JOURNAL OF THE PALAEONTOLOGICAL SOCIETY OF INDIA
VOL. 32, 1987, P P. 122 — 130

RECENT FORAMINIFERA FROM COLVA BEACH SANDS, GOA

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ABSTRACT

Recent foraminifera from Colva beach sands, Goa, are studied. A total of 29 foraminiferal species are present. The foraminiferal assemblage comprises calcareous as well as agglutinated forms. *Textularia conica, T. foliacea, Globorotaloides hexagona, Spiroloculina* cf. *S. inflata, Glabratella* sp., and *Brizalina* sp., are being reported for the first time from Goa region. The affinities of Colva beach foraminiferal assemblage is discussed.

INTRODUCTION

A great volume of literature exists on the Recent foraminifera from beach sands of the different parts of the world but only a little has been published on these micro-organisms from Indian Coasts. The present paper is the first detailed account of the preliminary note by the authors (Bhalla and Gaur, 1986) on the Recent foraminifera from Colva beach sands, Goa. The chief objective of the present study is to enhance our knowledge about the occurrence and distribution of Recent Foraminifera along the Indian Coasts.

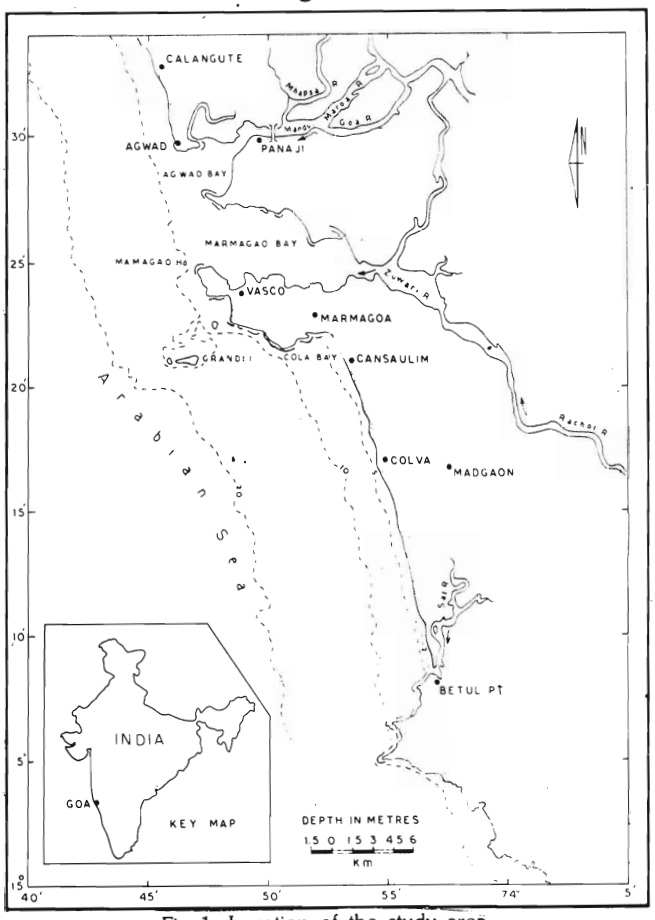

Fig 1. Location of the study area

The Colva beach (15° 17¹ N, 73° 54'E) is a 30 km stretch of sandy tract in Goa on the West Coast of India facing the Arabian Sea (Fig.1). It is the second largest beach in Goa and is about 40 km south of Panaji, the capital of Goa. Twenty-one samples of Colva beach sands were collected in December, 1983, from near the tourist entrance gate of the beach, covering a length of approximately 1 km. No difference in foraminiferal microfauna of different samples was observed. Hence, all the samples of the beach collected from different sample locations are being treated as one for the purpose of the present study.

All the foraminiferal species, whether rare or abundant, have been studied and illustrated. The usual laboratory method of screening and washing the samples through a set of standard sieves was followed. A fraction weighing 15 gm of each screened sample was treated with carbon-tetra-chloride for concentrating rare foraminiferal tests. Ilustrations of figures on plates are by SEM and camera lucida.

HISTORICAL RESUME

Recent foraminifera from Indian shore sands of Western India have been studied amongst others by Chaudhury and Biswas (1954), Bhatia (1956), Rocha and Ubaldo (1964 a,b), Jain and Bhatia (1978), Bhalla and Nigam (1979), Bhalla and Raghav (1980) and Bhalla and Lal (1985). However, study of Recent foraminifera from the beach sands of Goa was carried out by Rocha and Ubaldo (1964 b) and Bhalla and Nigam (1979).

REPOSITORY

All figured specimens have been housed in the micropalaeontological collections of the Department of Geology, Aligarh Muslim University, Aligarh.

SYSTEMATIC DESCRIPTION

The Classification of Foraminifera Proposed by Loeblich and Tappan (1964) and subsequently modified by these authors (Loeblich and Tappan, 1984) has been followed. The different species within a genus have been placed alphabetically. The following species are being

reported for the first time from the Goa region: *Textularia conica* d' Orbigny, 1839; *T. foliacea* Herron-Allen and Earland, 1915; *Spiroloculina* cf. *S. inflata* Terquem,1882; *Quinqueloculina ludwigi* Reuss, 1866; *Quinqueloculina* sp.-A; *Quinqueloculina* sp. - B; *Brizalina* sp.; *Glabratella* sp.; *Elphidium* sp.; *Globorotaloides hexagona* (Natland),

Genus Textularia DEFERANCE, 1824
Textulaira conica d' ORBIGNY, 1839
(Plate I—2)

Remark: T. conica is a cosmopolitan species and only two specimens were found in our material. They resemble the form described by Bhatia (1956) from the Bhogat beach, Western India.

Textularia foliacea HERRON-ALLEN and EARLAND, 1915
(Plate I—1)

Remarks: A solitary but entire specimen of *T. foliacea,* a characteristic Indo-Pacific species, was found from Colva beach. The present specimen shows resemblance to the one described by Bhatia (1956) from Bhogal Beach, Western India, except that later chambers in our specimen are rather inflated and sutures are somewhat excavated.

Genus Spiroloculina D' ORBIGNY, 1826
Spiroloculina depressa D' ORBINGNY, 1826
(Plate I—3)

Remarks: Two broken specimens of *S. depressa* were found in the present material. Test is oval in outline with depressed central portion. This is a cosmopolitan species and has earlier been recorded from the East and West Coasts of India.

Spiroloculina excavata d' ORBIGNY, 1846
(Plate I—4)

Remarks: S.excavata is a cosmopolitan species and occurs commonly in the Colva beach material. Our specimens resemble those described by Bhatia (1956) from Juhu beach, Bombay.

Spiroloculina eximia CUSHMAN, 1922
(Plate I—7)

Remarks: Typical specimens of *S.eximia were found in the Colva beach material. It is a cosmopolitan species and was first reported from West Indian region by Cushman (1929). Our specimens are similar to those reported by Bhalla and Nigam [(1979); Nigam (1979)] from Calangute beach, Goa.*

Spiroloculina cf. S. inflata TERQUEM, 1882
(Plate I—5)

Remarks: A few well-developed specimens which can be compared with *S. inflata* were found in our material. It has a fairly large, eliptical test with five visible chambers on either sides. The final chamber is more broad and inflated near the base and is slightly protruding. Aperture is terminal with a bifid tooth.

Genus Quinqueloculina D' Orbigny, 1826
Quinqueloculina ludwigi REUSS, 1866

Remarks: Only two entire specimens of *Q. ludwigi* were found in the Colva beach samples. The aperture is placed on a rounded neck with a bifid tooth and is surrounded by a raised lip. This species was reported for the first time from the Oligocene of Germany by Reuss (1866) and our specimens are identical to the illustration and description of the German forms.

Quinqueloculina seminulum (LINNAEUS)
(Plate I—6)

Remarks: Q. seminulum is the most widely recorded and at the same time hightly confused species of *Quingueloculina.* It has been described by earlier workers under different trivial names and a long synonymy bears a testimony to it. Rare specimens of this species were found in our material.

Quinqueloculina sp./A
(Plate II—2)

Remarks: A solitary but entire specimen of this indeterminate species was found in the Colva beach material which has no resemblance to any known species of *Quinqueloculina.* In fourchambered view, a ridge-like structure is present on the final chamber. Aperture is terminal with a simple tooth.

Quinqueloculina sp. B
(Plate II—3)

Remarks: Rare specimens of this indeterminate species of *Quinqueloculina* were found in our material. The test has quinqueloculine arrangement of chambers. In fourchambered view, the first chamber is less exposed and somewhat crescent shaped, second chamber raised and the final chamber more bulbous at base. Probably, it is a new species of the genus but more specimens are required to assign a new trivial name to it.

Genus Triloculina D' ORBIGNY, 1826
Triloculina terquemiana (BRADY).
(Plate I—8)

Remarks: T. terquemiana was first described by Brady (1884) from the shore-sands of Madagascar in the Indian Ocean. A few specimens of this species were found in our material which are identical to the form described by Bhalla (1968) from the East Coast of India.

Triloculina tricarinata D' ORBIGNY, 1826
(Plate II—9)

Remarks: Two specimens of this well-known cosmopolitan species of *Triloculina* having sharp

triangular outline were obtained from the present material. Our forms are similar to those reported by Bhalla and Nigam (1979); Nigam (1977) from Calangute beach, Goa.

Genus Brizalina COSTS, 1856
Brizalina sp.
(Plate I — 13)

Remarks: A solitary, broken, specimen of *Brizalina* was found which could not be referred to any known species of the genus. More specimens are required before a specific name could be assigned to it.

Genus Glabratella DORREN, 1945
Glabratella sp.
(Plate II — 4 a,b,)

Remarks: A single, entire, specimen of *Glabratella* was recovered from the present material which does not show resemblance to any known species of the genus. However, the present specimen somewhat resembles the one reported and illustrated by Bhalla (1970) from the Marina beach sands, Madras, East Coast of India, which was the first record of *Glabratella* from the Indian waters. However, it is being recorded for the first time from Western India.

Genus Cavarotalia MELLER-MERZ, 1980
Cavarotalia annectens (PARKER and JONES)
(Plate II — 6a-c)

Remarks: *C. annectans* is a characteristic Indo-Pacific species. It has been described from different areas of the East as well as West Coast of India. Huang (1964) made a detailed variational study of this species. It is abundant in our material and exhibits a wide range of variation in the shape and size of the test and also in the number of chambers on the similar lines as worked out by Huang (*op. cit.*)

Genus Ammonia BRUNICH, 1772
Ammonia dentata (PARKER and JONES)
(Plate II—5a-c)

Remarks: *A. dentata* is also an Indo-Pacific species and is rare in our material. It is characterised by having a peripheral border of several chambers drawn out in a triangular process and sutures on dorsal side are occasionally beaded. The present specimens closely resemble the form described by Bhatia (1956) from Juhu and Bhogat beaches of Western India.

Ammonia papillosus (BRADY)
(Plate II—7 a-c)

Remarks: *A. papillosus*, an Indo-Pacific species, is characterised by a strongly biconvex test and beaded nature of sutures. It occurs commonly in Colva material. The present specimens are similar to those reported by Bhalla and Nigam (1979); Nigam (1977) from Calangute beach, Goa.

Genus Elphidium DE MONTFORT, 1808
Elphidium advenum (CUSHMAN)
(Plate I—10)

Remarks: *E. advenum* is a cosmopolitan species of *Elphidium* which occurs in warm and shallow waters of tropical region. It widely occurs along East and West Coasts of India and is frequent in our material.

Elphidium indicum CUSHMAN,
(Plate I — 11)

Remarks: *E. indicum* was first described by Cushman (1936) from West Coast of India. It frequently occurs in our material. It is characterised by the presence of numerous coastae running more or less parallel to the periphery. Our specimens resemble the form described by Bhalla (1968) from Vishakapatnam beach sand on the East Coast of India but differs in being smaller in size.

Elphidium sp.
(Plate I—12)

Remarks: A few specimens of *Elphidium* were found in tthe present material which do not resemble any known species of the genus. The specimens possess well developed, rounded to sub-elongate, retral processes which extend between the sutures and the umbilical region has rounded pores on the surface. It is, probably, a new species of the genus but more specimens are required before assigning a trivial name to it.

Genus Globigerina D' ORBIGNY, 1826
Globigerina bulloides D' ORBIGNY
(Plate I—14)

Remarks: A single specimen of *G. bulloides* was encountered in our material. It is abundant in subarctic and transitional waters and is practically absent in tropical and subtropical waters south of 40°S. Bhalla and Gaur (1986) attributed the sporadic occurrence of such planktonic forms in the benthic assemblage of Goa to ocean currents and or sea-storms prevailing in the region.

Genus Globorotaloides BOLLI, 1957
Globorotaloides hexagona (NATLAND)
(Plate I—16)

Remarks:A solitary but entire specimen of *G. hexagona* with characteristic surface texture of coarse reticulations forming hexagonal pits giving the wall a honey-combed appearance was recovered from the present material. To our knowledge, this is probably the first record of *G. hexagona* from the shore-sands of the Indian Coasts.

Genus Poroeponides CUSHMAN, 1944
Poroeponides lateralis (TERQUEM)
(Plate I—20)

Remarks: P. lateralis is a highly variable species, especially in the shape of its last-formed chamber. It is a shallow water, cosmopolitan species and has been beach sands of East and West coasts of India our specimens are identical to the forms described by Bhalla (1968) from frequently reported from Vishakapatnam beach sands on the East Coast of India also to those described by Bhatia (1956) from Juhu, Chowpatty, and Bhogat beaches of Western India.

Genus Amphistegina D' ORBIGNGY, 1846
Amphistegina radiata (FICHTEL and MOLL)
(Plate II—8a-b)

Remarks: A. radiata was first reported from the Indian region by Chapman (1895) from near Laccadive Island in the Arabian Sea. A few specimens of *A. radiata* were recovered from the present material which resemble the form reported by Bhall and Nigam (1979); Nigam (1977) from Calangute beach, Goa.

Genus Cibicides DE MONTFORT, 1808
Cibicides refulgens DE MONTFORT
Plate II—9a-b)

Remarks: C. refulgens is a well-known and widely reported species of *Cibicides*. It is rare in our material but our specimens are similar to the forms reported by Bhalla and Nigam (1979); Nigam (1977).

Genus Nonion DE MONTFORT, 1808
Nonion boueanum (D' ORBIGNY)
(Plate I—17)

Remarks: N. boueanum is a cosmopolitan species and was first described from the Miocene of Vienna Basin. It commonly occurs in Colva material.

Genus Florilus DE MONTFORT, 1808
Florilus elongatus (D' ORBIGNY)
(Plate I—18)

Remarks: A single, entire, specimen of *F. elongatus* was found in our material. Dev (1975) made a case study of three closely allied species, *viz; N. boueanum, F. elongatus* and *F. scaphum* and his views have been followed in the present study. Our forms possess more elongated and flaring last chamber.

Florilus scaphus (FICHTEL and MOLL)
(Plate II—19)

Remarks: A few specimens of F. scaphus were found in the present material. They show flaring tests with depressed umbilical region filled with calcite granules and resemble the forms described by Bhalla (1970) from Marina beach sands, Madras, East Coast of India, and also those reported by Bhalla and Nigam (1979); Nigam (1977) from Calangute beach, Goa, on the West Coast of the country.

AFFINITIES OF COLVA FORAMINIFERAL ASSEMBLAGE

The Colva foraminiferal assemblage is compared with the assemblages from other beaches of the East as well as West Coast of India described by earlier workers.

From the West Coast, a prolific foraminiferal assemblage comprising 45 species was described from Juhu, Chowpatty (Bombay) and Bhogat (Saurashtra) beaches by Bhatia (1956). Amongst these, the following species also occur in the Colva material: *Textularia conica, T. foliacea, Spiroloculina excavata, S. eximia, Quinqueloculina seminulum, Triloculina terquemina, T. tricarinata*, Cavarotalia annectens, Ammonia dentata, *A. papillosus, Elphidium advenum, E. indicum, Poroeponides lateralis* and *Florilus scaphus*. Rocha and Ubaldo (1964a) recorded 52 species from Diu, Gogola and Simbor beaches. The species common to Colva and these beaches are *Spiroloculina eximia, Triloculina terquemina, T. tricarinata Cavarotalia annectens, Ammonia dentata, A. papillosus, Elphidium advenum, E. indicum, Amphistegina radiata, Cibicides refulgens* and *Florilus scaphus*. In a subsequent publication, Rocha and Ubaldo (1964b) reported 22 of foraminiferal species from Jampore (Damao) and Buga (Goa) beaches. Amongst these, *Spiroloculina depressa, S. eximia, Triloculina tricarinata, Cavarotalia annectens Ammonia dentata, A. papillosus, Elphidium advenum, E. indicum, Poreponides lateralis, Nonion boueanum* and *Florilus scaphus* also occur in the present assemblage. Following 16 species of foraminifera were found to be common to the Colva (present study) and Calangute (Bhalla and Nigam, 1979) assemblages of Goa: *Spiroloculina eximia, Quinqueloculina seminulum, Triloculina terquemina, T. tricarinata, Cavarotalia annectens, Ammonia papillosus, Elphidium advenum, E. indicum, Globigerina bulloides, Globigerinoides rubber, Poroeponides lateralis, Amphestigina radiata, Cibicides refulgens Nonion boueanum, Florilus elongatus* and *F. scaphus*. Species common to Colva beach of Goa and Cochin, Challanam and Purakkad beaches of Kerala (Bhalla and Raghav, 1980) are *Triloculina tricarinata, Cavarotalia annectens, Ammonia papillosus, Globigerina bulloides, Globigerinoides ruber, Amphistegina radiata, Nonion boueanum, Florilus elongatus,* and *F. scaphus*.

From the East Coast, Bhatia and Bhalla (1964) described 14 species of foraminifera from Puri beach sands, out of which *Quinqueloculina seminulum, Cavarotalia annectens, Ammonia dentate, Elphidium advenum, E. indicum* and *Poroeponides lateralis* and *Florilus scaphus* are also found in the Colva beach assemblages. Bhalla (1968) described 16 species from the Recent shoresands of Vishakhapatnam beach. *Quinqueloculina seminulum, Triloculina terquemina, T. tricarinata, Cavarotalia dentata, Elphidium advenum,*

E. indicum and Poroeponides lateralis are common to both Colva and Vishakapatnam assemblages. From Marina beach sands, Madras, Bhalla (1970) described 15 species of foraminifera of which *Quinqueloculina seminulm, Glabratella* sp., *Cavarotalia annectens, Florilus scaphus* and *Poroeponides lateralis* are also found in the Colva assemblage.

Discussion: The foregoing comparison of West and East Coasts foraminiferal assemblages reveals that only a few species are common to both the regions. There is also a marked difference in the population of these species. For example *Cavarotalia annectens* which is abundant on the West Coast shows rare occurrence on the East Coast, while *Ammonia dentata,* abundantly found on the East Coast, occurs rarely on the West Coast. *Elphidium indicum* and *Nonion boueanum* commonly found on the West Coast are rarely found on the East Coast. Likewise, *Quinqueloculina seminulum* and *Elphidium advenum* are commonly found on the East Coast but are either frequent or rare on the West Coast.

Certain species, eg., *Textularia conica, T. foliacea, Spiroloculina depressa, S. excavata, S. eximia, S.* cf. *S. inflata, Quinqueloculina ludwigi, Brizalina* sp., *Amphistegina radiata, Cibicides refulgens, Florilus elongatus, F. scaphus* which are common to rare in occurrence in the beach, sands of Western India have, probably, not so far been reported from the Eastern India. On the other hand, *Spiroloculina communis, Quinqueloculina tropicalis, Asterorotalia trispinosa, Pseudorotalia schroeteriana,* and *Dentostmina agglutinans* are well represented on the East Coast but are totally absent from the West Coast. The above species belong to Indo-Pacific realm except *S. communis* and *T. trigonula* which are cosmopolitan in occurrence. The other cosmopolitan species found on both the coasts are *Triloculina tricarinata, T. terquemina* and *Poroeponides lateralis.*

An attempt has been made to display the frequency and occurrence of Recent foraminifera present in the beach sands on the East and West Coasts of India as described by different authors from time to time (Table I). Names of the different species as given by them have been followed as such. Those species which were put under open nomenclature have been excluded from the purview of the present table unless they are relevent in the present context.

CONCLUSION

In view of the foregoing discussion, it may be inferred that the Colva beach foraminiferal assemblage shows close affinities with those described from the West Coast of India. However, a considerable difference exists in the foraminiferal assemblage of the East and West Coasts *(Vide etiam* Regothaman and Kumar, 1985).

The Colva beach assemblage, like other foraminiferal assemblage of the West Coast beaches, belongs to a

Table. 1. Comparison of Recent Foraminiferal Assemblages from beach sands of East and West Coast of India.

Name of the Species	Frequency distribution	
	West Coast	East Coast
Bathysiphon sp. indet	R	X
Textularia conica	R	X
T. foliacea	R	X
Chrysalidinella dimorpha	R	X
Massilina secans tropicalis	P	X
Spiroloculina aequa	P	X
S. antellariam	X	R
S. communis	X	R
S. depressa	F-R	X
S. depressa var. *rotunda*	R	X
S. excavata	A-R	X
S. eximia	F	X
S. indica	A-R	X
S. of. S. inflata	R	X
S. tricarinata	R	X
Verteraling striata	P	X
Dentostomina agglutinans	R	X
Quinqueloculina crassa	R	X
Q. (Milliola) kerimbatica	R	X
Q. lamarchina	A-F	X
Q. ludwigi	R	X
Q. cf. Q. mosharrafai	R	X
Q. pseudoreticulata	R	X
Q. subcuneata	P	X
Q. seminulum	F-R	X
Q. cf. Q. seminulum	X	A-R
Q. tropicalis	X	R
Q. venusta	F-R	X
Q. vulgaris	R	R
Milionlinella cf. M. labiosa	R	X
Triloculina cf. T. rotunda	F-R	X
T. aff. T. rupertiana	R	X
T. terquemiana	R	R
T. tricarinata	R	R
T. trigonula	R	F-R
Lagena cf. *costata* Var.*amphora*	P	X
L. gracilis	P	X
L. gracellima	P	X
L. laevis	P	X
L. laevis variant	P	X
Robulus sp. indet	R	X
Guttulina sp. A and sp. B	P	X
Brizalina sp. indet	R	X
Bolivina cf. *B. pseudoplicata*	R	X
B. striatula	R	X
B. variabillis	R	X
Rectobolivina rephanus	R	X
Bulimina marginata	R	X
B. marginate biserialis	R	X
Siphogenerina rephanus	A-R	X
Discorbis sp. indet.	R	X
Neconorbina terquemi	P	X
Cancris auricula	R	X
Glabratella sp. index	R	R
Peseudoeponides equatoriana	R	X
Cavarotalia annectens	A-R	R
Ammonia aff. A. audovini	F	X
A. catesbyanus	R	X
A. dentata	R	X
A. cf. *A. hozanensis*	X	R
A. papillosus	F	X
A. tepida	F-R	X
Asterorotalia denata	F	X
A. trispinosa	X	R
Pararotalia boltovskoyi	F	X
P. nipponica	A	R
Pseudorotalia schroeteriana	X	F
Elphidium advenum	R	X
E. craticulatum	A-R	X
E. crispum	A-R	A-R
E. aff. *E. discodale*	R	X
E. hispidulum	-	X
E. indicum	F-R	R
E. minutum	X	R
E. cf. E. minutum	R	X
E.cf.E. minutum	R	X

E. oceanicum	F	X
E. simplex	F-R	F
Nummulites ammonoides	R	X
Globigeringa bulloides	R	X
Globigerinoides hexagona	R	X
Globortaloides hexagona	R	X
Eponides of. E. Praeclnetus	R	X
E. repandus	F	X
Poroeponides cribrorepandus	F	X
P. Lateralis	A-F	F-R
Amphistegina madagascariensis	X	R
A.radiata	R	X
Cibicides lobatulus	A-R	X
C. refulgens	R	X
Loxostomum limatum	R	X
Nonion asterizans	R	X
N. boueanum	R	X
N. scaphum	R	F
Florilus asterizans	R	X
F. elongatus	R	X
F. scaphus	F	X
Hanzawaia concentrica	R	X
Melonis sp. indet.	P	X

R = Rare = up to 2 specimens
F = Frequent = 3 to 7 specimens
A = Abundant = more than 7 specimens
P = Present (only occurrence were given by the authors).
X= Absent

typical warm water environment and the rare occurrence of cold water planktonic foraminifera, eg., *Globigerina bulloides, Globigerinoides ruber* and *Globoróta-loides hexagona* suggests the influence of ocean currents which sweep these species into the area. The prolific population of foraminifera on the West Coast in comparison to the East Coast may possibly be attributed to the presence of higher percentage of organic matter in the Arabian sea (0.85 to 5%; Rajamanickam and Setty, 1973) than the Bay of Bengal (0.77%, Subba Rao, 1968).

ACKNOWLEDGEMENTS

The authors are thankful to Prof. V.K. Srivastava, Chairman, Department of Geology, Aligarh Muslim University, for various facilities. We are gratful to the late Dr. H.N. Siddiquie, Director, National Institute of Oceanography, Goa, and also to Dr. Rajiv Nigam, scientist in the same institute, for providing facilities for field work at Goa. We thank the authorities of K.D.M. Institute of Petroleum Exploration, Oil and Natural Gas Commission, Dehradun, for providing SEM facilities at the Institute. Thanks are also due to Dr. Abu Talib, Lecturer in Geology, Aligarh Muslim University, and Mr. A.K. Sisodia for their help at different stages of the present work. The present work was funded by the University Grants Commission, New Delhi.

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EXPLANATION OF PLATES

PLATE I

(All are Scanning Electron Micrographs)

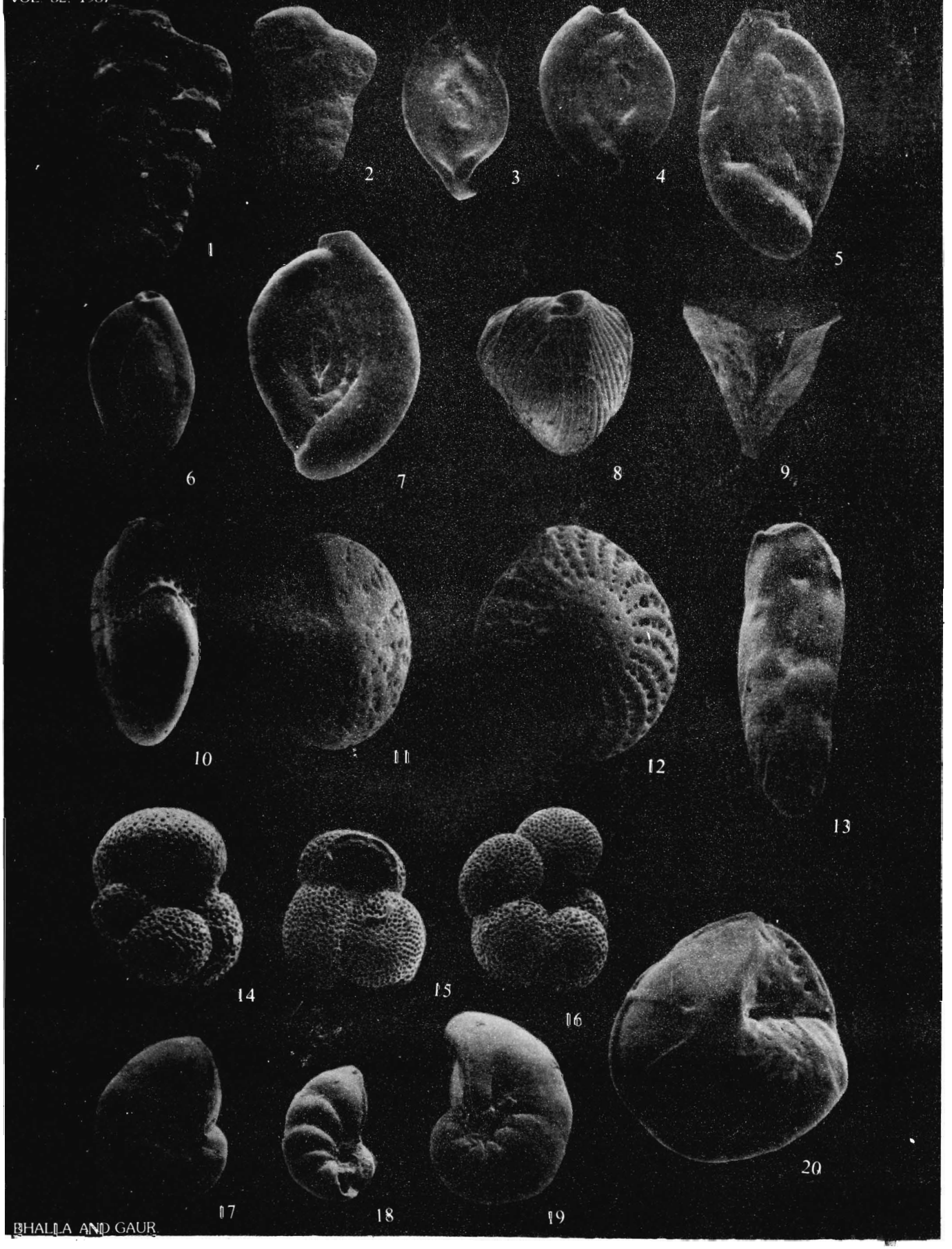
1. *Textularia foliacea* Heron-Allen and Earland; side view. Magnification X 82.
2. *Textularia conica* Orbigny; side view; Magnification X 76.
3. *Spiroloculina depressa* Orbigny; side view. Magnificantion x 39.

4. *Spirolculina excavata* Orbigny; side view, Magnification x 38.
5. *Spiroloculina*, cf. *S. inflata* Terquem; side view. Magnification x 80.
6. *Quinqueloculina seminulum* (Linnaeus); side view. Magnification x 60.
7. Spiroloculina eximia Cushman; side view. Magnification x 62.
8. *Triloculina terquemina* (Brady); apertural cum side view, Magnification x 62.
9. *Triloculina tricarinata* Orbigny; apertural view.
10. *Elphidium advenum (Cushman); apertural view; Magnification x 75.*
11. *Elphidium indicum* (Cushman); side view. Magnification x 94.
12. *Elphidium* sp.,; side view. Magnification x 80.
13. *Brizalina* sp.; side view. Magnification x 80.
14. *Globigerina bulloides* Orbigny; ventral view. Magnification x 89.
15. *Globigerinoides ruber* (Orbigny); ventral view. Magnification x 93.
16. *Globortaloides hexagona* (Natland); ventral view.
17. *Nonion boueanum* (Orbigny); side view. Magnification x 87.
18. *Florilus elongatus* (Orbigny); side view. Magnification x 80.
19. *Florilus scaphum* (Fichtel and Moll); side view. Magnification x 80.
20. *Poroeponides lateralis* (Terquem); ventral view. Magnification x 75.

PLATE II

(All are Camera Lucida Illustrations)

1. *Quinqueloculina ludwigi* (Reuss)
   la, side view; lb, apertural view. Magnification x 65.
2. *Quinqueloculina* sp.—A
   2a, four chambered view; 2b, three chambered view; 2c, apertural view. Magnification x 103.
3. *Quinqueloculina* sp. B.
   3a, four chambered view; 3b, three chambered view; 3c, apertural view. Magnification x 73.
4. *Glabratella* sp.
   4a, edge view; 4b ventral view. Magnification x 128.
5. *Ammonia dentata* (Parker and Jones)
   5a, dorsal view; 5b, ventral view; 5c, apertural view. Magnification x 60
6. *Cavarotalia annectens* (Parker and Jones)
   6a, dorsal view; 6b, ventral view; 6c, apertural view. Magnification x 38.
7. *Ammonia papillosus* (Brady)
   7a, dorsal view; 7b, ventral view; 7c, apertural view. Magnification x 47.
8. *Amphistegina radiata* (Fichtel and Moll)
   8a, side view; 8b, apertural view. Magnification x 59.
9. *Cibicides refulgenus* Montfort
   9 a, dorsal view; 9b, ventral view. Magnification x 90.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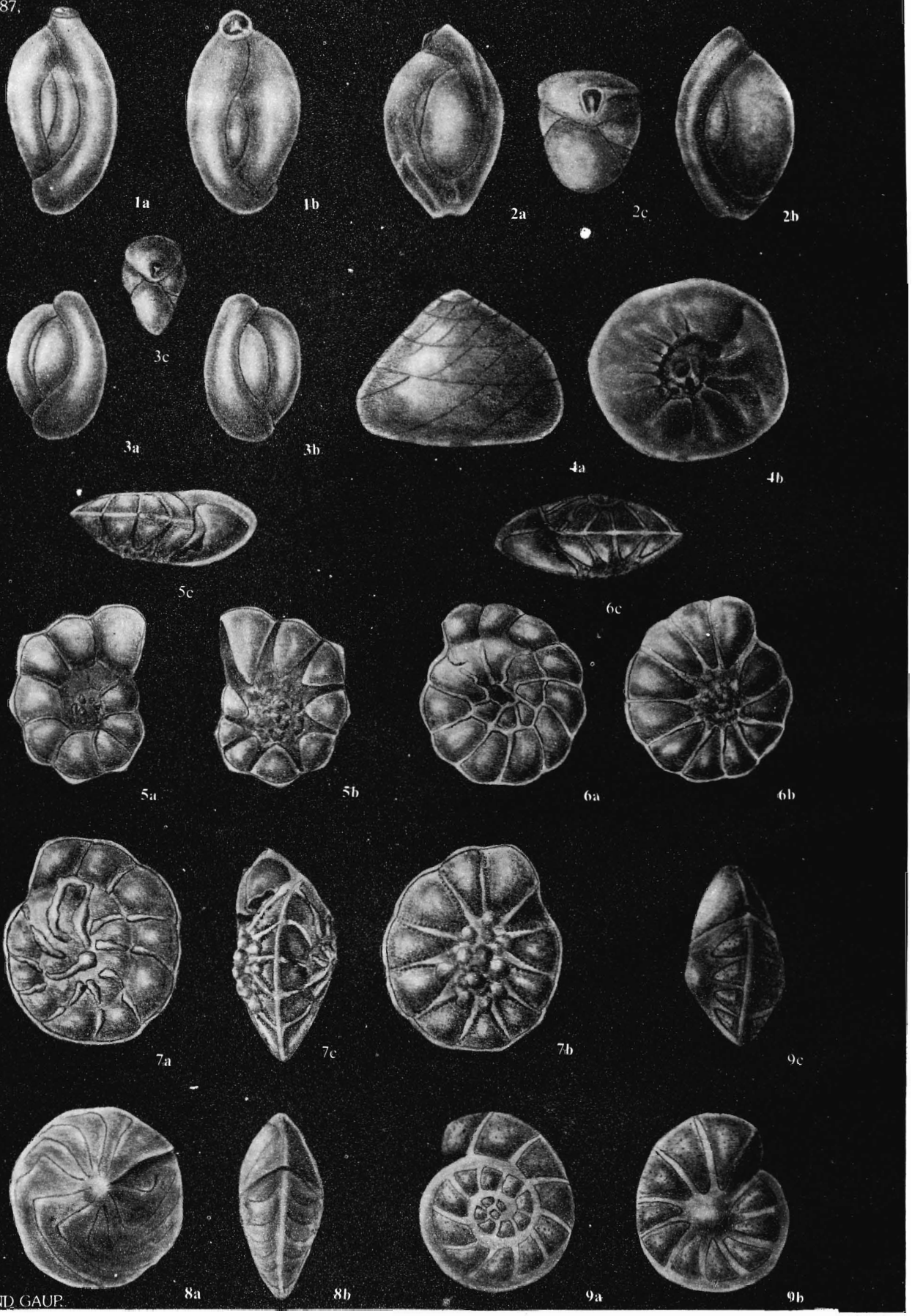
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