi (Cushman and Wickenden, 1929)

(Pl.2.Fig.19)

Description: Small, laterally compressed test tapers from apertural end towards a blunty rounded initial end. Expecting the last formed chambers, others are broader than high. Oblique sutures slightly depressed, limbate at

the centre and becoming thin towards outer marging. Periphery is sub acuate to subrounded. Wall is thin, calcareous, translucent coarsely perforate and covered with a network of fine irregularly patterned reticulation. Aperture is a narrow loop at the base of the apertural face.

Bolivina nobilis (Mc culloch, 1981)
(Pl.2.Fig.20)

Description: The test is small, elongated and gently tapering, oval in cross section. Proloculus globular and usually clearly visible. The chambers are slightly inflated becoming higher and more globose in adult. Sutures are straight, curved and slightly depressed in the early portion and highly depressed in the latter. Narrow elongate aperture extends from the base of the ultimate chamber to a terminal position. Wall glossy and coarsely perforate.

Family Rotalidae Ehrenberg, 1839
Subfamily Pararotaliainae Reiss, 1963
Genus Pararotalia Le Calvez, 1969

Pararotallia nipponica (Asano, 1936)
(Pl.2.Fig.21)

Description: The small, rounded test is almost equally biconvex and has about 3 whorls. Dorsally, the chambers of the earlier whorls are less distinct due to granulations, but those of the final whorl are distinct and gradually increase in size. Ventrally, 7-8 subtriangular chambers of the final whorl alone are visible externally and are rather inflated. Dorsally, the arcuate sutures are slightly depressed, whereas ventrally, they are more depressed and incised. Umbilical region eighter partially or fully filled with small plugs of shell substance. Wall is thin calcareous smooth except for the sutural granulations. Lobulate periphery is subcarinate. On the ventral side, the thin silt-like aperture is interiomarginal.

Subfamily Ammoninae Saidova, 1981
Genus Ammonia Brunnich, 1772

Ammonia becarii (Linne, 1767)
(Pl.22.Fig.22)

Description: Large, almost rounded, trochoid, test is unequally biconvex with a more convex ventral side. Dorsally, about 3 whorls are visible, whereas only the last-formed whorl is visible on the ventral side. Chambers on the dorsal side are slightly higher than broad and gradually increase in size while on ventral side the externally visible 11-13 chambers are subtriangular. Dorsally, distinct arcuate sutures are limbate and slightly raised, whereas ventrally, they are deeply depressed and radial. Umblical area covered with solid plugs of shell material. Thin calcareous translucent wall is finely perforate. Periphery is subacuate. Elongate silt-like aperture is interiomarginal.

Ammonia dentate (Parker & Jones, 1865)
(Pl.2.Fig.23)

Description: Large, trochoid test is subcircular and consists of about 21/2-3 whorls. Dorsally, earlier chambers are less distinct, but in the later whorls, they are distinct and gradually increase in size. Ventrally, 12-14 subtriangular chambers of the last –formed whorl alone are visible. Distinct sutures on the dorsal side are limbate and raised in the early whorls but slightky depressed in the final whorl. Ventrally, they are deeply depressed and radial. Umblicus is either partially or fully filled with shell substances. Lobulate periphery is carinate with a prominent peripheral rim, which is produce to form blunt projections that emerge near the central portion of every chamber in the final whorl. Ventral aperture is intermarginal.

Ammonia tepida (Cushman)
(Pl.2.Fig.24)

Description: Small, subcircular, test is trochoid and almost equally biconvex, the ventral side being more so. Dorsally, the chambers slightly inflated, higher than broad and gradually increase size. Ventrally, about 7-8 subtriangular chambers of the last-formed whorl alone are visible. Sutures are raised in the early portion, whereas slightly depressd and arcuate in the final whorl, dorsally while they are radial, excavated and thus a shallow cavity are formed around the umbilical region on the ventral side. Rounded periphery is lobulate. Thin calcareous wall is finely perforate. Small elongate ventral aperture is intermarginal.

Genus Asterorotalia Hofker, 1950

Asterorotalia inflate (Millett, 1904)

(Pl.2.Fig.25)

Description: The small unequally biconvex trochoid test has aconical ventral side and a slightly convex dorsal side and consists of about 21/2- 3 whorls. Dorsally, the chambers of the early whorl are less distinct, whereas those of the later whorls are distinct and gradually increase in size. Ventrally, the 5-6 chambers of the last whorl are subtriangular. Dorsally, sutures are arcuate, limbate and beaded with shell material, whereas ventrally, they are deeply depressed with minute granules along the margins. Wall is thin calcareous perforate smooth except for the granules. Periphery is subacute. Two silt-like narrow apertures emerge from the base of the elongate subtriangular apertural face on the ventral side.

Asterorotalia multispinosa (Nakamura)

(Pl.2.Fig.26)

Description: Small, subcircular, trochoid test is dorsoventrally compressed. Dorsally, 2-2.5 whorls are visible with slightly inflated chambers, which gradually increase in size while, 9-10 subtriangular chambers of the last whorl alone are visible ventrally, dorsally, distinct sutures are limbate and raised while they are radial and much depressed, ventrally. Umbilical region is either partially or fully filled with shell material. Wall is thin, translucent, cacreous and perforate. Subacute carinate periphery ornamented with many long slender spines. Which emerge from the peripheral rim near the middle portion of every chamber in the final whorl. Thin silt-like aperture is interiomarginal.

Family Elphidiidae Galloway, 1933
Subfamily Elphidiinae Galloway, 1933
Genus Elphidium de Montfort, 1808

Elphidium advenum (Cushman, 1922)

(Pl.2.Fig.27)

Description: The small, rounded, laterally slightly compressed test is planispiral involute and has a small umbo on eighter side. About 12-13 chambers of the last whorl are gradually increase in size. Distinct sutures are slightly raised, slightly curved back and have about 7-8 retral processes. Acute periphery is carinate and lobulate in the latter part of the test. Wall is finely perforate, calcareous, translucent and smooth excepting the tetral processes. Aperture consists of a few minute openings at the base of the sub triangular apertural face.

Elphidium crispum (Linnaeus, 1758)

(Pl.2.Fig.28)

Description: Large, planispiral, involute, test is biconvex, rounded, having a prominent coarsely perforate umbo on both side, and lenticular in peripheral view. About 18-20 subtriangular slightly arcuate chambers of the final whorl are found to gradually increase in size. Distinct arcuate sutures are limbate, raised and ornamented with many well-developed retral processes that gradually increase in size towards the periphery. Wall is calcareous perforate and smooth but the retral processes. Acute periphery is keeled. Aperture consists of a few small rounded openings at the base of the subtriangular apertural face.

5. SUMMARY

A foraminiferal study has been undertaken in the off shore region of Gulf of Mannar between Thirayshapuram to Vanthivu. The study of twenty five samples highlights the presence of a multi-ethnic fauna of foraminifera. Twenty nine benthic species (table 2) belonging 10 families, 14 genera were identified from the 25 sediment samples. A comparison of the identified species with inventories made by earlier workers from this region reveals the nix presence of new species. Species richness in the samples from the stations 2 to 8 because of their favorable niche closest to the Thirayshapuram . Stations 1 and 9 the lower diversity and population may be due to the winnowing action of the waves.

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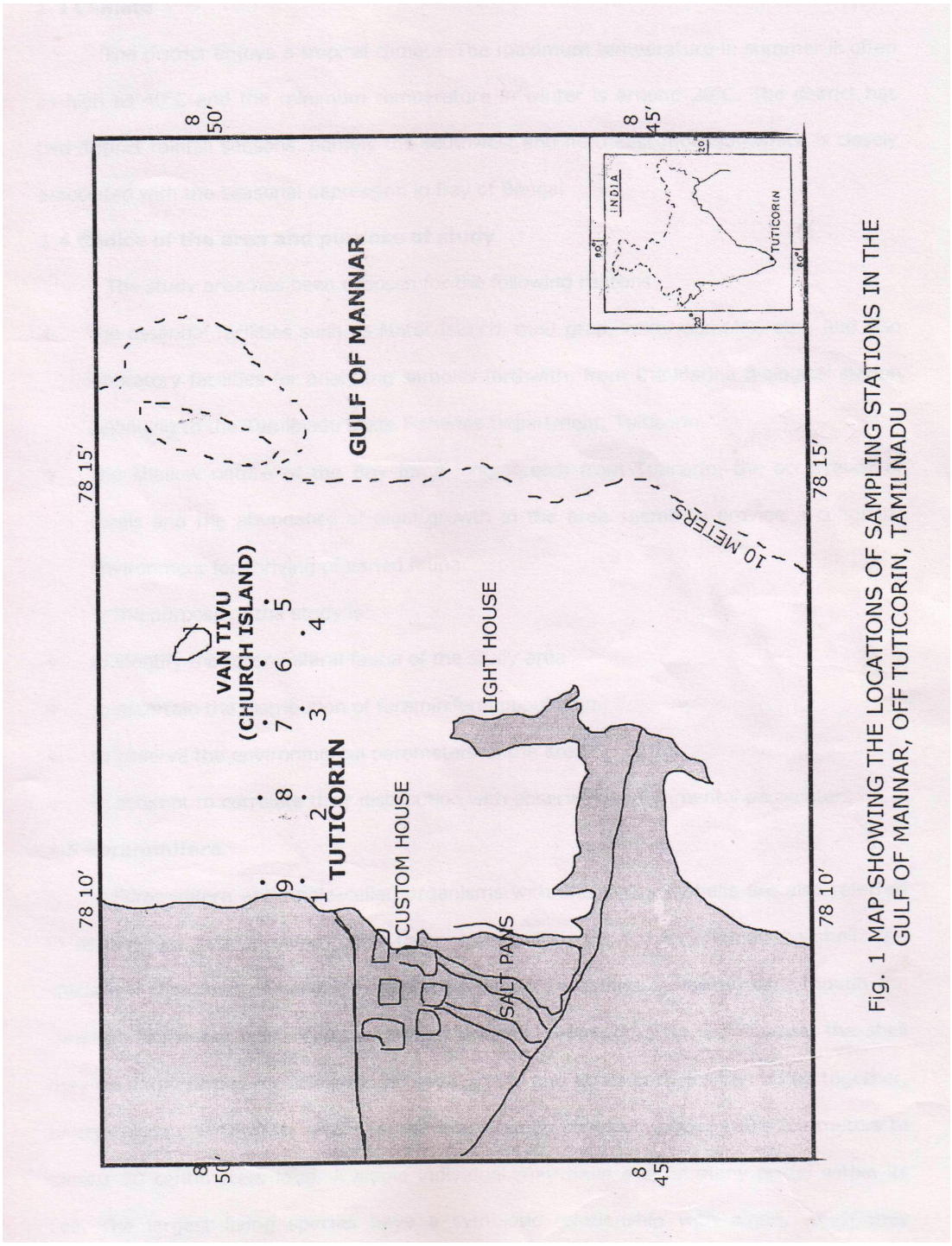
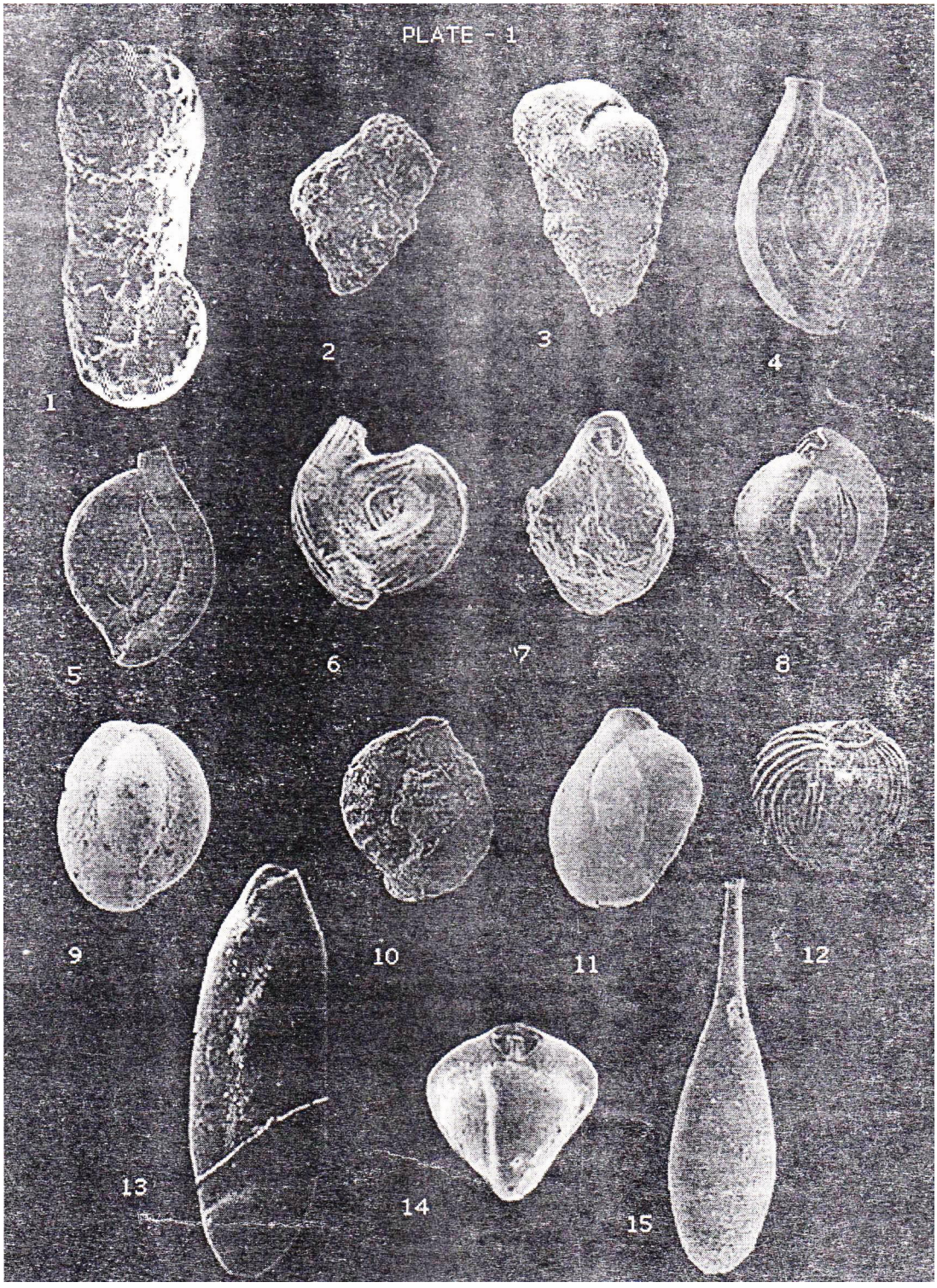


Fig. 1 MAP SHOWING THE LOCATIONS OF SAMPLING STATIONS IN THE GULF OF MANNAR, OFF TUTICORIN, TAMILNADU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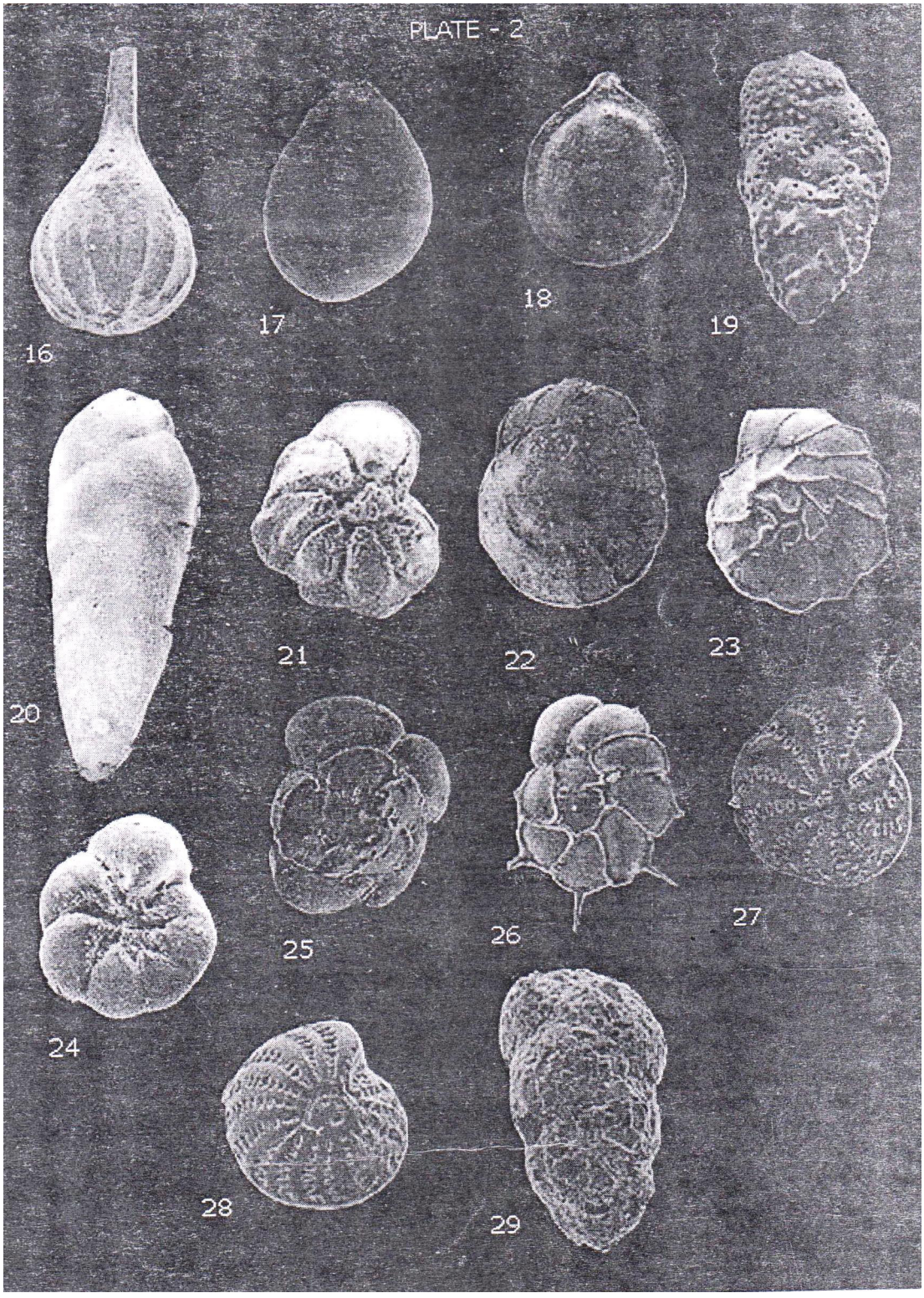
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