

FORAMINIFERA OF THE PALK BAY AND GULF OF MANNAR

ABSTRACT

In this study of Foraminifera, twelve species have been described and illustrated along with a list of 34 species reported from the beach sands of Palk Bay and Gulf of Mannar. This includes six new records from the Indian region. Details regarding the morphology of the test and the world-wide distribution of the different species have been given.

FROM a study of literature, it is found that a good amount of work has been carried out on the Foraminifera of the Indian Region (Carter, 1880; John Murray, 1889; Chapman, 1895, 1907; Dakin, 1906; Stubbings, 1939; Gnanamuthu, 1943; Sethulakshmi Amma, 1958; Bhatia and Bhalla, 1959; Bhalla, 1968; Antony, 1968; Rao 1969, 1970, 1971; and Hamsa, 1971). For the present study samples of beach sands were collected from various localities along the intertidal areas of Palk Bay and Gulf of Mannar. Sampling was done by picking up the fine sand from the top 5-7 cm from the shore deposits exposed at low tide. The material examined contained 34 species of Foraminifera belonging to 13 families and 24 genera.

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List of species :

Out of the 34 species, the diagnostic characters of 12 species which are of special interest have been included here along with illustrations. Of the 12 species described, 6 species marked with an asterisk (*) in the following list are recorded for the first time from the Indian coasts: 1. *Quingueloculina seminulum* (Linnaeus); 2. *Q. vulgaris* d'Orbigny; 3. *Q. venusta* Karrer; 4. *Q. boueana* d'Orbigny; 5. *Q. bicornis* (Walker and Jacob); 6. *Q. contorta* d'Orbigny; 7. *Triloculina oblonga* (Montagu); 8. *T. circularis* (Bornemann); 9. *Hauerina bradyi* Cushman; 10. *Cornuspira planorbis* Schultze; 11. **Marginulina* cf. *crepidula* (Fichtel and Moll); 12. *Nodosaria cylindracea* Dakin; 13. *Nonion scaphum* (Fichtel and Moll); 14. **Elphidium frigidum* Cushman; 15. *Peneroplis pertusus* (Forskål); 16. *P. planatus* (Fichtel and Moll); 17. *Bolivina variabilis* (Williamson); 18. *Spirillina vivipara* Ehrenberg; 19. *S. limbata* Brady, var. *denticulata* Brady; 20. *Discorbis globularis* (d'Orbigny); 21. *D. orbicularis* (Terquem); 22. **Rosalina concinna* (Brady); 23. *Parrella bengalensis* (Schwager); 24. *Rotalia calcar* (d'Orbigny); 25. **Asterorotalia pulchella* (d'Orbigny); 26. **Pararotalia armata* (d'Orbigny); 27. **Amphistegina gibbosa* d'Orbigny; 28. *Globigerina bulloides* d'Orbigny; 29. *Globorotalia menardii* d'Orbigny; 30. *Planulina ariminensis* (d'Orbigny); 31. *P. weullerstorfi* (Schwager); 32. *Cibicides lobatulus* (Walker and Jacob); 33. *Planorbulina mediterraneensis* d'Orbigny; and 34. *Polytrema cylindricum* Carter.

In the present work, the system of classification followed is that adopted by Cushman (1959).

Hauerina bradyi Cushman (Fig. 1a)

(Family Miliolidae; Subfamily Hauerininae; Genus *Hauerina* d'Orbigny, 1839)

Hauerina bradyi Cushman, 1959, p. 180, pl. 14, fig. 26a, b; Hofker, 1964, p. 61 figs. 166-167.

TABLE 1. Meristic and Morphometric characters of the syntypes of *O. biauritus* (Cantor) and *O. brunneus* (Day) (Measurements in mm)

Character	<i>O. biauritus</i> Br. Mus. No. 1860 3.19.171 (Syntype)	<i>O. brunneus</i> Day Z.S.I. No. 1024 (Syntype)	<i>O. brunneus</i> Day Z.S.I. No. 1025 (Syntype)	<i>O. brunneus</i> Day Z.S.I. No. 1026 (Syntype)
Total length	459	385	390	455
Standard length	399	320	330	385
Head	105.5	90	95	110
Eye	13.5	12	12	13
Snout	22	19	19	23
Depth at anal origin	47.5	48	40	54
Dorsal fin formula	IX, 1, 27	IX, 1, 27	IX, 1, 29	IX, 1, 28
Lateral line scale	50-60	62	60	53
Lateral transverse scale	13-14/8-10	12/1/8	15/1/10	12/1/10
In standard length, head	29.2%	28.1-28.7%		
In head, eye	12.8%	10.8-13.3%		
Snout	21.7%	20.0-21.2%		
Depth at anal origin	44.9%	42.1-53.3%		

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Test flattened and thin walled; chambers many, irregular in shape and early chambers typically quinqueloculine; periphery broadly rounded and aperture cribrate. *Distribution in Indian Seas*: Krusadai Island (Gnanamuthu, 1943). Gulf of Mannar and Palk Bay. *General distribution*: Sulu Archipelago, Off Tawi Tawi, Hawaiian Islands, Mediterranean and Caribbean Shallow waters.

***Marginulina* cf. *crepidula* (Fichtel and Moll) (Fig. 1b)**

(Family Lagenidae; Subfamily Nodosariinae; Genus *Marginulina* d'Orbigny, 1826)

Marginulina cf. *crepidula* (Fichtel and Moll). Cushman, 1939, p. 9, pls. 1 & 2, figs. 1a, b & 10a, b.

Test ovate in outline and subcylindrical; early chambers forming a close spiral and later ones are inflated; sutures distinct; wall calcareous and finely punctated; aperture radiate, at dorsal angle. *Distribution in Indian Seas*: Palk Bay and Gulf of Mannar (New record). *General distribution*: Mediterranean, Cape Martin and Nukuhiva Island.

***Nodosaria* *cylindracea* Dakin (Fig. 1c)**

(Family Lagenidae; Subfamily Nodosariinae; Genus *Nodosaria* Lamarck, 1812)

Nodosaria cylindracea Dakin, 1906, p. 235, plate, fig. 8.

Test elongate and cylindrical; about 12 chambers, arranged in a straight line and separated by distinct sutures; surface with numerous fine longitudinal striations; aperture a small opening at centre of last formed chamber. *Distribution in Indian Seas*: Gulf of Mannar. *General distribution*: Not known from other seas.

***Elphidium* *frigidum* Cushman (Fig. 1d)**

(Family Nonionidae; Genus *Elphidium* Montfort, 1808)

Elphidium frigidum Cushman, 1933, p. 5, pl. 1, fig. 8; Loeblich, A.R. (Jr.) and H. Tappan, 1953, p. 99, pl. 18, figs. 4-9.

Test involute and planispiral; chambers slightly inflated, last whorl comprised of about ten to thirteen chambers; periphery rounded, and sutures slightly depressed and curved with a row of sutural pores from which grooves extend in both directions, grooves usually dying out in central area of each chamber; wall calcareous and densely punctated; aperture consisting of a row of pores at base of apertural face. *Distribution in Indian Seas*: Gulf of Mannar and Palk Bay (New record). *General distribution*: Off Point Barrow Base Camp, northern Alaska, east of Cape Rammelsburg, west side of Frobisher Bay, Baffin Land, Off North Wolstenholme Island, northwest Greenland.

***Peneroplis planatus* (Fichtel and Moll) (Fig. 1e)**(Family Peneroplidae ; Subfamily Spirolininae ; Genus *Peneroplis* Montfort, 1808)*Peneroplis planatus* (Fichtel and Moll) Cushman, 1933, p. 61, pl. 19, figs. 1-3 ; 1959, p. 243, pl. 24, fig. 1.

Test free and compressed ; younger chambers planispirally arranged and later portion much complanate and spreading out, reaching back on both sides towards earlier chambers, but not entirely embracing ; sutures distinct, depressed and somewhat limbate ; wall very distinctly striate ; the striae numerous and nearly parallel to periphery ; aperture simple, at base of apertural face. *Distribution in Indian Seas* : Krusadi Island (Gnanamuthu, 1943). *General distribution* : Mediterranean, Fiji Islands, Tonga Islands, Rotonga and Sulu Sea.

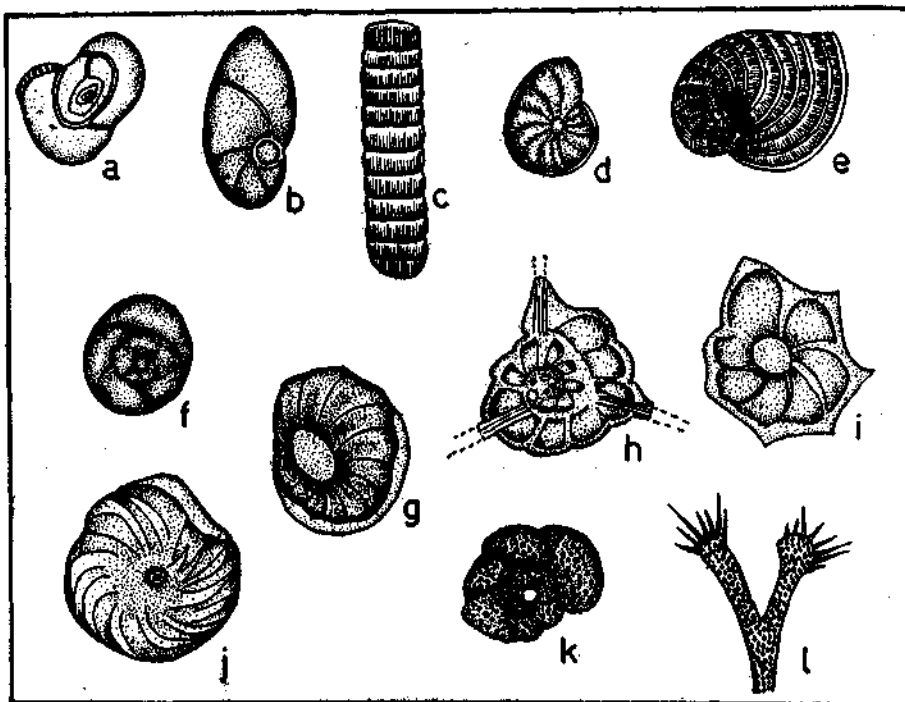


Fig. 1a. *Hauerina bradyi* Cushman. x33 ; b. *Marginulina* cf. *crepidula* (Fichtel and Moll). x132 ; c. *Nodosaria cylindracea* Dakin. x33 ; d. *Elphidium frigidum* Cushman. x33 ; e. *Peneroplis planatus* (Fichtel and Moll). x16 ; f. *Rosalina concinna* (Brady). x132 ; g. *Parrella bengalensis* (Schwager). x33 ; h. *Asterorotalia pulchella* (d'Orbigny). x33 ; i. *Pararotalia armata* (d'Orbigny). x66 ; j. *Amphistegina gibbosa* d'Orbigny. x33 ; k. *Cibicides lobatulus* (Walker and Jacob). x132 ; l. *Polytrema cylindricum* Carter. x16.

***Rosalina concinna* (Brady) (Fig. 1f)**(Family Rotaliidae ; Subfamily Discorbinae ; Genus *Rosalina* d'Orbigny, 1826)*Discorbina concinna* Brady, 1884, p. 646, pl. 90, figs. 7, 8 ; *Rosalina concinna* (Brady) Todd, 1965, p. 10, pl. 4, fig. 3.

Test free, circular in outline and last whorl comprised of four crescent-shaped chambers; wall thin, translucent and finely punctated on both dorsal and ventral surfaces. *Distribution in Indian Seas*: Gulf of Mannar and Palk Bay (New record). *General distribution*: Off the Cape Verde Islands, Coast of Holland and tropical Pacific Ocean.

***Parrella bengalensis* (Schwager) (Fig. 1g)**

(Family Rotaliidae; Subfamily Rotaliinae; Genus *Parrella* Finlay, 1939)

Anomalina bengalensis Schwager, 1866, p. 259, tab. 7, fig. 111; *Parrella bengalensis* (Schwager) Cushman, 1959, p. 291, pl. 51, fig. 19a-c.

Test planispiral and many-chambered; all chambers visible dorsally and only those of last whorl visible ventrally; wall calcareous and finely punctated; sutures oblique and umbilical area with a distinct solid mass aperture at base of last-formed chamber. *Distribution in Indian Seas*: Car Nicobar Island; Gulf of Mannar and Palk Bay. *General distribution*: Off Japan, Philippines, and Sulu Sea.

***Asterorotalia pulchella* (d'Orbigny) (Fig. 1h)**

(Family Rotaliidae; Subfamily Rotaliinae; Genus *Asterorotalia* Hofker, 1951)

Calcarina pulchella D'Orbigny, 1839, *Foram. Cuba*, p. 92, pl. 5, figs. 16-18; *Asterorotalia pulchella* (d'Orbigny) Hofker, 1951, pt. 3, p. 505.

A few specimens of this species were found in the sample.

The species described by Hofker (1951) varies slightly from that of the specimen described by Thalmann as *Rotalia trispinosa* Thalmann (*Eclog. Geol. Helv.*, 1933, 26: p. 248). Thalmann states that the spines in his material are solid and show no canal system but Hofker has found that all the spines in specimens of *Asterorotalia pulchella* observed by him show at least a single central canal and are not solid. The present forms are essentially similar in all respects to the specimens described by Hofker, especially in having the central canal in the spines.

Bhatia and Bhalla (1959) who collected *Asterorotalia trispinosa* (Thalmann) from Puri beach sand synonymised *Asterorotalia pulchella* (d'Orbigny) with the former which is entirely a distinct species as established clearly by Hofker (1951). This mistake has been rectified subsequently by Bhalla (1968).

Specimens well-developed, and have three spines (spines have broken after mounting in balsam); spines developed in first whorl, run through older whorls and pierces straight through a chamber. *Distribution in Indian Seas*: Palk Bay and Gulf of Mannar (New record). *General distribution*: Off Seba, Savu, Borneo-bank, Off Hawaiian Islands and Cuba.

Pararotalia armata (d'Orbigny) (Fig. 1i)(Family Rotaliidae ; Subfamily Rotaliinae ; Genus *Pararotalia* Le Calvez, 1949)*Rotalia* (*Rotalie*) *armata* d'Orbigny, 1826, *Ann. Sci. Nat.*, Ser. 1, 7 : 273 ; *Pararotalia armata* (d'Orbigny) Loeblich, A. R. (Jr.) and H. Tappan, 1957, p. 9, pl. 5, figs. 2a-c.

Test free trochospiral and biconvex ; chambers few and last whorl comprised of seven chambers ; periphery acute and peripheral margin of each chamber ends with a short spine ; umbilical area with a clear shell material ; wall calcareous with limbate sutures ; aperture situated at base of last formed chamber. *Distribution in Indian Seas* : Palk Bay and Gulf of Mannar (New record). *General distribution* : Dax, Dept. Landes, France.

Amphistegina gibbosa d'Orbigny (Fig. 1j)(Family Amphisteginidae ; Genus *Amphistegina* d'Orbigny, 1826)*Amphistegina gibbosa* d'Orbigny, 1839, *Foram. Cuba*, p. 120, pl. 8, figs. 1-3 ; Hofker, 1964, p. 88, figs. 224-226.

Test not much compressed, lenticular and asymmetrical with 12 to 13 chambers at dorsal side ; margin subacute and not keeled ; sutures simple and curved backward ; umbilical region hyaline and smooth with clear shell material ; aperture slit-like on ventral side ; secondary chamberlets on ventral side are small with simple sutures. *Distribution in Indian Seas* : Palk Bay and Gulf of Mannar (New record). *General Distribution* : Caribbean shallow waters.

Cibicides lobatulus (Walker and Jacob) (Fig. 1k)(Family Anomalinidae ; Subfamily Cibicidinae ; Genus *Cibicides* Montfort, 1808)*Cibicides lobatulus* (Walker and Jacob) Cushman, 1959, p. 335, pl. 36, fig. 11 ; Hofker, 1964, p. 76, fig. 204 a-c ; Antony, 1968, p. 114, pl. 8, fig. 11a, b.

Test dorsally flattened and shows complete spiral of chambers ; wall calcareous with distinct pores on both sides ; peripheral margin lobulate ; aperture marginal, extending over dorsal side. *Distribution in Indian Seas* : North and South-west coasts of India, Palk Bay and Gulf of Mannar. *General distribution* : Philippines, Hawaiian Islands and Off Japan.

Polytrema cylindricum Carter (Fig. 1l)(Family Homotremidae ; Genus *Polytrema* Carter, 1880)*Polytrema cylindricum* Carter, 1880, p. 441, pl. 18, fig. 1 a-g ; Cushman 1959, p. 347, pl. 37, figs. 30-32.

Test attached, cylindrical, consisting of a thick pillar developed from a slightly expanded base, dichotomously branched at free end into two branches, which are

equal and opposite, terminating respectively in an expansion, from which radiate a number of sponge-spicules. Test wall calcareous and surface pierced with scattered foramina. Orange in colour. *Distribution in Indian Seas* : Gulf of Mannar. *General distribution* : East Africa, Mediterranean, West Indies, Sulu-Archipelago and Damar Island.

Remarks :

In general, the foraminiferal fauna of this area resembles that of Philippines and adjacent seas. More than two-thirds of the species reported here have also been recorded from the different parts of the Indian region by recent workers.

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